

In Their Own Words: How Engineering Students Adapted to Disruptive Transitions Between Online and In-Person Learning

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Abstract

The COVID-19 pandemic created an unprecedented shift in students' learning environments that caused students who planned on in-person instruction to learn online instead. This change affected students' learning attitudes, anxiety, and success. In this work, we present students' personal voices to better understand how sudden disruptions in education affected students over nearly two years of transitioning between online and in person classes. In particular, we surveyed students during the Winter 2022 term in which, at the University of California Irvine, classes started online and transitioned back to in person after four weeks. We collected and analyzed students' written responses to four open-ended survey prompts that asked students to describe how they adapted to online learning and to the transition back to in person learning. We performed inductive coding of the students' responses to discover emergent themes from these first hand accounts of student experiences, and we discuss students' challenges and successes related to themes such as motivation, time management, maintaining a work/life balance, communication with peers, and access to technology and a quiet place to study. In these responses, students clearly describe both benefits and drawbacks to both transitioning to online courses and transitioning back to in person. These results provide important implications for student wellness in multiple learning formats and through disruptive transitions in learning.

Introduction

The prevalence of online classes has steadily increased since their introduction more than three decades ago. However, the COVID-19 pandemic uniquely impacted the way students and institutions approached education with a sudden and disruptive shift to virtual/remote and online learning. These sudden changes had dramatic and widely varying impacts on university students related to not only learning and study habits, but also to mental health, socialization, access to resources, and additional responsibilities besides their education, among others. It is important to understand these impacts in order to provide effective resources and learning opportunities for all students. Therefore, in this work, we aim to better understand and contextualize the experiences that diverse undergraduate engineering students had through these transitions.

Prior to the COVID-19 pandemic, research on online learning in higher education institutions

found that it has both benefits and drawbacks. While students learning online are less likely to collaborate, interact with faculty, and engage in discussions with diverse others when compared to students learning in person, they report increased engagement in quantitative reasoning [1]. A large study of more than 5,000 courses at a large, public, four-year university found “little to no difference in grade based student performance” between online and in person instructional modes [2]. The results of a smaller study on a set of physics students suggest that weaker performing students may be more likely to choose online courses over in person, and recorded lectures may help close the gap between these students and students who are initially more engaged and higher performing when in person [3]. Online education for engineering students, and its challenges and opportunities, have also been explored [4], and useful strategies for the design of online engineering courses have been developed, such as in an online undergraduate electrical engineering program discussed in [5].

Online education during the COVID-19 pandemic is unique from traditional online education in that it was suddenly the only instruction mode available for all students, which may have added to the pandemic’s impact on students’ mental and physical health. As stress caused by COVID-19 increased, “academic motivation, sense of belonging, [and] belief in online distance learning decreased” [6]. Two-thirds of college students also reported feeling greater amounts of anxiety in a survey taken in France [7]. With recommendations to stay indoors and loss of access to gyms, COVID-19 also led to a significant drop in students’ rigorous physical activity. This eliminated a traditional method for stress management and disrupted a critical component of students’ daily routines [8, 9]. Moreover, in a study of undergraduate STEM students, researchers found that the transition to online learning had a negative impact on student engagement [10]. In particular, they found that students participated less frequently in class discussions but interacted more frequently with professors outside of class, students’ self-efficacy and sense of belonging did not increase through the term, and students reported a significant decline in positive attitudes toward science. The pandemic also brought to light the issue of all students being able to meet certain workspace requirements. For example, the authors of [11] identified exams as being a hassle for students to complete remotely due to failing or slow WiFi, the need for webcams and working video software during proctored exams, and even lacking access to a laptop or desktop altogether. Moreover, a significant fraction of students suffered most from not having a quiet place to study at home.

Several studies have specifically investigated engineering students’ experiences transitioning to and from remote learning due to COVID-19. The authors of [12] found that students were concerned with learning course material, getting instructional support, and time management when transitioning from in person to online learning. Qualitative data from [13] show that the majority of students struggled to build relationships with their professors and peers. The authors of [14] investigated undergraduate engineering students’ test anxiety and its relation to exam formats and access to technology and a quiet place to study. The authors of [15] interviewed engineering students and instructors from a calculus course on the impact of the transition, and their results highlight the diverse needs of students and students’ decreased access to resources. A particular challenge for online engineering courses is facilitating virtual laboratory experiments and hands-on projects, and the impact of COVID-19 on senior capstone design courses has been studied (see, e.g., [16, 17]).

