

Remote Learning: Understanding Perspectives of Students and Teachers for Developing Novel Pedagogies

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ABSTRACT: The COVID-19 pandemic forced schools to transition from in-person to remote teaching. Evaluating the perceptions of high school students and faculty on remote learning is essential for establishing successful pedagogies that consider technological progress and skill sets required in the virtual learning environment. Surveys showed that students preferred the flexibility of studying from home but were more distracted, did not find classes engaging, and suffered from digital fatigue. Teachers felt that students learned less with online classes. Students did not have a clearly preference for in-person or online classes; teachers preferred in-person classes. This study highlights key factors that need to be addressed for successful distance learning at the high school level.

KEYWORDS: COVID-19; high school; online; remote; distance learning.

■ Introduction

In the spring of 2020, Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2)-mediated coronavirus disease 2019 (COVID-19) forced schools, colleges, and universities to transition from in-person classes to fully online classes in line with World Health Organization guidelines of safe distancing.¹ While students gearing toward a baccalaureate or graduate degrees may have taken online classes at some point during their education, converting to fully remote learning would have been a new concept for almost all of the approximately 55 million students studying in various schools within the United States and the 1.38 billion students worldwide. It is at the high school level that the foundation of future career tracks is carved. Therefore, understanding the impact of COVID-19-mediated remote teaching on high school students is critically important. Equally important is the need to identify caveats of fully online learning compared to in-person learning, such as learning non-cognitive skills involved in teamwork and professionalism, and recognize disparities in learning outcomes so that these factors can be quickly addressed when schools resume in-person teaching.

For online education to be successful, several factors must work in concert. The primary of these factors is access to computers and the internet. Only if students and teachers have excellent, uninterrupted access to broadband internet will it be possible to simulate an almost-in-person teaching ambience, with the exchange of files happening over seconds. Secondly, both students and teachers must master video conferencing software such as Zoom or MS Teams to avoid in-class glitches when operating online and during teamwork when students are assigned to breakout rooms. Thirdly, students should have access to an area within their homes where they can focus on their online classes and not be distracted. Fourthly, students should be able to communicate their problems accessing files

or completing their homework to the teachers. Obstacles to any of the above factors may induce stress and anxiety in students and faculty and disrupt the learning environment.

Teachers must be efficient during synchronous or asynchronous lectures and provide increased resources such as study materials so students can work independently. This can require more work and more effort upfront from the teachers. Since learning styles vary from student to student, teachers may need to adopt multiple methods to facilitate learning. Teachers may also have to test students via quizzes or examinations remotely and trust the integrity of the students when taking closed-book examinations. Teachers will need adequate academic support from their education management systems to ensure success in all of these variables.

Interestingly, while the perceptions of students and faculty in professional schools such as medical, dental, or graduate schools have been ascertained,²⁻⁴ fewer studies have recorded the plight of high school students and faculty. Understanding high school student and faculty perceptions is essential for identifying and providing increased resources and support to mitigate student and faculty anxiety and develop novel pedagogies and assessment tools that will help recover time lost once in-person classes resume, especially for those students with scant resources.

Therefore, the purpose of this study was to ascertain the viewpoints of high school students and faculty on online classes and, importantly, provide a ready reference for educators to develop novel teaching methodologies.

■ Methods

Ethical Considerations:

This project was determined as non-regulated research by the UT Health San Antonio Institutional Review Board, based on U.S. Department of Health and Human Services Regulation 45 CFR guidelines.

Surveys:

Two surveys were designed using Google Forms – one for students and one for faculty. A mixed study design incorporated both five-point, Likert scale-based questions for quantitative data and open-ended questions for qualitative data. Anonymous links to the separate surveys were sent via e-mail to a few students and faculty with a request to forward the links to other eligible students and faculty. Participation in the surveys was optional for both students and faculty. A total of 105 high school students and eight faculty completed the surveys. Both surveys were based on a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree). Internal consistency of surveys was determined by computing Cronbach's alpha using NCSS 2020 Statistical Software (NCSS, LLC. Kaysville, UT). Cronbach's alpha for student surveys was 0.79, and Cronbach's Alpha for faculty surveys was 0.75, indicating good reliability of the survey instruments.

Responses to open-ended questions on student and faculty surveys were analyzed for themes via an open-coding approach.⁵ Comments were sorted and categorized (coded). Comments that could be categorized into multiple codes were copied into their relevant categories. Codes were then condensed for the identification of themes and interpreted.

