

## **What I Wish My Instructor Knew: Navigating COVID-19 as an Underrepresented Student - Evidence Based Research**

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# What I Wish My Instructor Knew: Navigating COVID-19 as an Underrepresented Student – Evidence Based Research

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## Introduction

The 2020 global pandemic caused by COVID-19 changed our everyday lives. Higher education institutions were forced to immediately stop face-to-face teaching and transition to virtual instruction. In addition to the change of instructional modes, the forced closures of institutions also impacted other sectors of the university such as faculty and staff layoffs and loss of revenue from on-campus dining and housing [1]. Furthermore, it has become increasingly difficult to support students in the virtual learning environment, particularly those in STEM programs that rely heavily on specialized software, hardware, and lab spaces for coursework [2]. In engineering education there have been strong efforts to improve diversity, equity, and inclusion (DE&I) of underrepresented minorities (URMs) [3]. Preliminary research on the effects the pandemic has had on engineering students are finding that many of them, especially URMs, are being negatively impacted, personal and professionally [4], [5].

The purpose of this paper is to contribute to the research that is being conducted on URMs' experiences during COVID-19, particularly as it pertains to engineering. Using the online data and analysis platform SenseMaker, participants were asked to share a story in response to the following prompt: *Imagine you are chatting with a friend or family member about the evolving COVID-19 crisis. Tell them about something you have experienced recently as an engineering student.* In a similar study, at the University of Georgia, students expressed there was a lack of empathy from instructors during the shift to virtual instruction [6], [7]. Our overarching research question for this study is “*How has the abrupt transition to online instruction due to COVID-19 affected students traditionally underrepresented in engineering?*” In particular, we aim to highlight stories shared by participants who indicated a desire to share their experience with their instructor through the following sub-research questions:

*RQ1: What impact does race, gender, major, and perceived future impact have on participants' desire to share their experiences with their professor?*

*RQ2: How does gender identity impact students' coping mechanisms during COVID-19?*

*RQ3: How does racial identity affect the attitude or outlook students have when facing the struggles of a pandemic?*

## Methods

### *Participants*

A total of 500 micro-narratives from underrepresented engineering students were collected from June – July 2020. Undergraduate and graduate students were recruited for participation through the researchers’ personal networks, social media, and through organizations like NSBE. Participants had the option to indicate who are able to read their stories 1) Everyone 2) Researchers Only, or 3) No one. Qualitative stories shared in this work are of participants who granted permission for everyone to read.

### *SenseMaker*

SenseMaker is an online mixed methods data collection and analysis platform that involves four iterative steps: 1) *Initiation*; 2) *Story Collection*; 3) *Sense-making*; and 4) *Response* [8], [9]. This study builds upon a previously developed signification framework based on the concept of thriving [9]–[11] and a similar study conducted at the University of Georgia. This framework included five triads, three dyads, and 6 to 8 multiple-choice questions outlined in Table 1.

**Table 1** Five triads and three dyads that participants will use to self-signify their own stories.

<b>Theoretical grounding</b>	<b>Question</b>	<b>Triad</b>
Autonomy	My actions were motivated by...	Expectations of others, Self-Care, Necessity
Investment/ Discipline	What was valued in this story was...	Willingness to Experiment, Grit and Perseverance, Planning and Efficiency
Internal alignment/ Alignment with others	The experience I shared influenced my sense of...	Confidence, Purpose, Belonging
Openness/ Reflectiveness	Any decisions that were made in this story were influenced by...	Intuition, Self-Reflection, Feedback from others
Flexibility	Thinking about the future, this story encourages me to...	Embrace risk, Be willing to adapt, Rely on familiar ways of working
Thriving (overarching concept) + Accountability (sub-feature)	Dyad: This story was about...	Struggle – Progress
Collaboration/ Competition, Selfless/ Selfishness, Social contribution	Dyad: In this story I decided to prioritize...	Myself/my own self-care – Needs/expectations of others
Support, rate of change	Dyad: In this story, change is happening...	Too Slowly – Too Quickly

Unlike traditional surveys or other qualitative data collection methods, SenseMaker encourages participants to think more critically about the stories they share by inviting them to make sense of their story using a series of triads and dyads. Figure 1 is an example of a triad participants completed as it pertains to the narrative they have shared, and Figure 2 is an example of a dyad participants completed.