In this paper, we present a qualitative analysis of upper division engineering students’ responses

to open-ended survey questions on their experiences transitioning to and from remote learning. This survey was given in Winter 2022, which was a unique term at the University of California Irvine because courses started online and returned to in person later in the term. Moreover, it was not clear at the beginning of the term when courses would return to in person, only that they would eventually. Therefore, this was a particularly disruptive term for the students who had all previously experienced the transition to online learning in Spring 2020 and had transitioned back to in person courses by Fall 2021, only to return to online courses in Winter 2022 due to the spread of highly contagious COVID-19 variants. This provided a unique opportunity for students to reflect on their experiences adapting through disruptive transitions between online and in person courses at a time when they were again experiencing a disruptive transition. Moreover, all of the students in the study were enrolled in a course that involved significant hands-on learning experiences through laboratory experiments and a team project. With this study, we provide important context on these student's experiences through the students' own words in written responses to open-ended questions.

Research Questions

Our study is motivated by the following research questions.

- R1: What aspects of their lives did undergraduate engineering students feel were affected most by remote, hybrid, and in-person instruction?
- R2: How did students adapt to abrupt and disruptive transitions between learning formats during the COVID-19 pandemic?
- R3: What learning formats do students prefer, and why?

Research Methods

In this section, we describe how we collected data for the study, the survey instrument used, the numbers and demographics of students who participated in the study, and the assessment methods used.

Data Collection

The data for this study consists of students' self-reported responses to an online survey and institutional data for those students, who were all undergraduate engineering students enrolled in an upper division mechanical engineering course in Winter 2022. All participation in the study was voluntary and uncompensated. We received available institutional data for the students in the course from the University's Teaching Center. All data was collected with approval from the University's Institutional Review Boards.

Students were asked to respond to the following four open-ended prompts in an online survey given in the final week of instruction during the Winter 2022 term.

- S1. Please describe how you adapted to remote learning when it started in Spring 2020.
- S2. Please describe how you are adapting to a return to in person learning this academic year.

S3. Please describe a positive aspect of this quarter in particular, which started remotely before returning to in person.

S4. Please describe a negative aspect of this quarter in particular, which started remotely before returning to in person.

Out of the 192 students enrolled in the course, 159 students provided responses. Table 1 shows the demographics of the enrolled students. Institutional data were not available for all of the students in the course or for all of the students who responded to the survey prompts. However, these demographics are representative of the student population.

Table 1: Demographics of students for whom we have institutional data from the Winter 2022 course. The total enrollment was 192 students; 159 students provided responses to the open-ended prompts. Not all of the students who provided responses are represented in this institutional data, but these demographics are representative.

Group	Number of students (and % of total in each category)	
	Enrolled	Responded to open-ended survey prompts
Total	164 (100%)	134 (100%)
Low Income	36 (22.0%)	30 (22.4%)
First Generation	57 (34.8%)	47 (35.1%)
Transfer	6 (3.66%)	6 (4.48%)
Female	39 (23.8%)	33 (24.6%)
URM ¹	58 (35.4%)	44 (32.8%)
Freshmen	0 (0%)	0 (0%)
Sophomore	2 (1.22%)	1 (0.75%)
Junior	28 (17.1%)	24 (17.9%)
Senior	134 (81.7%)	109 (81.3%)

Assessment Methods

Qualitative analysis was performed through inductive coding of the students responses to the open ended prompts S1-S4. When the data was initially collected, we read every individual response to the prompts and made a list of frequently appearing themes. The most common themes were established as codes and used to classify the corresponding components of student responses to each prompt. We made a color key to visualize which themes appeared in which parts of each response. If responses had more than one theme, then sections of the response were highlighted with the proper color for each part. After all the data were categorized appropriately, we logged the frequency of each theme's appearance in conjunction with the other themes in tables (*see Tables 3–6 in the Results section below*). To increase intercoder reliability, responses to the first prompt were coded by both the first and last authors independently, and the results were compared and discussed in order to create a consistent codebook for how to code different aspects of

¹The university defines URM students as those who identify as Black, Latino, American Indian, Pacific Islander, Chicano, or Filipino.

students' responses. After establishing the codebook, data for prompts S2-S4 were coded by the first author only. It should be noted that the first author was a student enrolled in the course when responses were collected and therefore has first-hand knowledge of the impacts that disruptive transitions in learning format have on students. The last author was the course instructor.