Results and Discussion

Students from different schools participated in the survey:

A total of 105 students participated in the surveys. The demographics of the student respondents are shown in **Figure 1**. Of the 105 respondents, 96 were females (91%), and nine were males (9%). Based on grade level, one student from Grade 9 (0.95%), 76 students from Grade 10 (72.38%), 12 students from Grade 11 (11.43%), and 16 students from Grade 12 (15.24%) participated in the surveys. Students from different public and private schools in Texas cities, including San Antonio, Boerne, Austin, Coppell, Missouri City, and Prosper, other states such as California and Washington, and countries such as India completed the surveys. Of these, Health Careers High School (54%), Ronald Reagan High School (8.6%), John Marshall High School (5.7%), Earl Warren High School (4.8%), and Tom C. Clark High School (3.8%) were schools highly represented; the rest of the schools contributed to 22.8% of the survey. Students represented different ethnicities, including Asian (38%), Hispanic/Latino (29%), White/Caucasian (20%), African American (2%), American Indian (3%), and Hawaiian/Pacific Islander (1%). Finally, 77.1% of students indicated that they chose online classes when given the option of in-person learning, 10.5% chose in-person classes, and the remaining selected both options.

Overall, sufficient numbers of high school students participated in this project by providing their viewpoints. Although only a few teachers provided their input, the results were very consistent. Since the responses were voluntary, only those students and faculty interested in giving their opinions contributed to the survey. Indeed, most student responses were from female participants, not accurately representing the high school population. Nevertheless, it is an essential first step toward recognizing the viewpoints of high school students.

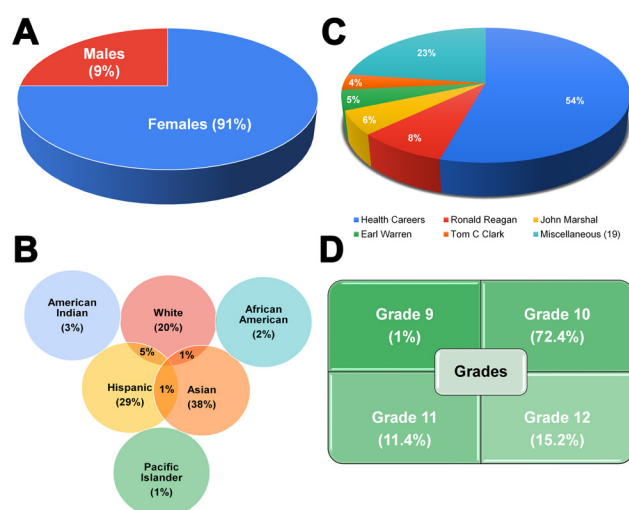


Figure 1: Demography of survey respondents. A. Sex distribution, B. Race/ethnicity distribution, C. School affiliations, and D. Study grade

Improved infrastructure and study environment are required for online classes to be successful:

Student responses to Likert-scale-based questions are shown in **Figure 2**. Most students indicated that their internet connection was not good (51%) compared to others with a good internet connection (29%). Basic requirements for receiving uninterrupted online education that incorporates synchronous teaching include having access to computers with moderate to high processor speed and clock speed and a reliable, high-speed internet connection. Unfortunately, 51% of students indicated that they did not have a good internet connection, including those whose parents were furloughed or lost their jobs. Poor internet connection would have made it harder to take classes online, perhaps contributing to poor communication with teachers and peers in breakout rooms and decreased engagement and participation during classes, leading to increased stress and consequently impeding their learning. While ensuring access to a high-speed internet connection for students working from home may not be possible at the institutional level, governments must equip schools with sufficient resources such that they can, at the very least, loan computers to economically disadvantaged high schoolers and make conditions equitable. The United States government provides access to high-speed internet to those in need (<https://www.getinternet.gov>); it also provides a one-time discount on purchasing a computer.

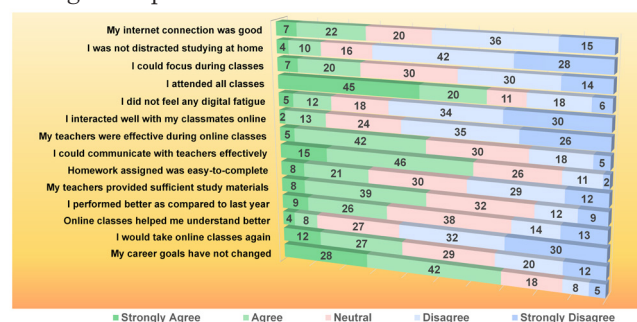


Figure 2: Quantitative data from student responses in the 5-point Likert scale survey.

