COVID-19 and the New Normal in Engineering and Computer Science Education: Students' Perspectives on Online and Hybrid Education

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Abstract

The COVID-19 pandemic caused a major disruption to colleges and universities, with many institutions cancelling in-person learning and moving to completely online instruction for a time. Since the pandemic began, institutions of higher education have utilized varying degrees of face-to-face, hybrid and online instruction. These changes have impacted both students and faculty in science and engineering fields. Traditional science and engineering students have had to adapt quickly to new, and largely unwelcome, means of learning. In addition, faculty have had to abruptly alter their teaching to adjust to changes in teaching formats imposed by the pandemic. Using a web-based survey of engineering and computer science programs in US and Canadian universities, this paper studies the challenges introduced to STEM education due to the COVID-19 pandemic from students' perspectives. The survey was administered in face-to-face, hybrid and completely online classes to study students' perceptions and attitudes as well as challenges related to changes in teaching formats during the pandemic. Furthermore, this study assesses students' perceptions about the future of teaching in a post COVID-19 environment. Results of this study provide insights into both current and future impacts of the COVID-19 pandemic on engineering and computer science education.

1   Introduction

COVID-19 has had a significant impact on society causing immense physical, social, and economic challenges. Worsening the situation is the fact that the virus continues to mutate leading to variants that cause resurgences. One scenario proposed by Kissler, et al. [1] is that a resurgence of COVID-19 could occur as far as 2025. One of the areas impacted by COVID-19 is the education sector, including schools, colleges, and universities, which experienced closures and had to quickly transition to online and hybrid forms of teaching and learning. Two years after the initial lockdown due to COVID-19 in the United States and Canada, many institutions of education have not returned to their pre-COVID-19 levels of face-to-face learning.

Due to the abrupt transition to teaching students in an online format, many universities were forced to switch from teaching students in a face-to-face format to teaching students in an online format within a short period of time. The drastic decision to shift to online modalities of teaching in response to the COVID-19 pandemic impacted both students and faculty, particularly those that did not have prior experience in online education. Some faculty who did not have prior online teaching experience had to switch to an online format within days. This hasty switch to online teaching has resulted in a disorienting and unwelcome experience for academics and has exposed deficiencies in higher education [2].

A common theme that surfaces within studies concerning online education during the COVID-19 pandemic is that the idea of online education was not an entirely new concept to institutions of higher education as much as the fact that the global pandemic merely accelerated the process in which online education was accepted (or more accurately, forced) among faculty and teaching

teams [3, 4]. Watermeyer, et al. [2] argues that due to COVID 19 and the resulting quick move to online teaching and learning, both the immediate and long-term future of higher education are linked to the digital transformations discussed prior to the pandemic. It is necessary that the education that students receive prepares them to be technology-change leaders and have the necessary skills to navigate a post-COVID world [5]

There is abundant literature about implementation of online teaching and assessment approaches in engineering and computer science fields [6-9]. Compared to other disciplines, many engineering fields rely not just on lecture sessions but also laboratory sessions which are traditionally carried out in a face-to-face format. Generally, remote labs in engineering are limited to those that primarily based on software and can be more easily implemented in a distance learning setting. However, various approaches exist to deliver virtual labs delivered in 2D or 3D virtual reality [8, 10]. During the pandemic, especially during closure of universities, faculty were forced to deliver online education including labs not traditionally offered online and were expected to have this format ready for delivery to students, in some cases in a matter of days. This undoubtedly led to challenges for both faculty and students who were both having to adapt rapidly to new teaching and learning formats.

2   Literature Review

2.1   Impact of COVID-19 pandemic on faculty

Many refer to the shifts to an online platform (such as Zoom, Google Classroom, and others) due to the forced closure of campuses as online education. However, some researchers argue that a more accurate term to describe this shift to online platforms during the pandemic is "emergency remote teaching" [11, 12], due to the inexperience of professors and teaching teams with regards to online classes. It rapidly became clear that this type of teaching that became the new standard in March 2020 when the majority of the world began lockdowns to help curb the spread of the novel coronavirus was not sustainable, and proper teaching plans and support for faculty needed to be in place to assist professors and teachers to effectively run their courses and aid students to the same degree that they were used to before the pandemic.