Results

Ten main themes and two sub themes were identified and are shown in Table 2. The frequencies that these themes appeared in total from all of the students' responses to all four of the open-ended prompts are shown in Figure 1.

Table 2: Themes that appeared in the responses to the open-ended survey prompts S1-S4.

Major Themes from Responses to S1-S4	
Study Habits or ability (SH)	Psychological/Motivation/Attitude (PMA)
Social life / Interaction with peers (Social)	Technology for learning or interacting (Tech)
Learning Outcomes and Skills (Outcome)	Time Management/Scheduling (TM)
Quiet Place/Environment (QPE)	Personal interests (outside school) (PI)
Commute	Learning Format (instructors' decisions, new norms) (LF)
Sub Themes Especially Appearing in Responses to S3 and S4	
Financial	Tiredness/Sleep/Health (TSH)

The Psychological/Motivation/Attitude (PMA) and Learning Format (LF) themes were the most prevalent by far, followed by Study Habits (SH) and Time Management (TM). The two sub themes related to students' financial situations and health appear in responses to two of the prompts. Thus, they appear in responses with lower frequency, but the context of their usage was significant.

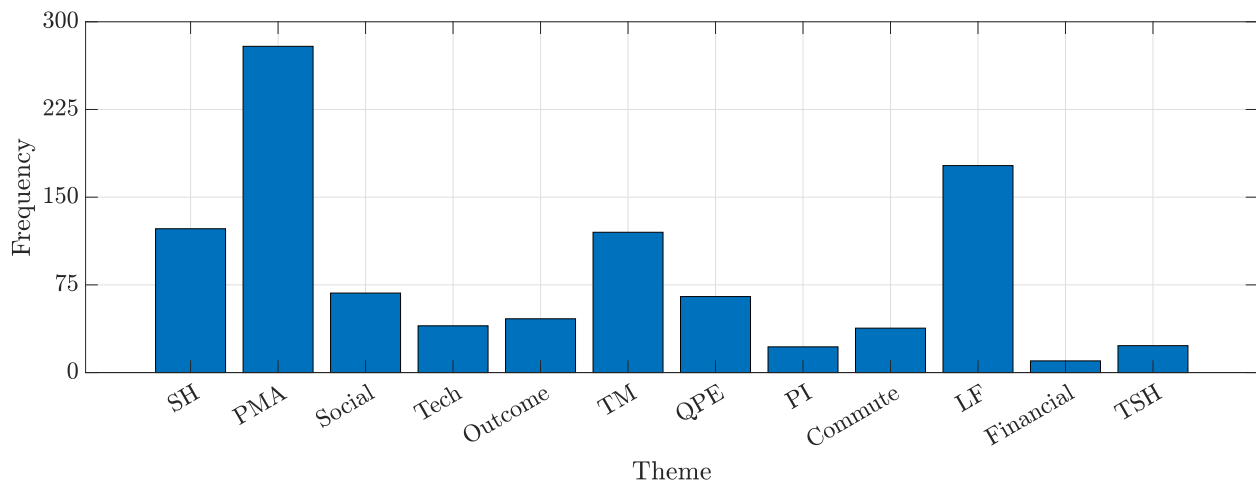


Figure 1: The frequencies that themes appeared in total from all of the students' responses to all of the open-ended prompts. A total of 159 students provided responses to four different prompts.

A codebook with definitions of the codes and examples from the data follows.

Study Habits or ability (SH): This theme was applied where students talked about how capable of learning they felt in a certain setting, when they made some sort of adjustment in how they learn (such as watching videos, making study sheets), or if they mentioned that they had strayed from their pre-pandemic study practices.

Psychological/Motivation/Attitude (PMA): Many students talked about whether or not they adjusted at all and their mindset at different times throughout hybrid and remote learning, so this theme is meant to encompass the more emotional aspect of their answers.