The study environment also played an important role. A majority of students were distracted when studying at home (70% as compared to 14% who were not distracted) and could not focus during classes (44% as compared to 27% who could focus). While most students attended all classes (65%), they also indicated digital fatigue caused by continuous exposure to electronic items such as computers, iPads, and smartphones (64% as compared to 17% who did not feel any digital fatigue). This is an important concern because excessive exposure to computer screens has been associated with decreased sleep quality and physical and mental issues that stem from sedentary routines.⁶ While it would be difficult to reduce overall screen time, encouraging students to move around between classes and having more asynchronous sessions by recording concise didactic lectures to provide flexibility, monitoring student feedback as well as having teachers or student counselors check with every student on symptoms such as eye strain, headache, exhaustion, loss of focus would help identify and mitigate problems early.

As expected, 61% of students indicated decreased interaction with their classmates as compared to 15% who continued to interact well with classmates virtually. Previous studies have pointed towards a significant negative influence of social distancing and quarantining or isolation from peers on following routines and overall learning experiences.⁷⁻⁹ Learning is affected by several interrelated factors that include environmental interaction as well as “physical, psychological, cognitive, social and emotional processes that influence one another—both biologically as well as functionally.”¹⁰ Therefore, improving interaction with both teachers and classmates is key for both cognitive development in a learner-centered environment¹¹ as well as for non-cognitive development such as personality, professionalism, and team building; student learning also improves when teachers are supportive.¹²

Schools can address this by scheduling one-on-one meetings with student counselors or other administrative personnel, helping set up schedules for daily routines as well as for short-term goals, creating an extensive brother/big sister/buddy system to encourage a sense of belonging, conducting short surveys periodically and addressing any student concerns, and providing frequent feedback to teachers and discussing action plans. Additionally, using a flipped classroom approach whereby students would prepare for the class session by viewing recorded videos of didactic lectures before the class and then having interactive class sessions with students organized as teams would be most beneficial as it would actively engage students¹³ in contrast to passive learning where students listen to didactic lectures. Such an approach would improve student-student, student-teacher, and student-content interaction. Additionally, increasing informal interactions would also result in effective learning.¹⁴ These informal interactions could include providing spatial access for students to hold asynchronous discussions or blog/vlog in the virtual environment and thereby create and collaborate within their own learning landscapes.

Most students felt that teachers were effective during classes (47% as compared to 23% who did not agree), provided sufficient study materials (47% agreed; 21% did not agree), and communicated with them effectively (61% as compared to

13% who did not agree). However, students who could not communicate with teachers found this aspect to be the most challenging part of remote learning. Periodic student feedback and prompt action by teachers would help boost communication. Periodic student feedback and prompt action by teachers would help boost communication.

Several students (41%) felt that homework was not easy to complete, compared to 29% who felt homework was easy. This could be a result of different learning styles that were not fully supported by the online environment.

While 35% of students indicated that they performed better than when they had in-person classes before the beginning of the pandemic, 27% disagreed. Notably, only 12% of students felt that online classes helped them understand the subject better, compared to 62% who disagreed. Respondents were almost equally divided between those who would retake online classes (39%), those who would not (32%), and those who remained neutral (29%). Online classes did not appear to significantly affect career goals, with 70% of respondents indicating that their career goals remained the same compared to 13% who indicated a shift in terms of their career goals.

Current pedagogy for online classes needs to be modified:

Thematic analysis of responses to open-ended questions was revealing (Figure 3). Students liked the flexibility of organizing their schedules (44 comments; 42%), the comfort of studying from home (23 comments; 22%), the decreased pressure to socialize (10 comments; 9.5%), the extended deadlines for completing homework (9 comments; 8.6%), easy accessibility to study materials (8 comments; 7.6%), and increased sleep time (7 comments; 6.7%). However, students found that remote learning decreased interaction with their teachers (21 comments; 20%), increased stress due to excessive homework and projects (17 comments; 16.2%), lack of socialization (16 comments; 15.2%), and classes were not engaging (13 comments; 12.4%). They were also distracted when studying from home (17 comments; 16.2%). Interestingly, the points raised by high school students – increased flexibility, digital fatigue, and anxiety – have been echoed by undergraduate medical students as well.¹⁵

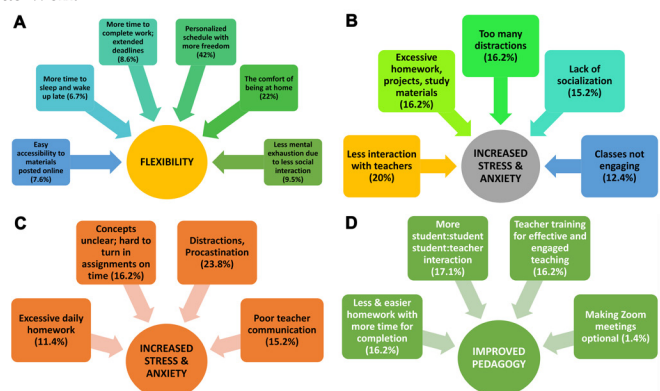


Figure 3: Thematic analysis of student responses to the open-ended questions. A. What did you like about remote learning?, B. What did you not like about remote learning?, C. What was the hardest part of learning material online?, and, D. If you could change one thing about your experience with online learning, what would it be and why?

