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Far from Normal – Student struggles with health and social interaction persist through three semesters of education during the COVID-19 pandemic

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Introduction

The COVID-19 pandemic has caused major upheaval to all aspects of life. For college students, sudden shifts in learning environment have exacerbated the plight of students who struggle with access to resources and mental health. In the worst cases, it has put students in unsafe situations. While national reports clearly show the increase in mental health challenges in all aspects of society since the start of the pandemic [1], each specific institution will experience certain stressors in unique ways based on the demographics of the student body. We wanted to understand how our students were responding to the added stress of suddenly and drastically changing their learning environment and the ways that affected their learning – especially in relation to mental health.

The college mental health crisis has been ongoing in America since the mid-1990s [2]. In 2010, 45.6% of students reported feeling hopeless and 30.7% of students reported depression interfering with their daily lives. Mental health disorders have been linked to decreased academic performance, increased risk of drop-out, and decreased functioning after graduation – which are now major concerns for all students trying to navigate college during a pandemic [3]. More recently, in 2017, 36% of students reported having a lifetime mental health diagnosis [4]. The mental health impact of quarantine and the uncertainties presented by the pandemic are believed to disproportionally impact those with pre-existing mental health conditions and mental health professionals recommend giving extra support to those most at risk for increased stress [5]. The COVID-19 pandemic may be exacerbating the reasons students do not seek help from mental health professionals, including not recognizing that they have mental health symptoms, a desire to handle the situation on one's own, a desire to talk to friends and family instead, or embarrassment for needing help [3].

We know that students do not learn in a vacuum but instead are continuously impacted by the situations and scenarios in their own lives. The COVID-19 pandemic has been more than an inconvenience for students, putting many in financial hardship and leading to worsening mental health outcomes as students deal with a lack of resources ranging from not having a personal laptop (and/or sufficient internet connection for remote learning) to food insecurity [6]. Previous crises from recent U.S. history have caused campuses to switch to emergency remote teaching plans to keep their students safe during times of uncertainty. However, even if campuses have not temporarily closed, many other forms of crisis – such as school shootings, natural disasters, or protests – highlight the effects that extreme stressors can have on students' ability to learn [7]. The pandemic has impacted the global education community and has lasted longer than typical emergency education interventions. Many students struggle to stay hopeful and positive in the wake of disrupted patterns of learning, largely because many have not yet mastered how to employ adaptive practices in times of crisis [8]. Although our college employed a HyFlex model in the fall (students back on brick-and-mortar campus but rotating through attending class in-person versus on Zoom for different classes and different days), the learning environment is still far from what we would typically consider "normal."

We sought to quantify the ways in which our engineering and computer science student body's perceived ability to learn was impacted by the emotional and mental health toll of the pandemic and its consequences. We wanted to develop a deeper understanding of the challenges facing our students so that we could modify our pedagogy to better support them, even as the structure in which we were delivering courses was also rapidly changing. Students were surveyed at the end of the spring, summer, and fall semesters, which were presented with emergency remote learning, premeditated remote learning, and Hy-flex learning, respectively. We found that regardless of learning paradigm, the challenges have remained constant. In each semester, between 29-38% of our students reported that at least one situation made learning almost impossible, while a consistent 15% of students listed at least eight distinct items that made learning at least highly challenging, if not almost impossible. The primary factors that contributed to these major challenges, in all semesters, were lack of motivation to do work, a general lack of daily structure, limited social interaction, and anxiety. As we transitioned from emergency remote teaching to HyFlex teaching, our students reported an organized learning management system (LMS) and clear communication being very helpful, while also acknowledging their need for compassion, empathy, and praise from their instructors.

Methods

Our survey was deployed at York College of Pennsylvania, a private, medium-sized, liberal arts institution with four-year engineering and computer science programs that include three co-operative (co-op) experiences (for the engineering students) or an internship (for the computer science students). Our engineering and computer science student population is approximately 90% male, 85% white, and 38% of our students are commuters. Because of this, demographic data beyond major and course year was not collected as it would have prevented the anonymity of our student's responses. Beginning with the summer following sophomore year, the engineering curriculum will alternate a full-time co-op with a semester of full-time coursework; ending senior year with consecutive spring and summer semesters of full-time courses, graduating in August. As a result, we have full time teaching and learning during the summer semester for our junior and senior engineering students, which puts us in the unique position of having completed three full-time academic semesters during the pandemic. With the juniors on co-op in the spring and seniors in the fall, our 2021 cohort of engineering students has only experienced a single full semester (Summer 2020) of academic coursework during the pandemic. It also means that one cohort of our engineering students cannot participate in the survey each semester. In total, we had approximately 25% of the engineering and computer science student body, or ~33% of the eligible (i.e.course-enrolled) students, respond each semester.

We surveyed our engineering and computer science student body anonymously at the end of each semester impacted by COVID-19 (Spring 2020, Summer 2020, and Fall 2020). Students were asked to answer survey questions considering their engineering and computer science courses only. The survey was sent by e-mail within the last two weeks of the semester and the survey closed for responses approximately one month after the initial release date. All responses were reflective as we did not survey students at the start of the semester. Five percent of students were randomly selected (via random number generation) to receive a $25 Amazon gift card as incentive to complete the survey after completion. The survey was broken down into the following sections: 1) attitude toward remote learning, 2) personal challenges faced during remote learning, 3) impacts of course structure, 4) impacts of instructor presence, 5)

demographics. In addition to close-ended questions, we also have numerous places throughout the survey for students to provide open-ended responses regarding aspects of course structure, specific challenges, and overall positive and negative take-aways. A copy of the survey can be found in Appendix 1. Questions were added to the survey as we transitioned from emergency remote learning (spring) to pre-meditated remote learning (summer) to HyFlex (fall), at the request of engineering and computer science colleagues, to capture additional information for continuous course improvement (e.g., office hour attendance, exam delivery preferences). The questions added during the summer are marked with ** and the questions added in the fall are marked with ***. Once a question was added to the survey, it remained intact for subsequent deployments.

Due to partial or incomplete surveys, the number of responses for each section of the survey differs slightly resulting in changing N-numbers for different questions. Chi-squared analysis was used for multi-semester comparisons and Fishers exact test was used for comparisons between cohorts and between the spring and fall semesters. All statistical analysis was done using Microsoft Excel or Prism 9 software.

Results and Discussion

Students were asked to reflect on how their attitude and perception of their learning environment changed over the duration of remote/HyFlex learning. Overall, we found reversing trends as the pandemic progressed (**Fig 1**). Many students (33%) responded that they were somewhat happier at the end of the spring semester than when the emergency transition began in mid-March. However, in the fall when we were back on campus under a HyFlex model, 41% of students reported being somewhat sadder. In the spring, the average description of initial feeling was somewhat sad (2.36 ± 1.17, where one was "sad" and five was "happy") whereas at the start of the fall, the average description was trended more neutral (2.93 ± 1.21) although the change was not statistically significant.