Social life/Interaction with peers (Social): Since the pandemic sent many students back to their hometowns, meeting new people and seeing friends became extremely difficult. Additionally, this data was collected from a class with a group project and laboratory component which students touched on as being different from many online classes, so it was important to include a code that captured this aspect of going to a university. Finally, any mention of spending time with family was grouped under this category because family interactions filled in the space which socializing with peers normally held.

Technology for learning or interacting (Tech): Switching to remote education required students and instructors alike to grapple with new software like Zoom, Slack, and Discord for communication and lecture delivery. Some students also reported switching to tablets from pen and paper for taking notes and doing homework. Technology appeared frequently in survey answers because nearly all interaction took place through some form of technology.

Learning outcomes and skills (Outcome): Responses containing information about GPA, learning to do hands on work (i.e., fabrication, learning in lab, etc.), and professional development were all coded under this theme.

Time Management/scheduling (TM): Students who discussed having to budget time differently to complete their school work or methods used to stay on top of their studies fell under this category. Some students also attempted to preserve as many of their in person time management habits as possible, and those comments were included under this code.

Quiet Place/Environment (QPE): After being sent home in Spring 2020, many students reported struggling to find quiet spaces for studying. Location was still a recurring theme after the return to campus because students began staying on campus or in the library longer to study in order to improve focus or separate school from personal space.

Personal Interests (outside school) (PI): During the height of the pandemic, many professors recorded their lectures, making it less critical to “attend” class during the scheduled time. This resulted in students getting jobs, exercising, or participating in non academic activities during regular class hours which they discussed in their responses.

Commute: Students who discussed not having, or resuming their regular drives, to campus fell under this theme. Responses concerning having to walk to classes from their apartments were also considered as part of the commuting category.

Learning Format (instructors' decisions, new norms) (LF): Whenever students mentioned recordings, how a lecture was being delivered, or a new grading policy, it was coded under learning format. Responses regarding recorded lecture videos were coded as a new learning

format as opposed to technology based on context. Technology is meant to encompass adapting to/installing/ purchasing specific software beyond what is normally used, whereas recorded videos were discussed in terms of a new way of learning material. Classes transitioned back to in person during the midterm exam season, so responses that included exam format and practices were coded as learning format as well.

Responses to survey prompts S3 and S4 also included what we call “sub themes” - categories that were heavily mentioned in responses to these two prompts but were not mentioned in responses to other prompts. Specifically, these themes were discussed in a significant manner by respondents, and we felt it was important to highlight that.

The sub themes were:

Financial: This was the smallest theme of all, and it was often tied to commuting and gas, however responses involving finances used some of the most urgent language and was perceived as significant enough to require attention. The financial category was also unique because it was the category that not all students were able to control as opposed to something like study habits.

Tiredness/Sleep/Health (TSH): During the online portion of the course surveyed, some students chose to sleep through the scheduled lecture slot while others chose to wake up early and watch class in real time. When classes returned to campus, many students noted that they had to wake up earlier in order to get to their lectures on time. Another somewhat frequently occurring concern among students after in person education resumed was a fear of getting COVID, so those responses fell under this code as well.

Often multiple themes appeared together in a single response. To quantify these connections between themes, we counted how many times each theme appeared with another theme in the same response. These data are shown in Tables 3–6. For responses with three or more themes, we noted the theme appearing highest in the rows of Tables 3–6 and added “1” to the value in the columns corresponding to the themes that appear in the same response as the theme in that row. For example, for a response that includes SH, PMA, and TM, we went to the SH row and added “1” to the PMA column and to the TM column.

Discussion

Independent of whether the changes were positive or negative, students cited the pandemic as a source of disruption in the areas of their lives concerning the ten main themes and two sub themes. We discuss students’ responses to each of the four open ended prompts in the subsections below.

Responses to S1: “Please describe how you adapted to remote learning when it started in Spring 2020.”

The most drastic changes occurred for students in the spring of 2020. In terms of study habits, some students “made sure to look over recordings after class” while others “[spent] countless hours aggregating the material into a ‘cheat’ sheet” for exams in order to absorb material better. Students were split on whether they found it easy or “hard to study” at home. Part of the difficulty

Table 3: Frequency of themes appearing in responses to S1. Numbers on the diagonal signify how many times a theme appeared alone in a response, and numbers on the off-diagonal signify how many times the theme in that row appeared with the theme in that column in the same response. There were a total of 159 responses to prompt S1.