The pandemic also required a change to be made in the way that teaching was being approached, and research has shown that the main change to make, amongst others, was the way that teachers themselves acted in the classroom [4, 12]. Rather than teachers becoming a source of knowledge and imparting it directly amongst their students, they must change their efforts to instead become a guiding hand towards the knowledge itself. Rather than lectures with PowerPoints, slides, textbook readings, teachers must create scenarios and situations in which students could learn the knowledge from themselves. This could be achieved through the use of projects, collaborative work, discussion sessions between groups of students. These types of academic activities also have the added benefit of giving the feeling of students being a 'class', rather than a name in a list of a video conference.

The majority of research, however, shows that there are many concerns, with online education, many of which were the same concerns that held back the implementation of online education in the past. A key concern that professors and lecturers have is how to properly assess their students on the knowledge they seek to impart on them [12-14]. In a traditional format, the majority of

courses will have a mixture of assignments, and a midterm and a final exam. In an online format, teaching teams and faculty have to determine new and effective ways to assess their students. Another issue is how to engage students because connecting with students can be challenging in an online class. The lack of face-to-face communication can cause an online classroom to feel very impersonal resulting in students feeling disconnected. Another glaring issue with online education, especially the rushed versions that became commonplace in March of 2020 when shutdowns and switch to online teaching began was the issue with the faculty being technologically illiterate. The sudden shift to online education left many teaching staff using technology that was relatively new to them resulting in some challenges [13-15]. Additionally, faculty were concerned that students would not have access to the necessary internet bandwidth, or computers/laptops to be able to participate fully in their new 'classrooms'.

One bright spot in the sea of issues and challenges that resulted from the pandemic was the shift in opinion regarding online learning. While the opposition to online education before the pandemic was strong, the experience of many professors using online platforms during the pandemic to teach their students led many to believe that a mixed approach to learning would be highly beneficial to all - both students and faculty [13, 16].

2.2 Impact of COVID-19 pandemic on Engineering and Computer Science Students' Learning

Studies have been conducted on the impact of the pandemic on learning by evaluating students' perceptions and attitudes towards online and blended learning. An online teaching survey of students reported that students perceived psychological safety and confidence to be higher in online classes compared to the face-to-face classes, indicating that teamwork was improved in online learning environments [17]. This finding is important given that many engineering and computer science teaching calls for teamwork. The results for minorities were mixed and indecisive [18].

Another impact reported by students was that the shift to online education resulted in a reduced sense of belonging among men and students who do not identify as a minority. The results for minorities were mixed and indecisive [18]. Students reported, besides improving teamwork, work life balance, will power, better time management, students still faced challenges of maintaining focus and motivation, experienced mental health concerns, lack of social communication, and missed face-to-face interactions [19]. A study by Jamalpur, et al. [20] identified some lessons learned from online education during the pandemic based on a study of engineering students. Some of the lessons learned include the need for faculty to act as mentors and the need for shorter online classes. Interestingly, a study by Revilla-Cuesta, et al. [21] found that engineering students perceived their teachers to have the technical knowledge, social skills, as well as empathy and understanding of the dire situation necessary for an abrupt switch to online and blended education. A large study of 3,611 students in China to gauge their anxiety levels during COVID-19 found that females reported higher anxiety compared to their male counterparts, while there was no significant difference in anxiety between students from arts or science majors. Additionally, it was also found that students in higher grades reported higher stress levels compared to students in lower grades [22]. Anxiety and stress were some of the concerning issues reported by students during the pandemic. Additional concerns reported by the

engineering students include "logistical/technical problems, learning/teaching challenges, privacy and security concerns and lack of sufficient hands-on training" [23]. Students reported lack of focus, zoom fatigue, perceived increase in cheating during exams and concerns related to open book exams [23]. On the other hand, computer science students in a study conducted in the United Kingdom reported positive attitudes to online learning, when compared to other disciplines [24].