Indeed, the hardest parts of remote learning were distractions, loss of focus, and procrastination (25 comments: 23.8%). It was also difficult to understand concepts taught during the online sessions (21 comments: 20%), which made it harder to turn in assignments on time. This was exacerbated by poor teacher communication (16 comments: 15.2%) and heavy loads of homework (12 comments: 11.4%).

When asked about what they would like changed with regard to remote learning, students requested increased interaction with their teachers and peers (18 comments: 17.1%), reduction in homework coupled with extended deadlines (17 comments: 16.2%), more teacher training to effectively engage students during online classes (17 comments: 16.2%), and keeping synchronous lectures on Zoom optional (12 comments: 11.4%).

Importantly, when asked to rate their overall learning experience with online learning, most students agreed that it was excellent to a good learning experience (76.2%); only 23.8% of respondents indicated that their learning experience was bad.

Faculty preferred in-person classes to online classes but are willing to adapt:

A total of eight faculty from Health Career High School participated in the surveys. The demographics of the faculty respondents are shown in Figure 4. Of the eight respondents, six were females (75%), and two were males (25%), consistent with the demographic of the school. Faculty who participated in the survey taught band, jazz band, senior seminar, music theory AP, computer science, PHS, clinical rotation, medical research, and English language arts, covering a broad spectrum of subjects. Ethnicities of the faculty included five white or Caucasians (62.5%), two Hispanic/Latinos (25%), and one that belonged to both groups (12.5%). All of them taught Grade 10 (8: 100%), with some also teaching Grade 9 (3: 37.5%), Grade 11 (4: 50%), and Grade 12 (3: 37.5%). Of note, teaching fully online classes was a new experience to most faculty (5: 62.5%), with only three faculty having taught online before (37.5%).

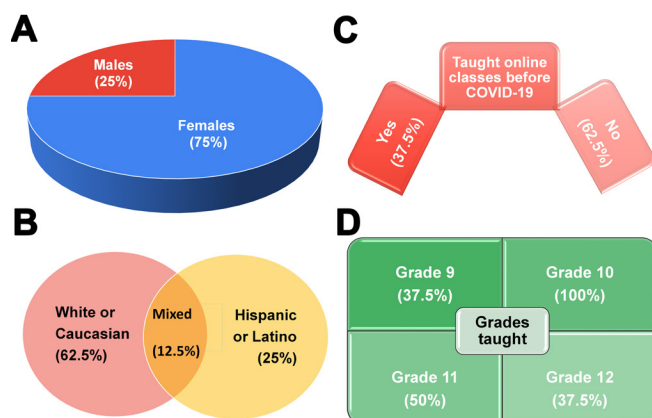


Figure 4: Demographics of high school faculty. A. Sex distribution, B. Race/Ethnicity distribution, C. Prior online teaching experience, and D. School grade taught.

Faculty responses to Likert-scale-based questions are shown in Figure 5. Most faculty were comfortable using the Zoom platform for conducting classes (75%) but were not satisfied with the virtual setup (50% as compared to 37.5% who were satisfied). Virtual setup includes incorporating structure and

rules to Zoom meetings, such as mandatory requirements of participation in all Zoom meetings and turning on video cameras, having meeting times that match in-person class times, incorporating technologies that allow easier study material manipulation, and incorporating methods that overcome lack of hands-on activities in breakout rooms, among others.

Teaching online required more effort than teaching in person (75%: 12.5% disagreed) and more preparation time (75%: zero faculty disagreed). However, all faculty felt that students asked fewer questions in virtual classes than in in-person classes (100%).

While previous studies have reported no differences in student performance between identical online and in-person classes,^{16,17} teachers participating in this survey felt that students learned less than in previous years (75%: zero faculty disagreed), which also led to more lenient grading (75%: 12.5% disagreed) and perhaps increased class averages (37.5% agreed as compared to 12.5% who disagreed). Teachers agreed that remote quizzes and examinations did not sufficiently gauge student knowledge of their subjects (87.5% agreed; zero faculty disagreed). Thus, it was not surprising that most teachers did not prefer online classes (62.5%) compared to those who did (12.5%). However, most faculty (75%) would implement changes in their in-person classes to improve learning.