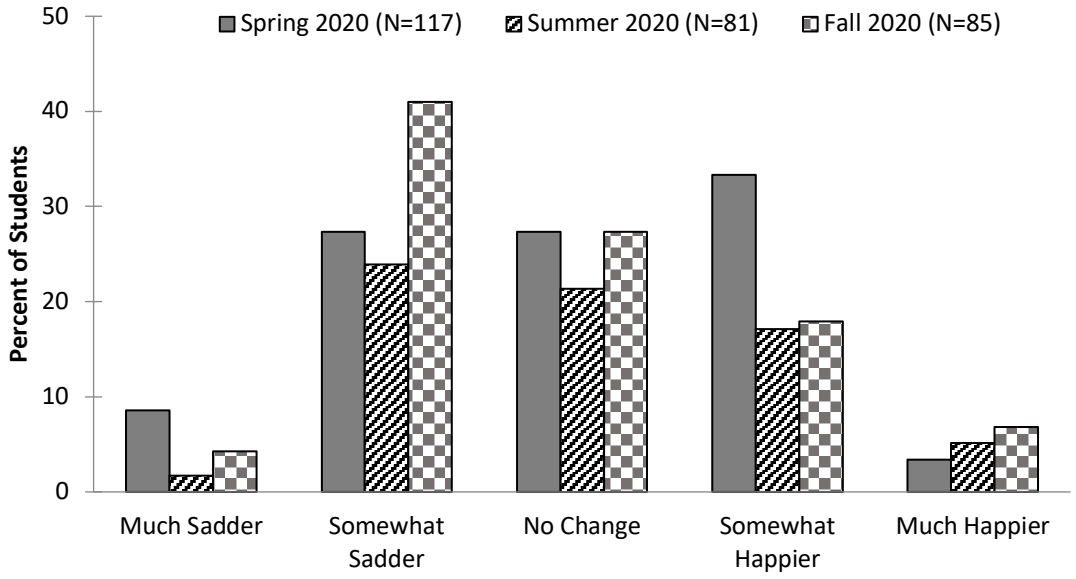


Figure 1. Student change in attitude from beginning to end of the semester.

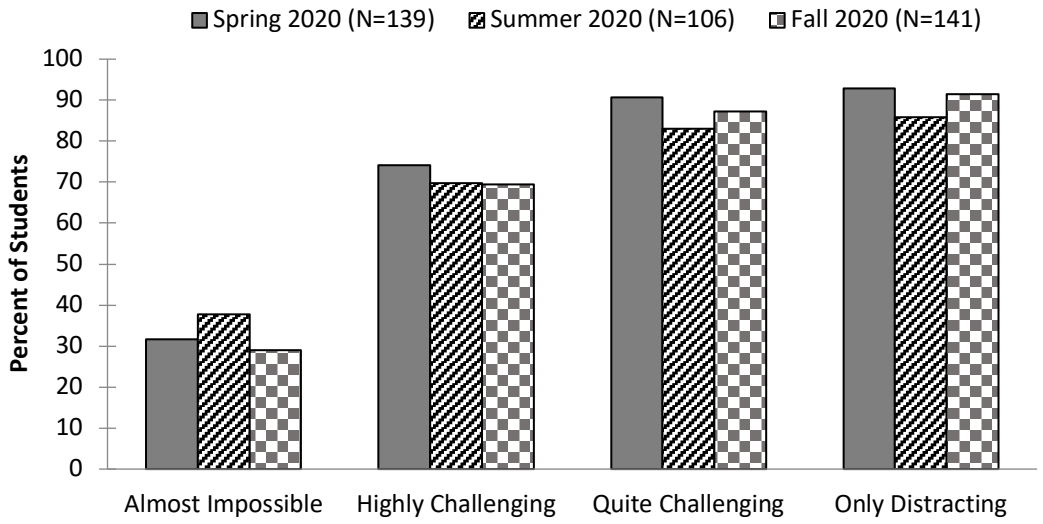
During the spring, our students recognized that the transition was rapid with little time to prepare. As our students said, "the teachers didn't have time to prepare [for] the situation… the spring teachers did the best they could do," and, "[we] were all adjusting together and professors were helping to make do of the situation." While many of our students were unhappy with the emergency transition to remote learning ("this just really sucked," and "it was generally just a worse form of non-remote [*sic*] learning, it should be avoided at every opportunity"), there was still optimism for the future, as one student said, "I think it went ok, and I think we all hope we'd rather not do it again!" In the fall, it seems as if our students may have approached the semester thinking that because the professors had the summer to prepare, and they were back on campus, it should be more "normal".

While most students appreciated being back on campus and felt the classes were better organized and use of technology was smoother, some students felt that "fall was much more complicated and it felt like the school was unprepared," and "HyFlex is just a stupid buzzword for inconsistency." Some of this likely comes down to each student's individual experience in their specific set of classes; another student wrote, "I think there needs to be some form of training for professors or at least a base standard as some professors did extremely well with HyFlex and others felt extremely disorganized and haphazard. A standard and some form of training would help alleviate some of this." While training was offered by the college in multiple avenues, it was not mandatory, nor can training completely replace learning from experience. Despite this frustration, we also had a lot of students extend gratitude or empathy to their professors. In total, 10% of students in the spring and 5% of students in the fall mentioned praise or thankfulness of specific professors or general thankfulness for their professors' hard work, effort, and empathy for the difficulty of the situation.

Level of disruption stays constant through three-learning modalities

In the survey, students were asked to grade a list of 20 scenarios as making learning "almost impossible," "highly challenging," "quite challenging," "only distracting," or "did not pose a problem" to them in relationship to their learning experience. The scenarios were broken into access issues (i.e. internet access, computer availability, software availability, a place to work, etc.), mental/physical health issues (i.e. inconsistent sleep schedule, anxiety, personal sickness, sickness or death of a family member etc.), social issues (work schedule, lack of structure, lack of social interaction, etc.), and course-related issues (inconsistent structure, too much work, feeling unsupported by faculty etc.). An average of 33±4% of our responding students ranked at least one scenario as making learning "almost impossible" and 71±3% of our responding students ranked at least one scenario as making learning "highly challenging" across all three semesters (**Fig. 2a**). The percentage of students responding to each level of difficulty did not change significantly with changing learning environment from emergency remote (spring), to premeditated remote (summer), to HyFlex (fall). Furthermore, 38±9% of students reported significant difficulty because of 2-5 scenarios and 15±7% of students whose learning was negatively affected by eight or more scenarios (**Fig. 2b**). Regardless of semester, ~15% of our students reported having eight or more scenarios that made learning "almost impossible."

a)