Figure 1 SenseMaker triad that probes the concept of autonomy.

When presented with a triad or dyad, participants are asked to move a dot on the triangle or slider to the position that best fits their story. In the analysis software, each dot represents a story that can be examined for trends.

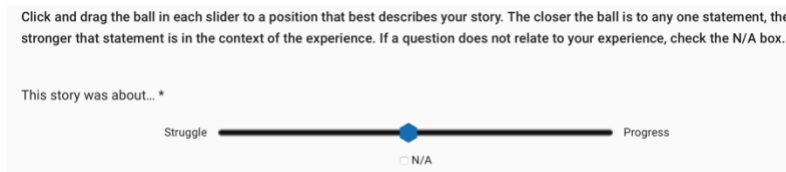


Figure 2 SenseMaker dyad that probes the overall concept of thriving.

After completing their narrative and a series of triadic and dyadic questions, and participants were also asked sentiment-based multiple-choice questions (MCQ) relevant to their story. One MCQ participants were required to answer was “If you could do so without fear of judgment or retaliation, who would you share this story with?” and were given the following options: 1) Family 2) Instructor 3) Peers 4) Prefer not to answer 5) Other. A third of the participants indicated that they would share their story with their instructor.

### *Additional Analyses*

Pearson’s chi-squared tests were conducted on the quantitative data of the MCQ stated previously to determine if there were any statistically significant differences in the data. To this end, we sought to answer the following sub-research question:

*RQ1: What impact does race, gender, major, and perceived future impact have on participants’ desire to share their experiences with their professor?*

We also used NVIVO to conduct a high-level thematic analysis of the qualitative narratives to answer the following sub-research questions:

*RQ2: How does gender identity impact students’ coping mechanisms during COVID-19?*

*RQ3: How does racial identity affect the attitude or outlook students have when facing the struggles of a pandemic?*

## **Results**

### *Quantitative Findings*

A general overview of how this set of participants felt about their experience show that ~50% of participants reported feeling negative or extremely negative about their experiences, ~30% reported feeling neutral, and ~20% reported feeling positive or extremely positive about their experiences.

Chi-squared tests were conducted to see if there were any statistically significant differences between participants who wanted to share with their instructor and factors such as race, gender, major, year in school, and perceived future impact their experience would have on them a year from now. Race had no statistically significant impact on participants' desire to share with their instructor.

There was a statistically significant difference between gender and how participants felt about their experience. Of the participants who wanted their professor to know about their experiences, men were more likely to have positive experiences ( $n = 55$ ) and women and other gender expressions were more likely to have negative experiences ( $n = 102$ ),  $p = .0495$ .

There also was a statistically significant difference between the perceived impact this experience would have on participants a year from now and their desire to share with their professor. Of the participants who wanted their professor to know about their experiences, participants indicated that the experience they shared would have low impact on their lives a year from now ( $n = 157$ ),  $p = .0001$ .

Additionally, there was a statistically significant difference between participants' major and their desire to share with their professor. Of the participants who wanted their professor to know about their experiences, participants who major in Aerospace ( $n = 9$ ), Civil ( $n = 22$ ), Industrial and Systems ( $n = 18$ ), and Mechanical ( $n = 35$ ) were more like to want their professor to know about their experiences, whereas participants who major in Computer Science ( $n = 11$ ) were less likely to want their professor to know about their experiences,  $p = .0156$ .

Lastly, there was a statistically significant difference between gender and year in school. Of the participants who wanted their professor to know about their experiences, sophomore men

(n = 12) and junior women (n = 31) were more likely to want their professor to know about their experiences. However, sophomore women (n = 12) and junior men (n = 13) were less likely to want their professor to know about their experiences,  $p = .0078$ .

Because of the statistically significant impact gender had on participants who indicated wanting to share their experiences with their professor, we aimed to explore this more deeply through a qualitative analysis of the stories shared by participants (RQ2). While race did not have a statistically significant impact on participants desire to share their experience with their professor, we still sought to qualitatively explore the impact of race amongst our participants.

### *Qualitative Findings*

To answer our research questions, a high-level thematic analysis was conducted on all of the stories of participants who indicated they would like their professor to know about their experience. In the following sections, we will highlight the major themes that resulted from this analysis for each research question.