3 Methodology

Data for this study was collected using a web-based survey administered to students enrolled in Engineering, Engineering Technology Management and Computer Science classes at three universities in the United States and Canada. The survey was designed to capture students' experiences with online and hybrid teaching formats prior to the pandemic and to relate prior experience to their current classroom (physical or virtual) experience during the pandemic. The survey also captured students' access to internet and other online resources, which are critical to online learning. Lastly, the survey gauged students' predictions about teaching formats post pandemic. The web-based survey was distributed to students in University X during fall semester 2020 and spring 2021. In University Y and Z, the survey was administered during fall 2021 semester. The MEANS procedure in SAS was used to summarize the data and to calculate descriptive statistics for the variables. The initial Likert scale for this study was a 5-point scale but due to low sample sizes was condensed into a 3-point ranges from 1 (disagree/strongly disagree) to 2 (neither agree nor disagree) to 3 (agree/strongly agree). Therefore, the midpoint of the likert scale is 2. This indicates that a mean score less than two indicates an average negative experience while a mean score greater than 2 indicates an average positive experience.

4 Results

4.1 Student and Institution Background

Results from 120 students including 27 students, 23 students and 70 students from University X, University Y and University Z respectively were used for this study. As shown in Table 1 below, the sample from University X was disproportionately male and had the highest proportion of male students compared to the other universities. Students surveyed at University X are enrolled in an undergraduate online degree programs. However, they can take face-to-face classes outside of their major program of study if they choose. Therefore, the migration of learning to an online format due to the COVID-19 pandemic did not have a significant impact on most students already in the program. This data was collected for multiple classes including a 300-level class that the students typically take in their first year in the program and a 400-level class. All students that completed the survey already have an associate degree or have completed the vast majority of coursework for an associate degree, so even though they are in their first year of the program, they typically complete the degree program in 2 years if they are full time students. Students in their first semester in the program may not have had previous experience with online learning prior to the pandemic. In terms of experience with online classes, all of the students in the 400-level class reported taking an online class before the pandemic whereas 65% of the students in the 300-level class reported taking an online class prior to the pandemic.

Students surveyed at University Y are from a computer science department. These students include sophomores, juniors, and seniors. University Y switched to mostly online classes. A handful of classes requested special permission to have blended classes. One of the classes surveyed was a blended class. As seen in Table 1, approximately 22% at University Y had taken an online class prior to the pandemic while 5% of the students had taken a hybrid class before the pandemic.

Table 1: Students' background information

		University X N=27	University Y N=23	University Z N=70	Total N=110
Gender	Male	81.48%	65.22%	41.43%	66.00%
	Female	18.52%	34.78%	58.57%	54.00%
Prior class experience	Completed online class before pandemic	74.07%	21.74%	28.57%	45.00%
	Completed hybrid class before pandemic	55.56%	4.35%	-	-

Students that completed the survey at University Z are enrolled in four programs: architectural, civil, environmental, and geological engineering. These students surveyed were in first year and second year level courses. It is important to note that the engineering program in University Z is a cohort program where students are automatically enrolled in all the required courses for their program from their first year. In March 2020, University Z closed and switched to online learning as a result of the pandemic. Instructors and students were given one week to prepare for this transition. University Z continued online education until September 2021 when it switched to hybrid mode to accommodate for the 50% capacity limit enforced by the administration. The survey was sent to the students in October 2021 after they have been at least one year in their programs. Approximately 29% and 0% of the respondents had prior (to the pandemic) online class experience and hybrid class experience, respectively. Table 2 describes the setup for online and hybrid classes in University X and Z.

Table 2: Online and hybrid class setup

University	Setup for Online Courses	Setup for Hybrid Courses
University X	All students surveyed were enrolled in both asynchronous and synchronous online courses. Some online classes at the university combined both synchronous and asynchronous components.	A range of hybrid formats were utilized including combining face-to-face and online students as well as classes that met partly online and partly face-to-face.
University Z	Online courses included asynchronous and synchronous parts.	Due to the 50% capacity limit during COVID-19, the hybrid format included half the class face-to-face and have the class online being taught synchronously. The students alternate every week.