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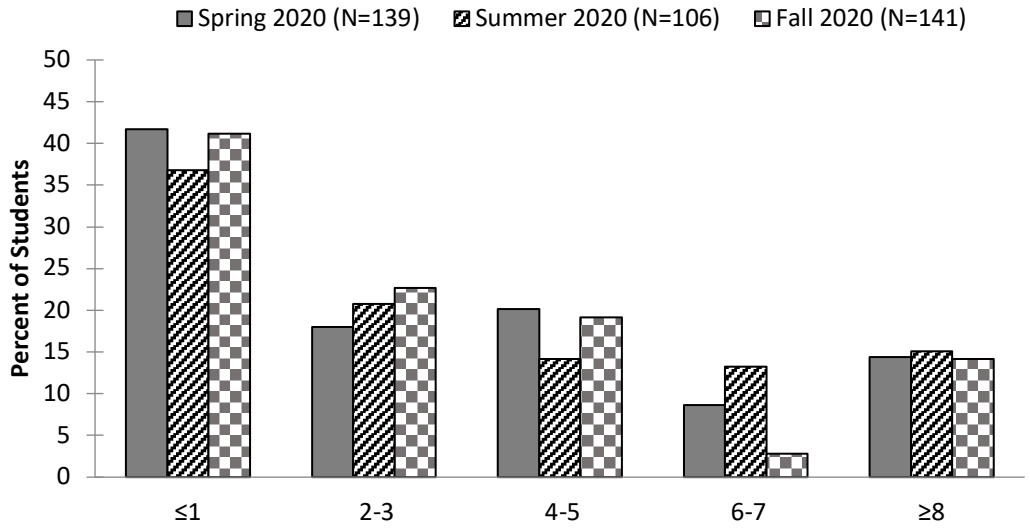
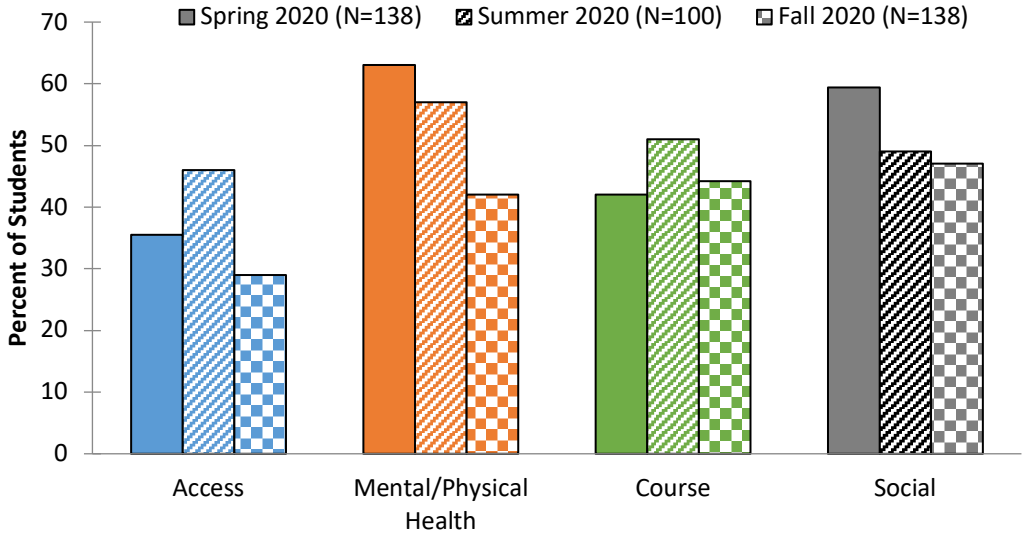


Figure 2. a) Percent of students that reported experiencing at least one scenario having negatively impacted their learning and b) the number of unique scenarios that made learning "impossible" or "highly challenging" for individual students.

Looking at how many students reported that at least one scenario made learning at least "highly challenging," the overall theme of the student responses was clear: mental and physical health and social issues were the primary cause of disruption to normal learning during the emergency transition (**Fig. 3a**). In the Spring 2020 semester, 63% of students reported at least one mental/physical health scenario that made learning at least highly challenging. While mental/physical health remained the highest reported category in the fully-remote summer (57%), social concerns were reported at the highest levels in the HyFlex learning environment in the fall (47% compared to 42% mental/physical health) (**Fig. 3a**). A positive outcome seems to

be that our total number of students experiencing acute mental health challenges is decreasing as the pandemic continues, despite a lack of significance based on Chi-squared analysis.

a)



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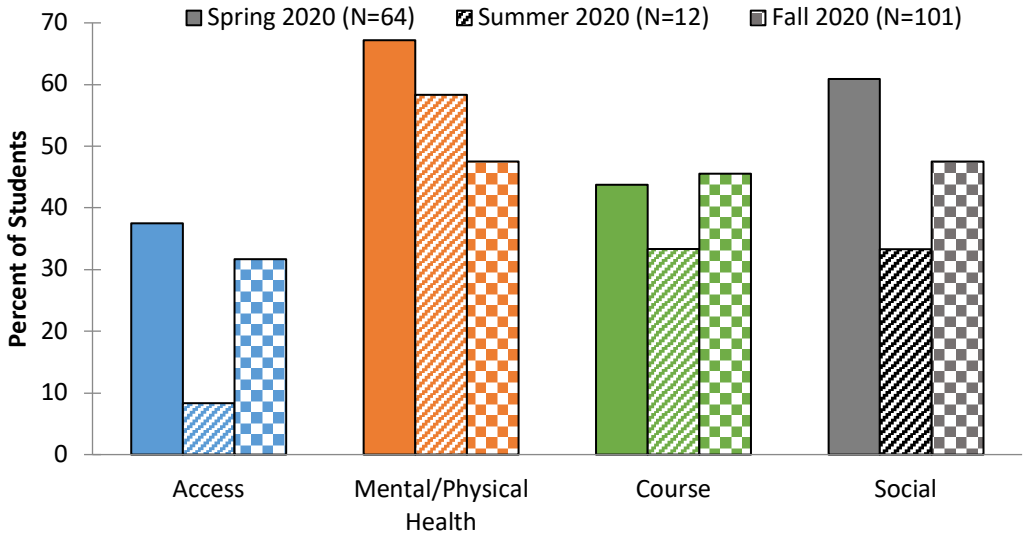

Figure 3. Categorical conditions that made learning "almost impossible" or "highly challenging" for a) all engineering and computer science students and b) for the 2022 and 2023 engineering cohorts and the 2021 computer science cohort. There was no statistical difference between any of the semesters or between the whole population and the continuous cohort of sophomores and juniors, based on Chi-squared analysis.