	SH	PMA	Social	Tech	Outcome	TM	QPE	PI	Commute	LF	Financial	TSH
SH	10	16	2	7	4	7	11	3	3	1	0	0
PMA	16	31	0	5	1	10	7	0	4	6	0	0
Social	2	0	3	1	1	1	0	0	1	0	0	0
Tech	7	5	1	10	0	2	4	0	0	0	0	0
Outcome	4	1	1	0	0	1	0	0	0	0	0	0
TM	7	10	1	2	1	19	3	3	4	0	0	0
QPE	11	7	0	4	0	3	8	0	0	1	0	0
PI	3	0	0	0	0	3	0	0	0	0	0	0
Commute	3	4	1	0	0	4	0	0	1	0	0	0
LF	1	6	0	0	0	0	1	0	0	3	0	0
Financial	0	0	0	0	0	0	0	0	0	0	0	0
TSH	0	0	0	0	0	0	0	0	0	0	0	0
Total	64	80	9	29	7	50	34	6	13	11	0	0

came from study spaces. As one student put it, “it was hard to adapt because I was no longer living on campus. Instead, I was at home, where the environment was not as quiet”. Others noted that the new environment made them lazy. In order to have adequate learning conditions, one student said they “had... to explain to [their] family the conditions [they needed] to be able to do well” or else they studied outside of their homes entirely. Some students tried to preserve their old time management practices and attended lectures “when they were held to keep a set schedule throughout the day” while others opted to “watch lectures on [their] own time”. Regardless of how they utilized their time, students found that it was much easier to fall behind in classes due to the new format’s flexibility. Another source of adjustment was the technology required, because “nothing new was really changing in terms of the material being taught”, but “installing software to accommodate [remote learning] such as Zoom, Respondus, etc.” and “having to watch lectures online and take tests online [was] a little strange”. Heavy use of software resulted in learning norms that had not been seen before. Students acknowledged that “professors were still unsure of how to adapt” and had mixed responses to their policies. In general, “online exams were preferred” but remote work was “non conducive to meaningful lab work”. Between less hands-on learning and “limited social interactions” outside of forming “study groups with peers”, some students worried that they lost out on acquiring “social skills that could be relevant to professional environments”.

The attitudes of students showed the most variation out of all the themes. For students who found the transition natural, common phrases were “I managed”, “I adapted pretty easily”, and “I went along with it”. By contrast, those who disliked the change described it as “very difficult”, “[having] no choice but to adapt”, and it led to them being “more easily distracted”. More positive outlooks on the situation came from students who no longer had to commute to campus, citing the saved time from “not having to drive so much” as a reason they “could actually focus on school”. Across all four prompts, commuters continued to have the most consistent responses in

Table 4: Frequency of themes appearing in responses to S2. Numbers on the diagonal signify how many times a theme appeared alone in a response, and numbers on the off-diagonal signify how many times the theme in that row appeared with the theme in that column in the same response. There were a total of 159 responses to the prompt S2.

	SH	PMA	Social	Tech	Outcome	TM	QPE	PI	Commute	LF	Financial	TSH
SH	3	11	4	0	0	2	3	0	0	11	0	0
PMA	11	28	8	0	0	7	7	5	7	36	4	2
Social	4	8	1	0	0	2	3	1	0	2	0	0
Tech	0	0	0	0	0	0	0	0	0	1	0	0
Outcome	0	0	0	0	0	0	0	0	0	0	0	0
TM	2	7	2	0	0	8	3	2	5	5	0	0
QPE	3	7	3	0	0	3	9	0	0	0	0	0
PI	0	5	1	0	0	2	0	0	0	0	0	0
Commute	0	7	0	0	0	5	0	0	0	1	0	0
LF	11	36	2	1	0	5	0	0	1	10	0	0
Financial	0	4	0	0	0	0	0	0	0	0	1	0
TSH	0	2	0	0	0	0	0	0	0	0	0	0
Total	34	115	21	1	0	34	25	8	13	66	5	2

favor of hybrid learning.