4.2   Experience with Online and Hybrid classes

Results in Table 3 show an average positive experience with online classes across all three universities with mean scores ranging from 2.2 to 2.44 out of 3. Furthermore, students in all three universities indicated an average positive experience in hybrid and face-to-face classes. It is interesting to note that the mean score for positive experience in face-to-face classes for all three universities is higher compared to online and hybrid classes even in University X where all the respondents are enrolled in an online degree program. Although students in University X had a higher mean score showing more positive experience with face-to-face classes compared to online and hybrid classes, they indicated on average, a preference for online and hybrid classes compared to face-to-face classes.

Table 3: Descriptive statistics for survey questions

Variable	University X (N=27)		University Y (N=23)		University Z (N=70)	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Online class experience is positive	2.444	0.801	2.435	0.896	2.200	0.894
Hybrid class experience is positive	2.444	0.641	2.609	0.583	2.329	0.557
F2F class experience is positive	2.778	0.424	2.870	0.344	2.386	0.546
Prefer online class to F2F class	2.148	0.949	1.478	0.665	1.743	0.829
Prefer hybrid class to F2F class	2.111	0.847	1.826	0.717	2.243	0.806
Additional help needed with online class	2.630	0.688	2.087	0.793	2.557	0.673
Additional help needed with hybrid class	2.296	0.724	1.870	0.757	2.186	0.644
Online resources are adequate	2.370	0.884	2.565	0.728	2.371	0.783
Hybrid class resources are adequate	2.296	0.724	2.609	0.499	2.286	0.568
Support transition to hybrid during pandemic	2.630	0.629	2.478	0.846	2.757	0.550
Transition to online/hybrid class was smooth	2.407	0.747	2.217	0.795	1.957	0.751
Have necessary equipment for online class	2.963	0.192	2.913	0.288	2.857	0.460
Have strong internet connection at home	2.741	0.656	2.870	0.458	2.657	0.700
Want classes back to normal post-pandemic	2.148	0.770	2.348	0.832	2.186	0.839
Online and hybrid class preference post pandemic	2.519	0.700	2.130	0.920	2.243	0.939

Many of the students in the program in University X are non-traditional students with full time jobs. Therefore, though they have a more positive experience in face-to-face classes, they may prefer online classes due to their convenience and flexibility. It is also interesting to note that the responses about preference for online classes compared to face-to-face classes had the highest standard deviation (0.949) compared to all other responses shown in Table 3. This reveals a wide spread of responses relative to the mean as shown in Figure 1. Some of the open-ended comments in response to the most useful aspects of online classes such as "The ability to work a full-time job and still take classes.", "Caters to busy schedule", and "I liked the convenience of attending class from home…", illustrate the reasons why students in University X prefer online classes. When asked what they found least useful in their online classes, some students in University X indicated that they did not have any concerns about online education as illustrated by the comment "I did not find anything that would be classified as "least" useful. I feel that my professors did a great job of explaining the material thoroughly and were always available if questions arose." Some concerns were related to online teamwork and interaction, "Teamwork

was difficult online", and "The one thing I found harder was not being able to talk to other students after class. We were able to make online study groups and easily overcome." as well as level of comfort participating in a virtual classroom "I still feel awkward with the live portions of classes online."
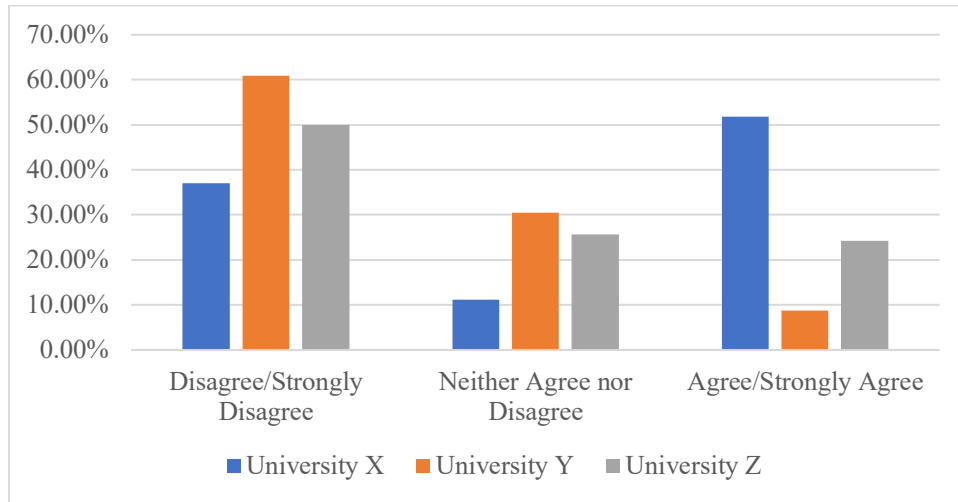