Course-related challenges were consistently rated as "highly challenging" or "almost impossible" among 42 and 44% of students in the spring and fall, respectively. For the summer, there was an increase to 51% of students with major course issues; however, it is worth noting that this includes 29 junior students who were on co-op for the spring semester, making the summer their first experience with remote learning in the pandemic. Figure 3b presents categorical data for only the 2022 and 2023 engineering cohorts and the 2021 computer science cohorts. These were the three common student groups between the spring and fall semesters; note that students from

this cohort taking summer classes would be taking courses out of sequence (i.e., in advance), which was likely a response to the cancellation of Summer 2020 co-ops in favor of remote-only internships. The consistency between the spring and fall student experience could be indicative of the fact that learning was still disrupted (albeit in a different manner), and that those disruptions were (and are) still causing our students significant learning challenges, despite reported improvements in mental health. It is also important to note that the role of social challenges is still high (47%), even when students have returned to campus. A handful of students even reported that the fall learning conditions were worse than the emergency transition to remote learning in the spring.

Sub-categorical challenges have cohort-specific impacts

While mental/physical health challenges seemed to decrease with the shift to being back on campus, we wanted to take a closer look at the percent of students reporting distinct, sub-categorical challenges to better understand the depth of impact for each class year and semester. All data from this point forward is in reference to specific scenarios reported as having made learning "almost impossible" or "highly challenging." During the emergency transition in the spring, we noticed that certain scenarios appeared to have a higher impact on the first-year students and seniors, compared to the sophomores and juniors (**Table 1**). Issues with access to resources, feeling unsupported by faculty, and limited social interaction were respectively reported at 33%, 33% and 20% higher than the central class cohorts. Interestingly, lack of access to resources nearly perfectly correlates with feeling unsupported by faculty – possibly pointing to students feeling left behind as learning moved forward, technologically speaking.

There were also areas that were generally challenging for all class cohorts that still seemed to have a greater impact on first-year students and seniors, such as disappointment (>25% vs. >15%). However, the main observation from this is that each cohort experienced certain anomalies based on their current place in the curriculum. First-year students and seniors have different social expectations (i.e., making new friends as they start a new chapter in life or spending as much time with their college friends before moving on to the next chapter after graduation), but the social experience is equally poignant in those populations. These students may also have higher disappointment rates because they are experiencing larger perceived losses and greatest barriers to access, whether that is from losing the hands-on avenue for capstone projects and senior research or because of a higher reliance on campus academic resources due to being new to the collegiate environment.

Beyond these more obvious points that may affect students at most institutions, our numbers continue to highlight that not all cohorts experience the pandemic equally. Our sophomore class should have gone out on their first co-op during the summer of 2020. This experience was cancelled (per institutional directives) and they reported levels of disappointment almost as high as the seniors (23%) and motivational challenges (53%) that were 10 percentage points higher than any other class year (**Table 1**). These students also experienced the highest anxiety at 35%, which was another 10 percentage points higher than the juniors and seniors who had already had real-world experiences (~24%), but only slightly higher than first-year students (~32%), who were dealing with major disruptions to their original vision of the college adventure. While we cannot be certain that this was the driving factor in the high disappointment rates in the spring semester sophomores, our 2022 cohort students frequently mentioned their sadness and

frustration with the loss of their co-op experience and their concern for the impact that would have on their future endeavors, even into the fall semester.

Table 1. Percent of students in each cohort who ranked these scenarios as making learning highly challenging or almost impossible during the emergency transition in Spring 2020.

	ACCESS		MENTAL/PHYSICAL HEALTH					COURSE		SOCIAL		
	Access to resources (laptop, etc.)	Personal work space	Sleep schedule	Disappointment	Lack of motivation	Anxiety	Unsafe home environment	Too much coursework	Feeling unsupported by faculty	Lack of daily structure	Limited socialization	N=
2023 Cohort	18.2	27.3	31.8	31.8	36.4	31.8	9.1	18.2	19.0	45.5	45.5	*22*
2022 Cohort	5.9	38.2	26.5	23.5	52.9	35.3	0.0	20.6	5.9	38.2	35.3	*34*
2021 Cohort	6.1	30.3	24.2	15.2	42.4	24.2	0.0	21.2	6.1	36.4	30.3	*33*
2020 Cohort	14.3	21.4	26.2	26.2	42.9	23.8	2.4	35.7	14.3	40.5	42.9	*42*

Table 2. Percent of students in each cohort who ranked these scenarios as making learning highly challenging or almost impossible during the HyFlex Fall 2020 semester.

	ACCESS		MENTAL/PHYSICAL HEALTH					COURSE		SOCIAL		
	Access to resources (laptop, etc.)	Personal work space	Sleep schedule	Disappointment	Lack of motivation	Anxiety	Unsafe home environment	Too much coursework	Feeling unsupported by faculty	Lack of daily structure	Limited socialization	N=
2024 Cohort	4.2	8.3	4.2	8.3	20.8	25.0	0.0	20.8	0.0	20.8	20.8	*24*
2023 Cohort	4.8	19.0	40.5	21.4	35.7	36.6	7.1	42.9	4.8	31.0	43.9	*42*
2022 Cohort	6.0	30.0	26.0	10.0	36.0	44.0	0.0	32.7	8.0	24.0	32.0	*50*
2021 Cohort	0.0	8.3	8.3	25.0	58.3	41.7	0.0	33.3	8.3	33.3	41.7	*12*

Additionally, we see that many of these cohort-specific challenges are persistent throughout the changing teaching modalities. In the spring, our first-year students (2023 cohort) reported the highest levels of unsafe home environments (9%, three-fold higher other class years) and the highest levels of difficulty regulating sleep (31%, five percentage points higher than the next highest class year). Not only were these issues more drastic in this cohort, but they were persistent (**Table 1, 2**). In Fall 2020, during HyFlex instruction, the 2023 cohort was the only cohort to report an unsafe home environment with 7% of our students saying that this scenario made learning "highly challenging." The sleep regulation worsened in this cohort with 40% reporting major difficulty, which is nearly double the next highest class. We see the same consistency with our sophomore class (2022 cohort) who continued to report the highest levels of learning disruption by not having their own place to work (38% in spring, 30% in the fall).

Because these challenges are being reported consistently and longitudinally (**Table 1, 2**), it points to the need to understand each cohort as a collection of individual students.

Return to brick-and-mortar campus does not significantly reduce most learning challenges

Comparing engineering and computer science program-wide results across semesters highlights that while there are some areas that improve with the transition back to on-campus (i.e., HyFlex) education, many of the primary scenarios are still causing significant hurdles for student learning. Lack of motivation to do work is the number one struggle our students report, regardless of learning modality (**Fig. 4**). While the total average number of students in all cohorts reporting major disruption decreases from 44% to 34% the maximum level of disruption increases from the spring (2022 cohort, 52%) to the fall (2021 cohort, 58%). Similarly, the spring had three scenarios with reporting above 30% average for all cohorts (lack of motivation, general lack of daily structure, and limited social interaction) the fall saw four scenarios above 30% (lack of motivation, anxiety, too much course work and limited social interaction). As one student described the comparison between their spring and fall semesters, "In the simplest terms, it wasn't as staggering of a change as the prior spring semester, but its requirement of less social interactions hindered my overall learning experience." Removing general lack of daily structure from the worst-impact list in the fall is logical given the physical movement of students to and from the classroom; however, it's still reported at 27% on average for all cohorts as a disruption that makes learning highly challenging or almost impossible.