Responses to S2: “Please describe how you are adapting to a return to in person learning this academic year”

With the return to in person learning, students were asked to adjust once again. In comparison to remote education, they began “Waking up earlier, spending more time on campus” and “being around other like minded individuals... to study with others and ask for help” because it “is much easier in person”. For commuters, some felt there was not “enough time in the day to do the same amount of studying AND travel to and from classes” compared with remote learning. In general, students took on more non academic responsibilities during COVID and to accommodate increased obligations, they had to “work later nights and get up earlier in the morning”. This had negative effects in some cases where reducing work hours “in order to be present for... classes” led “to less financial stability”. Students who had to quit jobs or work less tended to have more pessimistic views of the return to in person compared with those who did not mention outside obligations. Between waking up early to commute and balancing full days, students have been “a lot more tired than [when] studying remotely”, but have noticed benefits like being “able to retain more information”. Survey respondents indicated that lots of effort went into attempting to restore “pre-covid study habits”, with the context suggesting that they were more proactive about their learning prior to remote instruction. The use of technology in classes increased after COVID as well, because students invested in “devices that are portable” in order to maintain productivity in each learning format.

The rapid change back to in person learning yielded mixed feelings. In general, students tended to find the transition “difficult” and “stressful” more often than “nice” and “easy”, but ultimately both groups enjoyed participating in on-campus activities again and experienced increased motivation to complete schoolwork. Surprisingly, few students mentioned liking the hybrid

Table 5: Frequency of themes appearing in responses to S3. Numbers on the diagonal signify how many times a theme appeared alone in a response, and numbers on the off-diagonal signify how many times the theme in that row appeared with the theme in that column in the same response. There were a total of 159 responses to the prompt S3.

	SH	PMA	Social	Tech	Outcome	TM	QPE	PI	Commute	LF	Financial	TSH
SH	6	0	1	0	0	0	0	0	0	0	0	0
PMA	0	23	2	1	1	0	0	0	0	2	0	2
Social	1	2	22	1	2	2	1	0	2	1	0	0
Tech	0	1	1	3	1	0	0	0	0	3	0	0
Outcome	0	1	2	1	10	0	0	0	0	1	0	0
TM	0	0	2	0	0	3	0	0	1	3	1	1
QPE	0	0	1	0	0	0	0	1	0	0	0	0
PI	0	0	0	0	0	0	1	4	0	0	0	1
Commute	0	0	2	0	0	1	0	0	2	0	1	0
LF	0	2	1	3	1	3	0	0	0	44	0	4
Financial	0	0	0	0	0	1	0	0	1	0	1	0
TSH	0	2	0	0	0	1	0	1	0	4	0	5
Total	7	31	34	9	15	11	2	6	6	58	3	13

Table 6: Frequency of themes appearing in responses to S4. Numbers on the diagonal signify how many times a theme appeared alone in a response, and numbers on the off-diagonal signify how many times the theme in that row appeared with the theme in that column in the same response. There were a total of 159 responses to the prompt S4.

	SH	PMA	Social	Tech	Outcome	TM	QPE	PI	Commute	LF	Financial	TSH
SH	7	4	0	0	3	1	0	1	0	1	0	1
PMA	4	36	0	0	3	2	0	0	0	6	0	2
Social	0	0	4	0	0	0	0	0	0	0	0	0
Tech	0	0	0	1	0	0	0	0	0	0	0	0
Outcome	3	3	0	0	14	2	0	0	0	2	0	0
TM	1	2	0	0	2	16	0	1	0	3	0	0
QPE	0	0	0	0	0	0	4	0	0	0	0	0
PI	1	0	0	0	0	1	0	0	0	0	0	0
Commute	0	0	0	0	0	0	0	0	4	2	0	0
LF	1	6	0	0	2	3	0	0	2	28	0	0
Financial	0	0	0	0	0	0	0	0	0	0	2	0
TSH	1	2	0	0	0	0	0	0	0	0	0	5
Total	18	53	4	1	24	25	4	2	6	42	2	8

format beyond having access to recorded lectures, but this could be attributed to the return to campus falling “during midterm season” and casting the experience in a more negative light.

Responses to S3: “Please describe a positive aspect of this quarter in particular, which started remotely before returning to in person.”