Figure 1: Preference for online classes over face-to-face classes

In Universities Y and Z, the mean scores were 1.478 and 1.743 indicating that on average the students did not prefer online classes to face-to-face classes. Given that the main method of education for the surveyed students in University Y and University Z prior to the pandemic was face-to-face, these results indicate that students who register in such programs prefer that mode of instruction. Results about preference for hybrid classes compared to face-to-face classes were mixed with students in University Y on average indicating they did not prefer hybrid classes compared to students in University Z with a mean score of 2.186 showing an average preference for hybrid classes. Students' responses to the open-ended question indicate that they found that the hybrid model combines benefits from both online and face-to-face, providing flexibility in assessments, recorded lectures while keeping the benefits of face-to-face from in class activities such as labs and lectures. Students' comments include "Hybrid classes allowed for the best of online and face-to-face pros". "Hybrid is the best option in my opinion - prerecorded lectures with some in-person tutorials and labs". On average, students in all three universities indicated that they needed additional help in an online course compared to a face-to-face course.

In all three universities, students on average reported that they support the transition from face-to-face classes to hybrid classes due to the COVID-19 pandemic. Furthermore, Universities X and Y results showed on average, student's transition from face-to-face classes to online classes or hybrid classes due to the pandemic was smooth. In contrast the mean score of 1.957 for University Z showed that on average the students felt less positively that their transition to online or hybrid classes was smooth. Figure 2 shows students' responses. As previously stated, faculty were asked to transition to online teaching mode in a short amount of time and, in many cases, had limited support to aid the transition. Faculty had to try to adapt their teaching tools to accommodate for online learning and keep students engaged during the online lectures.

Furthermore, students, particularly those with no prior online class experience, also had to adjust to this new learning format.
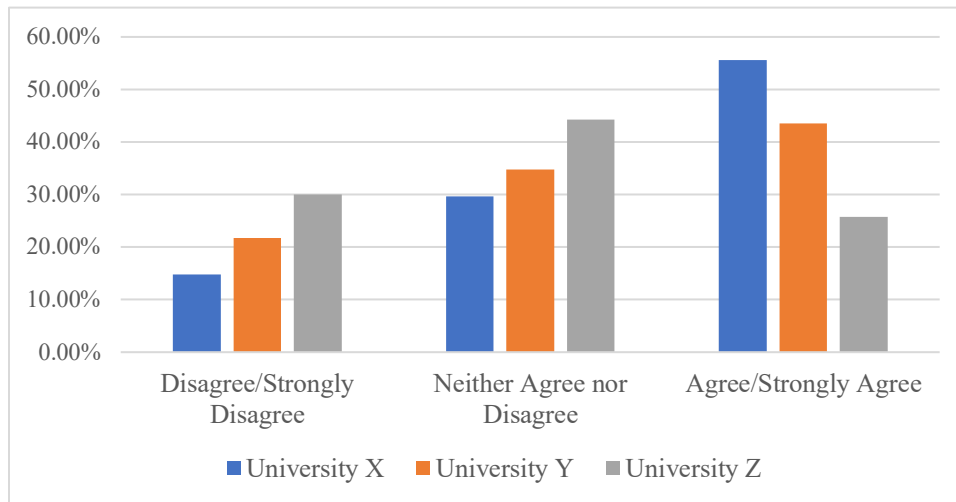

Figure 2: Response about transition to online or hybrid classes due to the pandemic being smooth

Some questions posed to students aimed to determine if students had access to the necessary resources and technology needed to be successful in an online or hybrid program. Our results indicate that in general, students had access to needed resources. Students in all three universities on average agreed that online class and hybrid class resources, including instructor availability and online class content, were adequate, they had the necessary equipment such as computer and webcam to participate in an online class, and they had access to a strong internet connection at home.