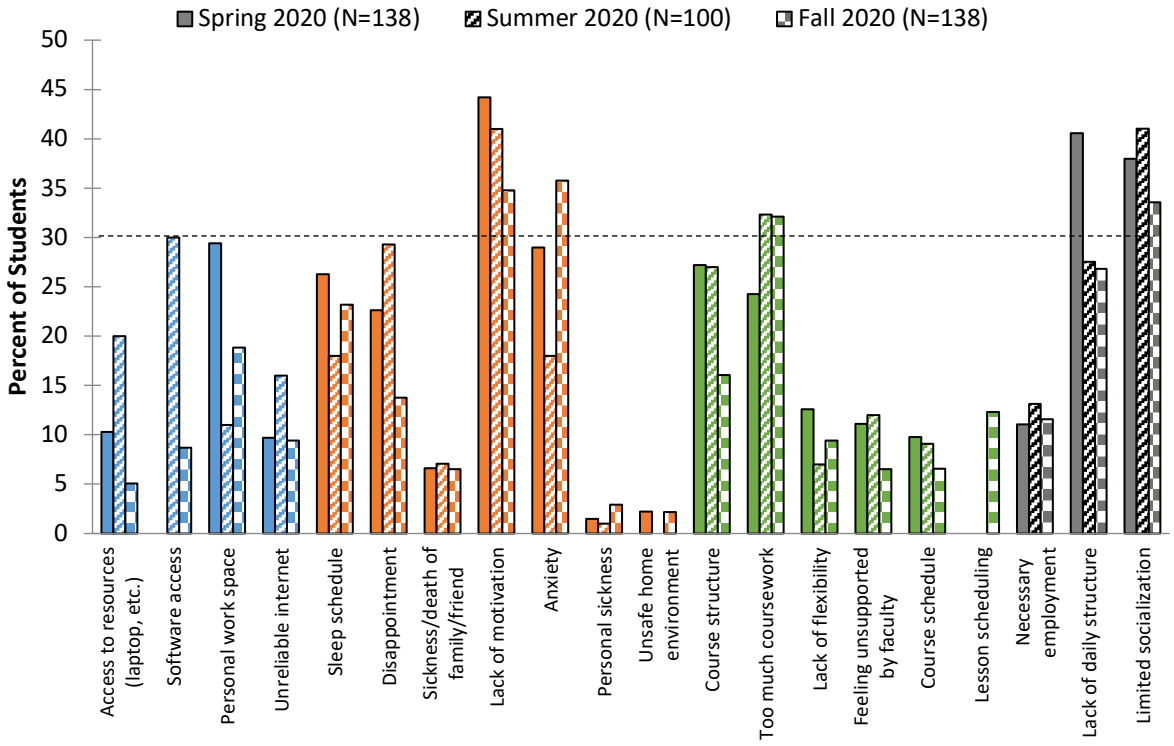

Figure 4. Percent of students responding that individual scenarios made learning "almost impossible" or "highly challenging." Color-coding is consistent with categories presented in Figure 3 (blue = access issues, orange = mental/physical health, green = course-related scenarios, grey = social implications.)

During the fall semester anxiety and too much course work saw nearly 10 percentage point increases from the spring (**Fig. 4**). One student described excessive coursework as, "Having the teachers unload more work on students because it's harder to convey through Zoom is not fair. I

spent upwards of 10-12 hours a day doing homework outside of the 3-5 hours of time spent in class. Little to no time for personal needs." In their comments, five percent of students who completed open-ended responses indicated that they stopped engaging in self-care due to being overwhelmed by coursework. We think the primary contributor to this increase in anxiety may have been the lack of breaks during the fall semester and increased use of proctoring for online exams. The semester was compressed so that students could remain home following the traditional Thanksgiving break in November, resulting in the loss of two-three lecture sessions, as well as the traditional fall break. As faculty, we noticed a severe burnout among our students, and ourselves, due to the loss of time to rest during the semester. As one student described, "fall was much more stressful because of lack of breaks and the shortened semester mean some classes don't pause to review anything." Comments also frequently cited the increased stress of testing remotely. Ten percent of our students indicated Honorlock, an online proctoring software, to be a major cause of stress and anxiety, with another six percent of students citing additional issues. The increase in workload and anxiety, along with personal sickness due to COVID-19, which doubled from the spring semester, were the only scenarios to get worse during the transition from emergency teaching to HyFlex teaching and had a palpable effect on the learning environment of the Fall.