#### RQ2: The Impact of Gender Identity

When analyzing data to answer RQ2, one theme that emerged was that there was a clear difference in how participants chose to react to the hardships they experienced due to COVID-19. More specifically, participants who were mostly male, expressed finding a silver lining amidst the struggles of the pandemic (Positive Outlook Stories) whereas participants who were mostly female, expressed pessimism or complacency in the stories they shared (Negative Outlook Stories). Examples of these experiences are presented in the next section for participants who indicated that their stories could be shared publicly. The legend for how we have labeled our participants can be found in Appendix A.

#### ***Positive Outlook Stories***

“Covid 19”

*This semester was the first semester where I really felt like an engineering student. I say that because I was taking Statics. It's the first engineering class that involves complex calculations of forces. The semester started great because my professor implemented study sessions which were chances to study together and they helped so much. With the coming of Covid-19, I was most scared about losing that resource. It turned out that the semester was able to end just as well as it started still because my professor prepared me to have*

*connections in that class with people who want to study and learn as much as I do and that was a great resource for tackling the new environment. [F1-2B-2N]*

#### *“A Crash Course: Grasping The Realities of Life”*

*My experience with COVID-19 is one of unfortunate timing. I am a first generation college student and I dealt with very difficult circumstances with completing my engineering degree. Upon concluding a poor academic semester back in 2016, I almost gave up my pursuit for an engineering degree during the end of my sophomore year. It was during that time that I received many suggestions to switch majors outside of engineering. However, it is now 2020 and I fulfilled my academic requirements to my university as a biological engineer and I could not be more elated to have come this far and all the support. This reality of timing of graduation with COVID-19, however, has made it very difficult continue the joyous celebration of completing my degree. It was an unorthodox ending to the semester as many classes that utilized lab-work and face-to-face moved online which made grasping certain material very hard and different to my ideal means for learning. The plans that my family made to commemorate my achievement has been postponed until further notice and the job market I have now entered is scarce in terms of job opportunities. This experience has reaped many of the expectations I had for this year, but has given me the opportunity to learn new skills. I have now filed for unemployment in order to help ease for family burdens and continually doing all I can to be helpful and productive during these times. [L10-2B-2S]*

#### *“A Toast to the Graduating Seniors”*

*While the COVID-19 pandemic has been going on, my undergrad research was pushed to online meetings along with everything else. I continued to work on the project I had been working on since August, and was able to effectively communicate and collaborate with my research professor, even remotely. Even though graduation was cancelled, my research professor wanted to celebrate the graduating seniors in our research group, and even delivered champagne to our apartments for a toast at our last meeting. Even though it wasn't as exciting as celebrating in person and having a physical graduation, I appreciate the effort my professor put in to congratulating us. [L8-2W-3S]*

In the positive outlook stories, participants highlight how, despite the challenges posed by the pandemic, they have still managed to thrive academically and professionally during this time. The sense of developing the feeling of being an engineer to actually graduating with an engineering degree are indicators of the silver lining amidst a very bleak situation.

### *Negative or Complacent Stories*

#### *“First Year Excitement Cut Short”*

*During my second semester of engineering, our drone project got cut short from my engineering class. I was super excited since I want to go into Aerospace Engineering, but because of COVID-19, I never got the chance to fly it. We were supposed to be able to go to the drone park and fly them!! Once the semester got cut short, my team that I was on was able to continue the semester working on group Matlab projects over facetime from each of our bedrooms. I was so weird to work on a project that way, but it was doable. When the semester finished out, we just said bye to each other over text instead of getting to walk back to the dorms from class one last time. This was such a weird experience. [F8-1W-4S]*

#### *“Virtual Lab Classes Don't Provide the Hands-On Experience Needed for Real-Life Engineering”*

*All of my classes went virtual which was quite weird as an engineering students. I mean, there's a reason why engineering classes are never offered online. Some professors adapted to the virtual teaching easier than others, but I lost a lot of valuable experience in the transition. I was taking a solid mechanics and materials lab course that I really enjoyed and it wasn't the same when it went virtual. I really enjoyed the hands-on experimentation and I don't think I got the same experience just by writing lab reports on historical data and watching a YouTube video or two. [J1-1W-3S]*

#### *“How Has COVID Impacted My Education/Learning”*

*As an engineering student, I believe that my education/learning experience has been hindered. I believe people have different have styles of learning and mine is definitely not suited for virtual learning. I learn best by doing and visual demonstrations. I'm addition, my home is not an adequate learning environment. I'm at my most productive when I'm at*



*a library instead of my home. Not only has this impacted my education/learning, but it also my ability to do my work. [L7-2B-2U]*

In the negative or complacent outlook stories, participants highlight how their education experience was negatively impacted by the pandemic. There was a loss of collaboration, comradery, and proper study space to execute their ideas of what it means to be an engineering student.