4.3   Preferences and perceptions related to future teaching formats

An aim of this study was to determine students' preferences for class formats as well their perception about the teaching formats to be employed in the post -COVID 19 period. Based on mean scores greater than 2, the students from the three universities indicate that on average they are more likely to take online or hybrid classes after the pandemic even if face-to-face classes are available. Unsurprisingly, the mean score was highest for the group of students that were enrolled in an online degree program. Furthermore, mean scores were greater than 2 for the question about whether students would like all classes to go back to the way they were before the COVID-19 pandemic. However, results for both questions about class format preference and interest after the pandemic had a high standard deviation particularly for Universities Y (0.832, 0.921) and Z (0.839, 0.939) indicating a wider spread of responses relative to the mean. Figures 3 and 4 further illustrate these results. As can be observed in Figure 3, the plurality of respondents in University X neither agreed nor disagreed that they would like classes to go back to the way they were prior to the pandemic. In contrast, the majority and plurality in University Y and University X respectively, agreed or strongly agreed that they would like classes to return to their pre-pandemic format. Based on the results shown in Figure 4 the majority and plurality of students in University X and Z indicated that they believed the future teaching formats in universities will be mostly hybrid. In contrast, the plurality of students in University Y indicated that they face-to-face teaching will be the primary teaching formats. In University X where the

students are enrolled in an online degree program, 33% indicated that the future of teaching will be online. In comparison 0% and 5.71% of students in Universities Y and Z respectively indicated that the future teaching format will be online.
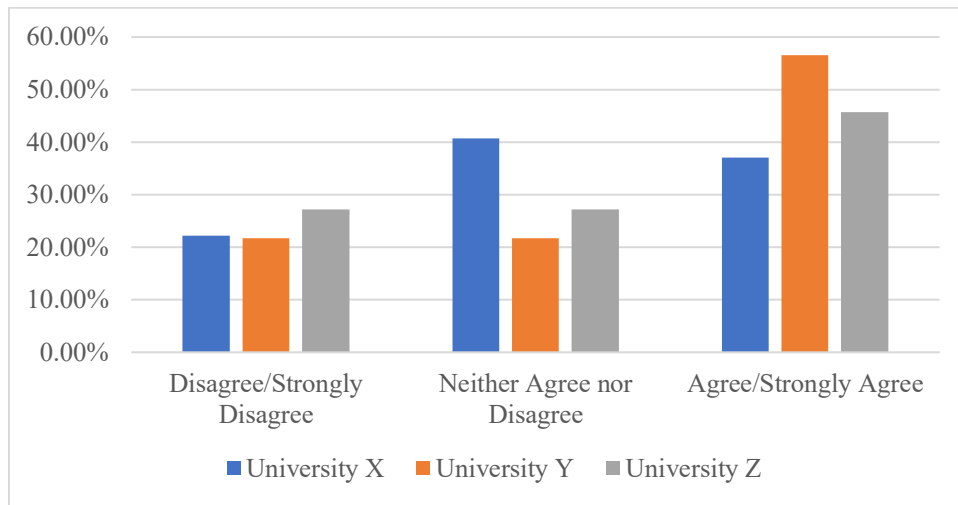