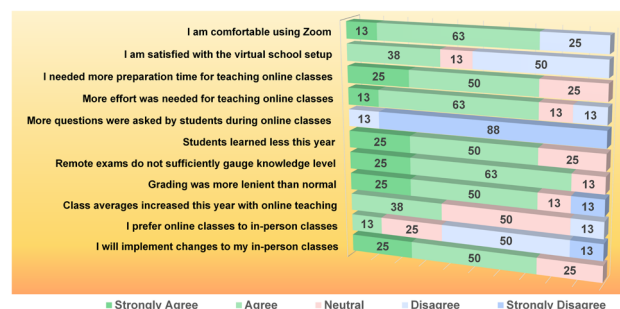


Figure 5: Quantitative data from faculty responses in the 5-point Likert scale survey.

Thematic analysis of faculty comments was consistent with responses to the Likert scale-based questions (Table 1). Transferring study materials for easy online access by students was a new change for faculty (3 comments: 37.5%).

A significant concern of faculty towards online learning was the lack of student participation and engagement during classes (4 comments: 50%), correlating with their most challenging part of teaching students online, namely, making sure that students were engaged when students kept their videos off (5 comments: 62.5%). Faculty wished they could ask students to keep their cameras turned on during online classes (4 comments: 50%). Interestingly, 50% of teachers also felt that student participation and engagement decreased during online classes, especially because students turned their videos off during class sessions. While this could reflect poor internet connectivity, keeping videos turned on was essential for teachers to connect and engage with students, which was missing. Correspondingly, 12.5% of students also did not find classes sufficiently engaging. The decreased engagement could partly

explain why only 12% of students found online classes useful in understanding concepts better.

Enhancing student engagement during online classes could be challenging; institutional support for training teachers on novel pedagogies and increasing their familiarization with existing technologies and software will play an important role in improving the content provided to students and, consequently, enhancing attention during classes. Both students and teachers would positively receive faculty training as the latter indicated that they were not fully satisfied with the virtual setup in their schools and required more effort and preparation time for online classes. Students also suggested faculty training as an important theme.

Table 1: Thematic analysis of faculty responses to open-ended questions.

What were your major concerns regarding online learning and why?		
Theme	Frequency (%)	Example
Lack of student participation and engagement during classes	4 (50%)	"Lack of student participation and the discussions that generates."
What were the changes you introduced to transition to online learning?		
Transferring study material online	3 (38%)	"Transferring any and all material online. Finding virtual labs that are (somewhat) engaging."
What was the hardest part of teaching students material online?		
Theme	Frequency (%)	Example
Making sure students were engaged, participating, and learning the material when their videos were off	5 (63%)	"Keeping students engaged. Not knowing whether students were truly learning course material. And maintaining positivity and motivation throughout the course when met with dark screens and no interaction during zoom classes."
If you could change one thing about your experience with online learning, what would it be and why?		
Making students turn on their cameras during Zoom meetings and interacting with one another	4 (50%)	"I wish more students would turn their cameras on so I don't feel so alone. It's kind of depressing that I don't know what half of my students look like."

Conclusion

Even before the onset of COVID-19, it was clear that the current educational practices in K-12 schools did not adequately address the skill sets required in the modern environment. These included independent and self-directed learning that incorporates higher order / critical thinking and the application of acquired knowledge in individual and team-based problem-solving sessions.¹⁰ COVID-19-mediated interruption of in-person education of millions of high school students by shutting down schools and forcing a transition to online learning has highlighted some of these issues as students and faculty have had to adapt to the pandemic without any prior preparation rapidly. This study aimed to identify factors that promoted or impeded their learning and teaching, respectively, with the long-term goal of strengthening the education system to meet future crises with adequate contingency planning.

Increased student stress²⁰ due to higher workload, decreased engagement during online classes, and reduced interaction with peers and faculty negatively impacted online learning. Yet, students were almost equally divided between their preference for online to in-person classes, perhaps due to a combination of several factors that resulted in increased flexibility during the day instead of a monotonous daily routine. All high school teachers in this survey also noted some of the advantages of online teaching and were open to incorporating changes to their in-person classes in the future. An example would be to use open-book examinations for assessments as have been used to successfully evaluate medical students in some schools^{18,19}; faculty teaching high school students can implement these methodologies. A concerted effort to integrate the benefits of

in-person and online classes in a hybrid or blended learning approach to modernize education in high schools at this time would, therefore, be most appropriate.

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