### RQ3: The Impact of Racial Identity

When analyzing data to answer RQ3, a similar trend of how participants described their experiences was found in the data. However, as opposed to gender identity being the factor in differing experiences, racial identity also played a role in the level of optimism shared by participants. From our analysis, White participants shared having more support and more hope for the future whereas the level of support was less prevalent amongst non-White participants. Examples of these experiences are presented in the next section for participants who indicated that their stories could be shared publicly.

#### ***White***

##### **“The Ups and Downs of Quarantine”**

*When I first heard that my education would be going virtual for the rest of the semester, I thought the world was ending. If you've ever seen the film Contagion, like I did back in my 9th grade biology class, that is the mental image I had of what the world would look like in the coming months. At the time I was on spring break vacation with my boyfriend, and we scrambled to make sure we both had stable places to live for the next few months to finish out the year. We were both fortunate enough to be able to return home to our families within a few days, and adjust to our new normal. In terms of academics, at first I was very motivated and had a lot of energy to invest into school. But as time went on, I found it harder to stay focused during lectures via Zoom. After my summer internship was canceled I knew I needed to find a job sooner rather than later, because I would need at least some money in my bank account when I returned to school in the fall. I took a part time job at an [company] fulfillment center which made academics even more challenging, but I was one of a very small population who had found work, so I couldn't complain too much. Quarantining has had ups and downs, but ultimately a break from always filling my*

*schedule as much as possible has been very pleasant. I am fortunate enough to have a family that has supported me in every possible way during this time. [J8-1W-4S]*

*“Mental Health in a time of uncertainty and confusion”*

*During the remainder of the school year of online learning, I learned how to study on my own. Teachers decided to throw as much work as possible at students because what else are you doing at home? you have no excuses. Because of this mindset, I learned how to maintain my mental health and relationships with friends and family while drowning in school work for 8-12 hours a day. While at school I would arguably spend 8-10 hours doing work anyway, this work would often be done in the company of other students enduring the same struggle. While at home, this was not the case. Yes, i could reach out to some friends and chat over facetime/zoom, however, the experience of sitting in the Civil Eng study room with a bunch of people you only know in this context, it was not the same. Additionally, being home with my family members who did not have to do work as long as I did everyday made it even harder to want to focus. I found that one of the most important ways for me to maintain my mental stability was to workout for an hour every day. This varied from running, to climbing a step mill, to walking 6 feet apart with my family/neighbors. It was a long struggle and took some getting used to for sure. This was an outlet to talk about school, COVID, or anything else that would distract from the stress we were all feeling. [S4-1W-4S]*

**Black**

*“The problem of honesty”*

*As an engineering student, I have witnessed the degradation of academic integrity as we entered the Covid-19 epidemic. Although we pay several thousand dollars to attend the university and dedicate countless hours to our coursework, we are now faced with an incredibly difficult task. Without the faculty and facilities that enable us to learn on campus, we have reverted to powerpoints and youtube videos to teach us what was already difficult to learn in a classroom. With the added distractions of social happenings, family life, health concerns, and environmental factors, every student faces a wildly different circumstance. While we are all well aware of the risks of violating any honor code*

*guidelines, our choices were less than optimal in the given situation. A student who was normally diligent in completing their assignments and studying now faces pressures that could never have been predicted. Do you risk your GPA and keep your integrity? Do you copy and cheat on homework assignments just to get through the end of the semester? Do you fail a course and retake over the next semester/summer? Not everyone has the money, mental health, nor the support to adapt to these changes in such a short timeframe. Yet here we are as students contemplating the value of an honest education. I know I certainly didn't pay nearly \$22,000 for this semester only to be taught by a pre-recorded lecture and powerpoints, so why should I be perfectly honest? The system is flawed currently and I cannot blame our staff for the nature of their emergency plans, after all this was very unexpected. What we should be discussing is how we can better teach and reinforce learning, rather than enforcing department guidelines to the detriment of students and their academic integrity. [F1-2B-6S]*