At the beginning of the Winter 2022 term when classes were still online, students were able to identify some positives in the alternative learning environment. Remote classes allowed students

to “sleep in” and eased “anxiety about getting COVID”. Some also liked staying at home longer because they had “more time to spend with family” and hometown friends after the winter break. Commuting students again experienced financial benefits resulting from “not having to purchase the parking permit and gas”. By starting the quarter completely online, some respondents felt it acted as a good buffer before changing formats back to completely in person, allowing them to “ease in”. For example, one student said “the flexibility and hybrid nature of the course helped me have an easier time and manage my other commitments, especially [because of online] lecture notes and recorded videos”. Another who still preferred in person learning found the option to tune in remotely beneficial when they “had a bit of a family emergency that required [them] to go home for a week and stay on schedule”. Others felt like they had the “ability to learn and understand at [their] own pace” because they “could pause and slow down the videos” as needed. In terms of learning outcomes, a couple students stated that “it was nice to learn the material without having the pressure to begin fabricating right away”, hinting that taking time to grasp the class content before hands-on project work could result in better knowledge acquisition and application of that information in the team project. With classes online, some extracurriculars and senior design projects provided students with a sense of community “as they served as small in person interactions even when many things were remote”, but this was only possible for students who stayed on campus during the remote period of Winter 2022.

Responses to S4: “Please describe a negative aspect of this quarter in particular, which started remotely before returning to in person.”

The online start to the quarter also proved to have downsides. The biggest drawback students perceived was in professional and learning outcomes. An overwhelming number of students were frustrated by “[being] delayed on starting in person labs” and thus “missing out on some important hands-on skills that would have benefited [them had they] started as usual on Week 1”. This meant “the workload was intense” once access to labs was restored and students had to make up for lost fabrication time, rendering time management and scheduling for other things more complicated. The “constant back and forth about whether the class would.. stay remote or return to in-person made it harder to schedule... work and life around... school and outside responsibilities”. Many students found the switch back to in person difficult because of the expectation for and format of exams. Health-wise, “students who did not want to come to school out of COVID worries... needed to” return in order to take tests. A self proclaimed “bad test taker... felt the midterms were harder” because they coincided with the return to campus and it seemed to negatively impact students’ attitudes. Experiencing multiple formats in one quarter “felt like two different quarters” for some people, and lazier study habits acquired at the term’s onset affected student “performance the rest of the quarter”. Commuters who purchased “a [parking] permit for the whole year” only to be kept away from campus were particularly unhappy because of the high cost of parking. Naturally, the distance once again made it “difficult to socialize with peers”. Old problems with technology persisted during this time as well, such as “recorded lectures” getting “cut off before the actual lecture ended, which could have been avoided in an in person setting. Interestingly, no students mentioned lacking access to a quiet study space during this time, unlike at the start of remote learning in 2020. This may be due to the fact that, in contrast to Spring 2020, students were allowed to live on campus in 2022.

Limitations

For this study, data from one undergraduate engineering course were analyzed. The first half of the course was online, and the second half was in-person. To get a fuller picture of how students adapted and how learning formats affect students' perceptions and performance, more courses should be studied that span multiple terms and multiple learning formats, including courses where students have options on how to take the course (e.g., in person, hybrid, or online).

The student data are written responses to an online survey. Therefore, the authors do not have additional context for the responses. Interviews with some of the participants would be beneficial to contextualize and further probe some of the students' responses. Furthermore, more information about the students, such as whether they commuted or lived on campus or had obligations or jobs outside of school, would have been helpful to contextualize their responses.

Conclusion

The COVID-19 pandemic affected the lives of undergraduate engineering students by forcing many of them to exchange their lecture halls, extracurricular activities, and friends for learning remotely, technology dependent past times, and interacting with only the people they lived with. Through a survey conducted during a class in Winter 2022 that was online for the first half of the term and in person for the second half of the term, students identified time management, study skills, learning format, and their outlook on education as the things that were altered the most during and after required changes in learning format due to COVID-19. The students' word choice and honesty in responses to open ended prompts gave glimpses into how deeply they were impacted by the sudden change, but their continual efforts to adapt also shined through. In this way, both benefits and drawbacks to transitioning online and back to in person were apparent. These results provide implications for course design and opportunities for future research on how to capture the benefits of multiple learning formats, increased flexibility, and the use of technology while reducing the drawbacks that students experienced during the COVID-19 pandemic.

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