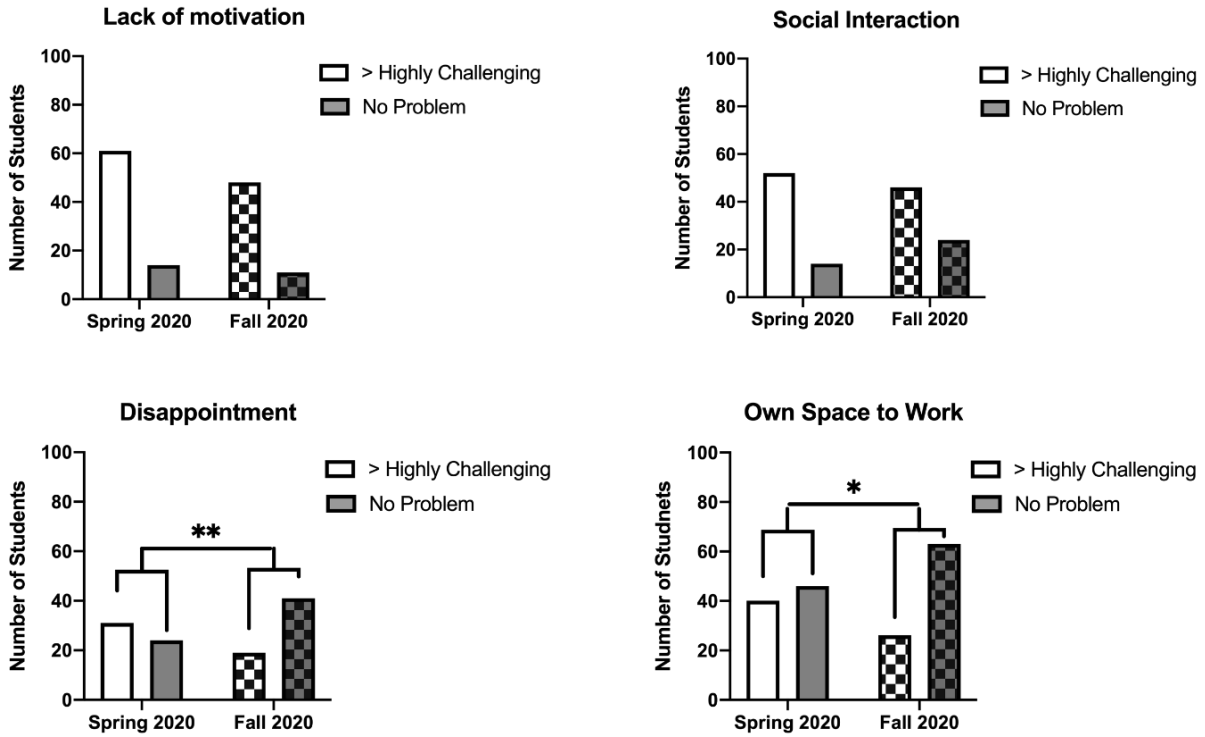

Figure 5. The majority of the scenarios we evaluated were unchanged from the spring to the fall semester, such as student lack of motivation to do work and insufficient social interaction, despite trends toward improvement during the fall. However, going back to the brick-and-mortar campus did result in a statistically significant reduction in student disappointment ($p=0.0089$) and providing students with a personal space to work ($p=0.0201$) based on Fisher's exact test.

The only statistically significant changes between spring and fall were a decrease in disappointment and inability find a private space to work (**Fig. 5**). The two major problems that

were consistent throughout the semester, lack of motivation and lack of social interaction, were statistically similar between the spring and the fall ($p = 0.9999$ and $p = 0.1257$, respectively). Even anxiety and too much course work, which were cited more frequently in both student comments and the survey, were not statistically worse during the fall than the spring ($p = 0.1251$ and $p = 0.3811$, respectively). These results serve to highlight the continued impact of the disruptions due to the ongoing pandemic – simply returning to a brick-and-mortar campus did not bring back "normal".

Completely remote learning exacerbated some challenges compared to emergency or HyFlex

While our analysis thus far has been focused on the emergency transition in spring 2020 and the on-campus HyFlex fall semesters, the summer semester was unique in that it was a pre-mediated remote learning experience. Due to our co-op schedule, the majority of the 2021 cohort was out on co-op during the emergency Spring 2020 transition to remote learning. This led to a disproportionally high demand on these students in terms of access and course structure when they started remote learning in the summer of 2020 (**Fig. 3a**). Forty-eight percent of 2021 cohort students reported at least one element that made learning "almost impossible" and 86% of students reporting scenarios that were at least "highly challenging" (compared to 44% and 69% for "almost impossible" and "highly challenging" situations for the class of 2020, who took classes during spring and the summer semesters) (**Fig. 6**). In contrast to the spring and fall semesters, only one student mentioned thankfulness or empathy for their professors. A fully remote summer semester also meant that students were unable to participate in many of the traditional hands-on (i.e., laboratory) activities. The spring semester students at least had the first half of the semester in-person (pre-pandemic) and while the fall semester was potentially modified to allow for social-distancing rules, etc., many hands-on components of the program were reintroduced.

	Almost Impossible	Highly Challenging	Quite Challenging	Only Distracting	*N=*
2022 Cohort	22.2	33.3	55.6	100.0	*9*
2021 Cohort	48.3	86.2	89.7	93.1	*29*
2020 Cohort	44.2	69.2	92.3	86.5	*52*

Figure 6. Percent of students who ranked at least one scenario as making learning "almost impossible" or "highly challenging" was higher in the 2021 cohort.

Student comments supported the idea that in the summer, they felt as if they were missing out on a key piece of their engineering education – "As an engineering major, I feel that this is no replacement for hands-on learning in a classroom… Our major is simply more difficult to do virtually, and because of this I think it should be planned for differently. We rely too much on in person instruction to keep being virtual." Students learning from home also experienced a shift in learning environment. On campus, they are surrounded by peers who are in similar academic mindsets. For students who moved to their family home for remote learning, they lost the peer-based support system and may have had to contend with family members that do not understand the time commitment their students dedicate to their college education – "Professors need to realize when at home we have more responsibilities than when at school. While at school they give us homework 24/7 but when at home families (parents and grandparents) do not understand how much work [an] engineer does. I constantly would get told that I needed to do something

other than sit at a computer all day. I also would be made to feel bad because of canceling plans with family or leaving early to do homework. This caused issues and created an environment where I felt bad for doing my work." Professor empathy (and potentially flexibility with assignment due dates) could help mitigate the adjustment to learning in a new environment, surrounded by a different type of support system.

Interestingly, we continued to see cohort specific impacts in the summer semester in the 2022 and 2023 engineering cohorts and the 2021 computer science cohort (**Fig 3b**). These cohorts had noticeably lower percentage of students reporting scenarios that made learning at least highly challenging across the access (38 percentage points lower), course-related (18 percentage points lower), and social scenarios (16 percentage points lower). As previously mentioned, these three groups of students would not typically be required to take summer courses during this semester; several took classes to compensate for cancellation of co-ops and formal or informal internship opportunities. Generally, these students were ambitious, taking courses ahead of the typical curriculum sequence. Because of the non-mandatory nature of these courses (at this specific time), we can assume that students who elected to do this, did so with some security in having the necessary resources (a laptop, reliable internet connection, etc.). However, we still see consistent levels of severity in scenarios affecting mental and physical health for this ambitious group of students, further supporting the notion that learning during a pandemic will universally influence the mental and physical well-being of our student body, regardless of teaching modality, personal ambition, or available tools and resources.

Faculty organization and tone makes a positive impact on students

Our students also cited common themes in helpful faculty responses that relieved the burden of learning in a system disrupted by COVID-19. The vast majority (greater than 90% of responding students) found that having a clearly organized LMS was helpful, on some level, which was also supported through individual student comments – "It would be nice if the professors were consistent. Some posted notes online, others didn't, some had a highly accessible Canvas, others didn't." and "Not having Canvas fully updated to reflect what was said in class and not having assignments in Canvas to show what we have coming up can be very stressful." This response was mirrored in an appreciation for clear communication of due dates, flexibility with due dates, and flexibility with exam timing. As alluded to previously, students were more receptive when their faculty were empathetic and patient as the students adjusted to a new learning modality – "Just more understanding from professors about its difficulties overall." At least 85% of student responses, again across all three semesters, indicated that feeling like the instructor was aware of the challenges of remote/HyFlex learning was at least somewhat helpful, with 64% in the spring and fall and 55% in the summer reporting it was very helpful. Student comments reinforced that the transition was not without hurdles and that they would and/or did appreciate modified expectations while they made the adjustment. Most students (83% in the spring, 75% in the summer, and 81% in the fall) reported finding it helpful to have instructors give positive feedback, in the form of praise. While some students did not experience receiving praise (10%, 17%, and 9% for the spring, summer, and fall, respectively), less than 10% of students who reported receiving positive feedback responded that it did not positively enhance their learning environment. In the face of uncertainty, students seem to be bolstered with reassurance that they are meeting and/or exceeding expectations and seem to be comforted in knowing that their hard work has not gone unnoticed.