*“Doing Your Job Vs. Caring to Do Your Job”*

*During the COVID-19 Pandemic, I had a horrible experience with one of my professors. This is one of my upper level engineering courses, and within the class I'm not only the one Black student, but a Black woman at that. This is often the case in many of my classes, and I try to always look at in a positive perspective and to represent that Black people can excel in engineering. However, once the pandemic hit and I had to return home, my focus had to be distributed. I live about ten minutes from Chicago, and have many family members who live directly in Chicago. Chicago held many cases of the pandemic, and the top numbers of those cases were in Black communities. So not only did I have to worry about my neighborhood, but also my family's neighborhoods being affected. Not to mention, I live in a single income household, so it was already stressful enough. Everything got turned upside down for me when my cousin suddenly passed away. Not from COVID-19, but it pandemic still did affect his death. My family was already in a rough spot financially due to the pandemic and now we all had to try and figure out how we could afford funeral costs. For a funeral that we would not even be able to attend all together and mourn as a family due to the pandemic. At this point I was getting drained. Just having lost my cousin, being stressed about finances, and being stressed because so many people around me were being*

*affected by the virus. There was a huge exam coming up in my engineering course, and I asked my professor if I could take it at a later date due to my situation. I explained everything in detail to him about what I was going through, and he came back and told me no. He told me that he felt I was looking for a break that I did not deserve because EVERY student in the class he assumed was going through a rough time as well. I then proceeded to schedule a Zoom Meeting with him, where he clarified that he felt every student in the class was having the same experience as me, so he wasn't going to give me a "break" due to fairness of the class. This was the single most disrespectful thing to me. How are my real life struggles being acknowledged at the sacrifice of fairness to the class? And how do you tell your only Black student, that everybody else is going through the same things that I am? I had to explain to him how the pandemic affected African American communities the most, and that just in life in general, nobody of a different race will EVER have the same experience as me. I did not like how he downplayed my whole situation and experiences, and his word choice of me looking for a "break." He disregarded my whole situation and did not care that my family was struggling financially, I was dealing with my cousin's death, my community being affected, my mental health, and just well being in general. To make a long story short, no matter how much I tried to explain it to this Professor, he did not care. I believe you should not be in this profession if you can't have understanding towards your student when it's needed. He was stuck in his mindset that no matter what I said, he was not going to budge on his answer. And all it did was add to everything else I was going through and made me realize once again that there are so many Professors out there who just there to do their job, but not care to do their job. [J7-1B-3S]*

### ***Asian***

#### ***“My Experience in Classes During COVID-19”***

*How well I transitioned to online classes during the COVID-19 crisis was based on the ability and willingness of my teachers. While I had some teachers who were willing and available, I had others who made the most basic effort to accommodate student needs. Two of my teachers were proactive in their updates on [University LMS] and made sure to adjust their teaching or assignments based on student feedback and were readily available through emails, but my other teacher struggled a lot with teaching online. He said that he*

*had to basically change his entire class in the span of two weeks that they were given before school started again and mentioned that he wasn't familiar with the tools and programs that we had to use. Perhaps this was why he never really announced anything or updated us. Even during the time he was answering questions during our class period, we would get vague answers or just no answers at all. Strength of Materials was one of the most difficult classes I've ever took during college thus far, and even before the coronavirus was a major problem in the US, it was hard. Now that not only the students were struggling, but the teacher was struggling, the class was exponentially harder. The testing software he chose to use was something new to us, and we never had any practice with it. When the first online test came around, one week after school started again, many of my classmates did not know how to navigate the website. Some missed questions because they didn't know that they could skip to the next question because there were multi-part questions that you had to answer before moving to the next part. In that first test, my teacher failed to include how much each question was worth, so we couldn't assess which questions we should do first. He also chose to include more questions than he said he would, even though our test was in the exact same amount of time and close-note, like our previous tests. Overall, it was a very frustrating half of the semester, and I felt like I learned less than I would have in-person. I know plenty of people who were extremely stressed from school in an already stressful time. USG's decision to not switch to an opt-in pass-fail system, despite the fact that many ivy league schools have was incredibly negligent on their part. [J1-1A-1S]*