Figure 3: Preference for pre-COVID-19 pandemic class format

Students in University X that indicated preference for face-to-face classes were more likely to indicate that the future class format in universities would be face-to-face or hybrid (75%) compared to those that preferred online classes who indicated that the future format will be online or hybrid (100%). Furthermore, those students that indicated a preference for online classes were more likely to agree or strongly agree (100%) that they would prefer online or hybrid classes compared to face-to-face classes in contrast to 50% of students that indicated a preference for face-to-face classes that were neutral.
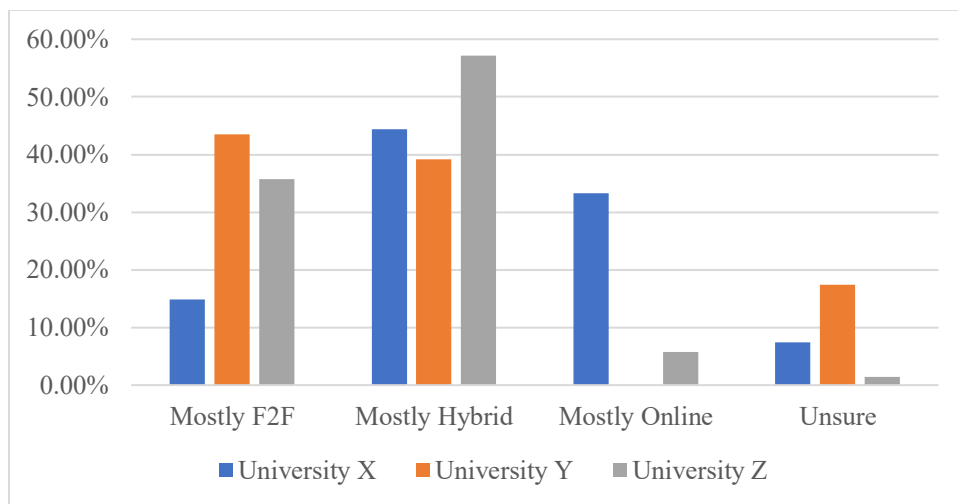

Figure 4: Prediction about teaching format in universities after COVID-19 pandemic

In University Z, the majority of students that preferred face-to-face classes listed mostly face-to-face or mostly hybrid as the future format (37.5% F2F, 37.5% hybrid, 12.5% online and 12.5%

unsure). In the same manner, the majority of the students that preferred online format listed hybrid or online as the future format (50% hybrid and 50% online). Students that listed hybrid classes as their preference mostly suggested that hybrid teaching will be the future format (16.67% F2F, 50% hybrid, 16.67% online and 16.67 % unsure). The plurality of University Y students (43.5%) predict that universities will move to a face-to-face teaching format after the pandemic, while 39% predict the university will choose a hybrid format. Roughly 17% are unsure. Interestingly none of the students at University Y predict the university will choose an online format. Of the 120 students across the three universities, a majority (50.8%) predict that the future teaching format in universities will be mostly hybrid, 32.5% indicate mostly face-to-face formats will be used while only 10.8% predict a mostly online format. The prediction about mostly hybrid teaching being utilized by universities in the future is supported by students' comments about the ability of hybrid teaching formats to combine the benefits of online and face-to-face teaching.

Female students' class preferences in University Z were 26.83% face-to-face, 31.71% hybrid, 7.32% online, 12.2% chose multiple modes, and 21.95% did not answer. Class preferences by male students were 20.69% face-to-face, 41.38% hybrid, 6.9% online, 6.9% chose multiple modes, and 24.14% did not provide an answer. The plurality of male and female students identified hybrid classes as being their preferred class format. The same was true for predictions for future teaching format in universities. Irrespective of gender the majority of respondents were of the opinion that the future teaching format will be mostly hybrid.

In response to the question "I am more likely to take online or hybrid classes after the pandemic even if face-to-face classes are available," 46.34% female student respondents in University Z answered agree or strongly agree, 2.44% neither agreed nor disagreed and 51.22% disagreed or strongly disagreed. In comparison, 17.24% of male respondents agreed or strongly agreed, 13.79% neither agreed nor disagreed and 68.97% disagreed or strongly disagreed. These results show that while female respondents are almost split between taking online/hybrid and not taking online/hybrid classes, the majority of the male students would choose not to take online/ hybrid classes in the future. It is important to note that given the previously mentioned positive perceptions about hybrid teaching formats, students' responses may change if the question does not combine the likelihood to take hybrid and online classes in the future.