Conclusions

We wanted to understand how our student body was responding to the shift from a traditional education setting to emergency remote teaching and then to HyFlex learning, as we progressed through the COVID-19 pandemic. We found that despite some improvements in the severity of the struggles our students faced while trying to learn, the effects of mental/physical health concerns, social disruptions, course modifications, and access to resources posed significant hurdles for student learning, regardless of learning modality. The return to campus in the fall noticeably decreased access issues and improved students' daily structure; however, it came with an exacerbation of anxiety in students, most likely due to a constantly changing schedule and the lack of breaks in the semester. Studies have shown that the pandemic is more than a disruption for many students lives, it is a major trauma where the mental health consequences are sometimes best compared to PTSD based on the way that quarantine is impacting the individual [9]. Students found it especially helpful when they perceived that faculty modified the course to account for the disruptions introduced by an unfamiliar learning modality and provided clear communication, flexibility, and praise.

As previously noted, each class year responded differently, based not only on their position in the curriculum, but also the specific students that make up a given cohort. While we saw similar responses to the loss of social interaction between first-year students and seniors during the spring emergency transition, it was our sophomore students, preparing to have their first co-op experience (which was ultimately cancelled by the college), who seemed to struggle the most with motivation. Other anomalies such as lack of access to resources, a private/quiet workspace, inconsistent sleep schedules, or unsafe home environments also highlight the need for faculty to understand the challenges facing their students personally. While this seems like common sense, when we as faculty are overwhelmed, it is easy to generalize our students and forget that they are all handling their own unique lives. The kind of support that is needed for someone who cannot focus, because they are trying to learn at the kitchen table around other family members, is different from a student who needs to hold a part-time job to financially support their family or the student who is coping with the emotional trauma that comes living through a pandemic. The good news is, getting to know your students also shows them compassion and flexibility, which is one thing that is cited as being very helpful to students in coping with new challenges presented by learning during a pandemic [7].

Another common criticism among students was not being able to provide evaluations for individual faculty. Just as our students are all struggling in different ways, so are our faculty. While our institution removed individual faculty evaluations to provide leniency for faculty who found difficulty transitioning, there may be a place to collect this feedback in a way that does not jeopardize the tenure process and also highlights the work put in by faculty to suddenly re-design their courses while simultaneously teaching them. Providing feedback is a major way that students can feel heard and respected in the classroom, and asking for early feedback within the first few weeks of a semester can have a lasting impact on their feelings of a course at the end [10, 11]. Beyond that, this helps us, as faculty, to understand some of the specific issues that may be facing the students in our classroom. One of our students commented, "[Our faulty] have been supportive and adaptive to this situation. In the beginning of the semester, one of my professor's

organization was rough to say the least. I was able to contact them and have a long zoom call, highlighting ways they could make the class more manageable. In that zoom session the professor was making live updates to [the LMS] and asking for my feedback." This was a great representation of how individual professors were doing their best to productively navigate this new form of learning. However, we also know that this conversation did not happen in every class. Since most students will not be so bold as to initiate the conversation on how a class can be enhanced, asking for feedback provides a key means of understanding student needs and should continue even under non-ideal learning conditions [12]. Fifteen percent of our students in the spring specifically voiced their frustration at not being able to provide professor specific evaluations, both for what went well and what did not. We don't think we could have said it better than one of our spring students, "removing course evals was a mistake because I can't give the appropriate feedback to each professor. I understand that overall they would be negative but I think that's crucial to developing an efficient and effective system for everyone."

The pandemic has highlighted the ways in which our world is increasingly violate, uncertain, complex and ambiguous (VUCA) [13]. Teaching under exacerbated VUCA conditions requires competencies in self-awareness, social-awareness, empathy, and communication skills that go beyond what is needed in a normal semester [14]. Many of our students specifically called out the importance of feeling supported by their faculty in their comments, and whether we want to recognize it or not, our ability to self-regulate our own emotions impacts our students[15, 16]. One of the ways in which we noticed our students' cry for help was their craving for informal interactions with us – whether in the form of show-your-pet-on-Zoom at the end of class or let's-play-a-quick-online-game before we start learning today. While we can provide due date flexibility, serious thought on the importance of specific material, and open-notes tests, we can also model humanity for our students and let them know that we understand this time is challenging and unlike anything they, or we, have lived through before. Beyond this, it is not currently a requirement for new professors to engage in training in the science of teaching, learning, and providing emotional support to students in crisis. The shortcomings of the traditional role of a professor as a technical content expert with limited reward/recognition for professional development in areas that are primarily important for our relationship with our students through teaching and mentoring, existed before the pandemic [17-21], but has also been exacerbated by it. The COVID-19 pandemic should serve to highlight the need to train and provide skills to higher education professionals, beyond just in the content that they will teach, and these skills should be rewarded in the tenure process. Our students rarely cited a lack of knowledge of their professors, but rather a lack of flexibility or empathy as reasons for frustration during the transition.

Students (and faculty) need a break from learning to learn at the level that is expected for college courses. Going into the fall HyFlex semester, we thought our students would be less stressed and feel more engaged with the material. While there were definite positive mental health impacts of bringing students back to campus, there was also a modest worsening of anxiety and perceived workload. Not having time to catch up on sleep, emotionally process current events (related to the pandemic or otherwise), and/or to just step away, led to perceptible increases in burnout, even if the numbers did not show statistical significance. As the COVID-19 pandemic continues, and as higher education continues to offer modified teaching modalities, our students will continue to carry the additional burdens of the pandemic throughout their learning experience.

On an instructional level, we as faculty should be prepared to offer support and guidance, as our students navigate an unfamiliar learning environment. On an institutional level, we need to ensure our faculty and students are provided with the tools and resources (including time) to be as successful as possible. On a personal level, we need to recognize that the current events are unprecedented and the challenges and emotions we all face are valid and warranted – and likely may continue, even after we return to "normal."

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Appendix 1: Remote/Hyflex Learning Survey

The following survey is meant to help us understand your experiences and responses to Hy-Flex learning this current semester (FALL2020). The more we know about what you experienced, the better we can provide effective Hy-Flex learning in the future this upcoming spring.