#### *“Global Pandemic vs School”*

*I was doing well in school for the first time in a long time. I was going to office hours, getting work done early, and studying efficiently. It was spring break and I was happy for the break. It was well deserved. However, things got sour when half-way into spring break, my college announced that they were transitioning online. I was a little bummed out, not going to see my friends and do fun stuff for the rest of the semester. But, it was a global pandemic, I had to sacrifice that. School resumed online and professor struggled to transition. I felt like I was really patient with them. However, when I would attend virtual office hours, I realized that I was getting looked over. I wasn't getting the help I needed. This really started to frustrate me. I had a hard time focusing and understanding the*

*material. My TA's weren't making anything easier by not being clear in office hours. I would watch videos hours on end and sometimes nothing made any sense. Finals rolled around and I was pretty frustrated at this point. I studied really hard and some of my exams were just too hard. Especially in engineering, professors don't understand that making exams really really hard during a global pandemic is maybe not the best thing to do. Finally I ended the semester, ended up doing not as well as I hoped (I got a D on my final for a class!). Nonetheless, I was done. I think that professors need to be more understanding in this time. I did not feel that they were accommodating. [S7-1A-3S]*

### **Hispanic**

**“Student, immigrant, daughter, and advocate”**

*“As an immigrant student whose extended family lives in another country, dealing with COVID19 has not been easy. One of my elderly grandparents has recently been hospitalized and my father had to book an emergency trip to see him. In addition to being worried about my grandparents' health conditions due to their age, COVID19 poses another risk for them. Being part of a low-income family also means that my fathers' absence will affect our entire family economically and add another stressor that prevents my sisters and me from being able to focus on our studies. Lastly, as a Latina who has experienced multiple microaggressions towards myself and my family in the past, seeing the protests and search for justice around the country has made an impact for me to continue advocating for minorities in STEM fields because the journey is not easy.” [J3-1H-2R]*

**“Cash rules everything around me”**

*My school life was not as affected as much as my work life was. I was a student manager at [University] Food Court for 3 years. When I got back from break only managers had a job, which was great for me at least because I was putting myself through school and received no monetary aid from my parents because they cannot afford it. Within the first week of returning to work every student was laid off with no notice. The world seemed to stop when COVID-19 came, but the bills never stopped. Loans needed to be paid, rent was due. I did not qualify for unemployment as a student or the stimulus check. My job after*

*graduation was pushed back. There were no forms of aid towards the many students who lost their jobs putting themselves through school until the CARES act which came months later. In a week my financial stability turned into a half a year of potential unemployment. I was lucky enough to find a new job at a grocery store, which has put me at some of the highest exposure to the virus. There are people who don't have others to fall back on, and we have been ignored. [L2-2H-1U]*

The narratives above highlight the differences in experiences based on racial identity. Despite race not having a statistically significant impact on participants who desired to share their story with their instructor, the context in which non-White participants framed their stories were less optimistic than White participants. Many of their stories focused on the need to juggle academics with less than accommodating instructors, jobs (as support for school, family, or both), and new responsibilities as caretakers. Most stories shared by participants like the ones included, simply reported what was happening in their lives or had an overall negative experience. While not all non-White participants had a bleak experience during this time, statements such as “being fortunate” and finding positive coping mechanism were more common amongst White participants as many of their stories reflected more of the silver linings that has come out of an otherwise unfortunate situation.

## **Discussion and Future Work**

While a number of students struggled during this time, the struggles seemed to be more exaggerated based on gender. As our data suggests, women and other gender expressions were more likely to have negative experiences during this time. Although participants may not have explicitly contributed their negative experiences to their gender expression, unfortunately women having negative experiences in engineering is not a new concept given the number of existing studies that explore why women are underrepresented in engineering and the struggles they face while persisting in the field [12]–[17]. The pandemic negatively influenced women’s ability to thrive during this time as described by Tobias (2014), given that many women shared stories about struggle, lack of support, and lack of autonomy given the many external forces outside of their control to which they had to adapt to [10].