4.4   Additional Student Perspectives

Comments provided by students shed more light on students' perceptions and attitudes about the change in teaching formats caused by the COVID-19 pandemic. Some students, primarily students in University X, were unaffected or were not negatively impacted by the abrupt change to online teaching and learning as illustrated by comments such as "It did not really affect me." "Did not notice any change," "Everything was great!." This is partly due to the fact that students are in an online program and were already taking some or all classes online when the pandemic began. As previously noted, some students in the program at University X take face-to-face classes outside of the program. Therefore, these students had to change their learning format in those courses in the middle of the semester.

Some responses illustrate students' perception of how the experience of the instructor and their attitude about the abrupt move to online education during the COVID-19 pandemic impacts the quality of instruction. Some students expressed concerns about faculty attitude and approach to

teaching in a "forced" online settings as illustrated by the comment "The level of instruction can be much worse if a teacher is not used to online classes or [is] unhappy they had to go online.." Students' learning and educational experiences were also impacted by changes occurring outside of the classroom caused by the pandemic as illustrated by the comment "The pandemic has caused more stress in households due to changes in school schedules, work, and daycares. All of the extra stress decreased the academic performance of many students especially the ones with a family responsibility." This issue is also illustrated by the comment "…I feel as though the pandemic has discouraged a lot of students in their schoolwork and have made them feel more depressed."

Some students advocated for more online or hybrid class offerings and/or expressed relief about the flexibility offered by "going online" due to COVID: "I really believe it would be beneficial to take an approach at making all classes available online for students... At the beginning of SP2020 semester, I had to drive 1.5 hours twice a week …and back for just one class. It was a breath of fresh air after spring break when the class was taken online. …investing more time and resources toward online classes will help students to achieve their academic goals by providing a more flexible schedule." Other comments include "I believe there are some classes that can be moved partially or fully online, the pandemic has made me realize that some classes are not necessary to be taken in person." Many of these comments were from students in University X.

Other comments also highlighted students' responsibility and the challenges of staying motivated and engaged in an online or hybrid education setting. Such comments include "I feel more motivated to do work when others are also doing work around me while at home it is more likely for me to procrastinate.", "It is hard to concentrate and stay focused." A comment highlighting students' responsibility in an online class is "The main issue with online classes for most students comes down to work ethic and being responsible for oneself because once you fall behind it is near impossible to catch up."

5   Conclusion

Overall, the students in all three universities in this study indicated an average positive experience with online, hybrid and face-to-face learning. However, the mean score for positive experience in face-to-face classes was higher indicating that students, including those in the online program had more positive experience in face-to-face settings. The results show that the students that were already enrolled in an online program prior to the pandemic had more favorable attitudes towards online education compared to students in other institutions. The responses of the students at the three universities varied depending on their past experiences, their technical skills, their program/department/university modes of teaching and their universities' response to the pandemic. Their responses provide insights into how teaching formats, such as online and hybrid teaching, which are likely to be more common in a post-COVID-19 world will impact students. It is important to note that respondents indicated that they had access to broadband and necessary equipment (such as computers). Therefore, their perceptions and attitudes may not be representative of students that do not have access to broadband and computers.

Most students in universities X and Z preferred a hybrid format, while students in University Y preferred a face-to-face format. This result can be attributed in part to the fact that the computer science program in University Y continued to deliver some face-to-face education despite the

pandemic. Overall, a majority of all the students in this study indicated that the future teaching format in universities will be mostly hybrid. Only a small percentage predict that a mostly online format will be used. As such it is recommended that universities consider incorporating hybrid modes of teaching in the future. As this study showed, students' experiences in a class were negatively impacted if the faculty was perceived to be unwilling to teach in a new or different format than the format they taught in prior to the pandemic. Therefore, buy-in from faculty as well as the provision of necessary training and resources is critical to achieve positive teaching and learning experiences for faculty and students, respectively. Further studies are needed to investigate innovative and effective hybrid modes of delivery that result in high levels of student engagement, satisfaction, and performance.

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