When you complete the survey, you will have the option to enter your student ID number for a chance to win a $25 Amazon gift card. Random drawings will take place when the survey has been closed after the Christmas

For the sake of this survey, we'd like you to **focus your feedback on ALL of your engineering courses specifically (as opposed to GenEd).** Thank you so much for your time.

Were you enrolled in an academic (non-co-op) course at YCP during the Fall 2020 semester

- ○ Yes (1)
- ○ No (2)

***What was your primary way to attending class this semester?

- ○ Hy-Flex (rotating between Zoom and in-person) (2)
- ○ All remote (3)

When the semester started in the August I would describe my **initial** feelings toward Hy-Flex learning as (with 5 being very happy):

1 (1)
2 (2)
3 (3)
4 (4)
5 (5)

Now, at the end of the semester, I would describe my **current** feelings about Hy-Flex learning as (with 5 being very happy):

1 (1)
2 (2)
3 (3)
4 (4)
5 (5)

Please rank the following options in the order that they most describe your CURRENT ATTITUDE toward Hy-flex learning

_____ Open-minded (1)
_____ Constantly wishing we were back to "normal" (2)
_____ Willing to experiment (3)
_____ Angry (4)
_____ Neutral (5)
_____ Disappointed (6)
_____ Surprised (7)
_____ Satisfied (8)

Please describe your experience with Hy-Flex learning

	Made Learning almost Impossible (1)	Highly Challenging (2)	Quite Challenging (3)	Only Distracting (4)	Did not pose a challenge to me (6)
Insufficient access to resources (laptop, internet, other) (1)	○	○	○	○	○
**Issues with access to campus software (2)	○	○	○	○	○
Inconsistent sleep schedule (4)	○	○	○	○	○
Not having my own space to work (5)	○	○	○	○	○
Disappointment (6)	○	○	○	○	○
Needing to work to provide for myself/my family (7)	○	○	○	○	○
Sickness/death of a family member or friend (8)	○	○	○	○	○
Lack of motivation to work (9)	○	○	○	○	○
Anxiety (10)	○	○	○	○	○
General lack of daily structure (11)	○	○	○	○	○

Personal Sickness due to Covid-19 (12)	○	○	○	○	○
Unsafe home environment (13)	○	○	○	○	○
Inconsistent course structure within a single class (14)	○	○	○	○	○
Too much course work (15)	○	○	○	○	○
Limited social interaction (16)	○	○	○	○	○
Lack of flexibility with due dates (17)	○	○	○	○	○
Feeling unsupported by my faculty (18)	○	○	○	○	○
Bad internet connection (19)	○	○	○	○	○
Class timing (20)	○	○	○	○	○
***Class scheduling (rotating between Zoom and in peson) (21)	○	○	○	○	○
Other (22)	○	○	○	○	○

If you answered other to the question regarding challenges to remote learning, please briefly describe your personal scenario

_____

Which of the following elements of an Hy-Flex course structure/expectations helped you to learn the most?

	Very Helpful (1)	Somewhat Helpful (2)	Not Helpful (3)	Did not expereince (4)
Clearly organized Canvas Page (1)	○	○	○	○
Clear communication on due dates (2)	○	○	○	○
Class structures that incorporated student interaction in the form of breakout rooms/small groups (3)	○	○	○	○
Flexibility with due dates (4)	○	○	○	○
Recorded lectures that allowed you to re-watch after class (5)	○	○	○	○
Flexibility with exam timing (6)	○	○	○	○
Feeling like the course was modified in some way to take into account the stress of the a new format (7)	○	○	○	○
Engagement of remote students by professor/activities during class time (8)	○	○	○	○

***Did you ever choose to attend class remotely when you could have attended in person? If so, what was the main reason for making that choice?

_____

***Do you have any feedback on the way that exams are handled in a Hy-flex environment (synchronous vs. asynchronous, in-person vs. online, Honorlock, Zoom...)?

Do you have a preference on exam administration?

_____

Is there anything else about class structure or organization you'd like us to know about?

_____

**Is there anything that you personally started doing differently from standard in-person learning that you feel was especially helpful in the Hy-Flex environment?

_____

Which of the following elements of an instructors presence helped you to learn the most?

	Very Helpful (1)	Somewhat Helpful (2)	Not Helpful (3)	Did not experience (4)
Instructor availability through online zoom office hours (1)	○	○	○	○
Instructor availability by e-mail (2)	○	○	○	○
Instructor availability by phone (3)	○	○	○	○
Instructor reaching out with personal e-mails to students (4)	○	○	○	○
Instructor reaching out with general e-mails to the whole class (5)	○	○	○	○
Feeling like my instructor was aware of the challenges to Hy-Flex learning (6)	○	○	○	○
The instructor told me/us we were doing a good job (7)	○	○	○	○

***How would you compare your office hour attendance in a Hy-Flex environment to a "normal" in-person environment?

- ○ Same - I ATTEND office hours regularly in both modalities (1)
- ○ Less - I attended office hours less under Hy-Flex instruction (2)
- ○ More - I attended office hours more under Hy-flex instruction (3)
- ○ Same - I DO NOT usually attend office hours either way (4)

***If your office hours attendance changed due to being in Hy-Flex, can you describe the main reason for that change?

_____

Is there anything else regarding instructor presence you'd like us to know about?

_____

Do you have any other comments, suggestions or other things to share based on your experience with Hy-Flex learning that you'd like to let us know about?

_____

Is there some aspect of your experience with Hy-Flex learning or the faculty's actions and efforts you'd like to see continued in the spring/when we return to fully in-person instruction?

_____

Major

- ○ Civil Engineering (1)
- ○ Mechanical Engineering (2)
- ○ Electrical Engineering (3)
- ○ Computer Science/Engineering (4)

Class Standing

- ○ First-year (1)
- ○ Sophomore (2)
- ○ Junior (3)
- ○ Senior (4)
- ○ 5th year (5)
- ○ Part-Time Student (6)

Did you take courses at YCP in the Spring 2020 during the emergency transition?

- ○ Yes (4)
- ○ No (5)

If you answered yes to the above question (took classes during Spring 2020), how did your fall experience compare with your spring experience?

_____

Total course load

- ○ <12 credits (1)
- ○ 12 - 15 credits (2)
- ○ >15 credits (3)

How many hours outside of class do you spend working on course work per week?

- ○ <5 hours (1)
- ○ 5-10 hours (2)
- ○ 10-15 hours (3)
- ○ 15-20 hours (4)
- ○ 20-25 hours (5)
- ○ 25-30 hours (6)
- ○ >30 hours (7)

20 Here is your randomized number to enter into the drawing for an Amazon gift card: ${rand://int/10000000:99999999}
This random number will not be saved in conjunction with your response and is given purely to allow us to draw winners for the gift card.

Copy this number and paste it into this Google Sheet along with your e-mail address to be contacted when we have finish collecting responses.

After you have copied the number, click next to finish the survey and save your response.