Additionally, we noticed in our qualitative analysis that the impact of race was more apparent in Black/African Americans and this impact was felt beyond the scope of school. More specifically, Black students shared narratives that spoke to the racial injustices that continue to plague the United States. The lack of empathy felt by Black engineering students in the classroom seemed to be more tangible evidence of the misalignment of universities' efforts to diversity, equity, and inclusion; efforts of which were only seen through statements released after traumatic events impacted the Black community nationwide [18]. In the future, we hope to explore this impact across all of our participants and not just those sampled in this paper.

Using the SenseMaker platform for this study presented unique differences to how it has been employed in industry settings [8]. SenseMaker is a great opportunity to quickly and widely gain qualitative and quantitative insights for a research study. However, in broad studies such as this one, using the data iteratively to create meaningful, positive shifts in the data is more challenging given 1) there is no guarantee that the original participants would be able to give specific feedback on the overall data and trends and 2) a variety of systems are involved for our participants that could delay positive changes based on data and trends (i.e. one school may be more comparable to one company than assessing all PWIs or all HBCUs). Through dissemination efforts (webinars, seminars, publications) we are working to combat the first limitation, so while we were unable to know if we were speaking with anyone who participated in the survey, we have spoken to those who were eligible to participate in the study if they received the call for participation during the data collection period. The second limitation is beyond our control given that we can provide recommendations based on our findings but acting on those recommendations would be up to the administration of individual institutions. It is also important to note that when considering using SenseMaker for a research project that the ability to probe deeper on a particular aspect of one's experience is limited and researchers' conclusions should be supported by existing literature when participants narratives do not explicitly state factors that influence their experience. For example, as outlined in the results section, we note that there were a number of women who had negative experiences during this time. However, from our data, we are unable to determine what specifically contributed to this difference based on gender (i.e. did women feel that their gender played a role in why their experience was negative) and thus we have to ground our findings in existing literature to gain better insight.



## **Conclusion**

The COVID-19 pandemic has had an unprecedented impact on higher education institutions. For URM engineering students, this impact was further exacerbated by the change to virtual instruction, an increased difficulty of courses that were already rigorous, and managing additional personal responsibilities such as finances and caretaking. Our findings show that majority of students had less than positive experiences during this time as students managed the aforementioned challenges as well as navigating courses where instructors lacked empathy for URM students. Overall, while this time has been difficult for everyone, URM students have had an increasingly difficult time, and this can be further exacerbated depending on gender, race, or the intersection of the two. It is important that as we move forward (during and post COVID), that true inclusion is built on understanding and being empathetic of others' experiences especially our students. When we truly prioritize inclusion and take meaningful steps towards creating inclusive learning spaces, we more than likely will reduce the number of negative experiences for our URM engineering students.

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## Appendix A – Participant Label Legend

(class)(major)-(gender)(race)-(salary)(home)

**Class**

- F – Freshman
- S – Sophomore
- J – Junior
- L – Senior
- G – Grad Student

**Gender**

- 1 – Cis – Woman
- 2 – Cis – Man
- 3 – Non – Binary
- 4 – Trans Woman
- 5 – Trans Man
- 6 – Prefer Not to Answer
- 7 – Other

**Income**

- 1 – Less than \$25,000
- 2 – \$25,000-\$50,000
- 3 – \$50,000-\$100,000
- 4 – \$100,000-\$200,000
- 5 – More than \$200,000
- 6 – Prefer not to answer

**Major**

- 1 – Mechanical Engineering
- 2 – Computer Science
- 3 – Biomedical/Biochemical Engineering
- 4 – Civil Engineering
- 5 – Electrical and Computer Engineering
- 6 – Chemical Engineering
- 7 – Industrial and Systems Engineering
- 8 – Aero- Engineering
- 9 – Materials Science and Engineering
- 10 – Food, Agricultural, and Biological Engineering
- 11 – Environmental Engineering
- 12 – Mining & Materials Engineering
- 13 – Engineering Technology
- 14 – Other
- 15 – Engineering Education
- 16 – Construction Engineering

**Race**

- B – Black
- A – Asian
- W – White
- H – Hispanic
- M – Mixed
- O – Other
- P – Prefer not to Answer

**Home Location**

- U – Urban
- R – Rural
- S – Suburban
- N – Not Sure
- P – Prefer Not to Answer