

Learning from the Voices of Faculty: An Analysis of the Impact of Shelter-in-Place on Faculty at San Jose State University in Spring 2020

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Abstract

This is a research paper based on an in-depth study conducted in Spring and Summer 2020 at San José State University College of Engineering that focuses on the students and faculty experiences during the shelter-in-place due to COVID-19. There were four parts to this study. In this paper, we focus on the interviews of 23 faculty members that taught in Spring 2021 (18 lecturers and five tenure-track and tenured faculty members). Seven women and 16 men were interviewed and they worked in almost every department in the College. The interviews were conducted via Zoom in Summer 2020. The faculty members had a variety of years teaching at SJSU: nine faculty members taught for 0-5 years, six faculty members taught from 6-10 years, two faculty members taught from 11-15 years, and six faculty members taught for more than 15 years. The interviews asked open-ended questions of the faculty members and used a thematic analysis approach to analyze the transcripts. The results of the interview analysis indicate that there were commonalities of experience in Spring 2020 after the unexpected shelter-in-place. Most of the faculty members had never taught online before and they struggled with switching to remote instruction. This paper gives a detailed analysis of the faculty voices about their experiences and present recommendations based on this analysis.

Introduction and Background

As the coronavirus pandemic hit the United States in Spring 2020, San José State University (SJSU) faculty members moved to remote instruction in March 2020 and faculty members promptly adapted their teaching pedagogies to remote instruction. SJSU was among the first to transition to 100% remote learning, and has continued in this modality in Fall 2020 and Spring 2021 with limited hybrid offerings.

Online instruction, which has grown in popularity in the last decade in the US, requires thoughtful instructional design, delivery and assessment, especially when student populations are underserved or at-risk, such as at SJSU. In the College of Engineering at SJSU, 16% of the students are Hispanic/Latinx, 25% are Pell Recipient and 23% are First Generation Students. Online instruction (also called online learning, distance learning or e-learning) is different from teaching in-person, and requires skills and expertise that are generally not part of faculty members' education and experience. Use of technology, which is of paramount importance in online instruction, can be a barrier to some of the faculty members.

Generally, online learning comprises of a combination of synchronous (real-time) and asynchronous learning (on-demand). Most common pedagogies in online teaching include discussion boards, audio and video submissions, text-based assessment, collaboration, emails exchanges, text-based chat, audio and video conferencing, real-time polls, real-time collaboration, and real-time assessment [1], [2]. These teaching modes can be classified as "surface structures" (pedagogies that transmit the information between the teacher and students), "deep structures" (pedagogies that encourage, higher order thinking and problem-solving) and

“implicit structures” (pedagogies that develop a moral dimension in terms of professional values and attitudes). According to Eaton et al. [1], some teaching activities in the online environment have “the potentials to cultivate deeper learning experiences, but they can fail to do so if activities are not designed and implemented properly.” The rapid switch to online instruction in March 2020 did not allow faculty members to train, plan and reflect upon the best teaching modes for online instruction, unless they had previously taught an online class. Therefore, as with many other researchers, we consider the Spring semester to be an example of remote learning rather than planned online learning [3].

In October 2020, the Chronicle of Higher Education conducted a survey among faculty members in US institutions to gain insights into how the pandemic affected faculty members from a mental and emotional perspective [4]. A total of 1122 faculty members responded to the survey from four-year and two-year universities. The analysis of the data highlights that the majority of faculty members are experiencing elevated levels of frustration, anxiety, and stress, as they are struggling with increased workloads and a deterioration of work-life balance. This is especially true for female faculty members. The survey also highlights that more than two-thirds of all faculty members are discouraged enough to consider retiring or changing careers and leaving higher education, with tenured faculty members even more likely to retire than others. Faculty members faced a multitude of challenges at the same time: abruptly changing their work strategies and habits, learning new technologies, job insecurity due to the economic challenges of higher education, worries about the health and well-being of their families as well as students, losing collaboration opportunities. The Chronicle of Higher Education’s survey, however, did not explore the experiences of the faculty members from a teaching perspective.

The experience of faculty members after this rapid switch to remote instruction was captured by blog posts and reports. These reports observed that faculty members lectured in the remote environment much more than in in-person environment [5-6], experienced a decreased interaction with students during class time and students’ engagement [5], [7], were concerned about their students [8] and in general felt that their course quality has decreased [7]. According to [7], the main challenges in remote learning in Spring 2020 were associated with students’ lack of access to technology or wi-fi, faculty members’ need to juggle work with personal needs, new administration policies as a response to the pandemic, as well as technical obstacles for faculty members. Some of the strategies that faculty members adopted to adapt to the remote environment include modifying or dropping assignments and exams, lowering their expectations about the quantity and quality of the work performed by the students [6]. Despite the challenges, according to [7], faculty members had a positive experience in teaching remotely in Spring 2020.

All faculty members in the United States were required to shift their pedagogy in Spring 2020, in what has probably been the quickest shift in teaching pedagogy that the academic environment ever experienced. In order to understand the underlying assumptions that drove faculty members in re-evaluating their teaching practices and adapted them to the remote environment at the end of the Spring 2020 semester, Deters et al. [9] conducted semi-structured interviews of three mechanical engineering faculty members and eight students. This study identified three main core belief that motivated faculty members’ decision: fear of cheating, valuing of hardiness, and views on flexibility. The personal challenges that faculty members experienced likely influenced their ability to effectively shift their pedagogy, and testify the resilience of the faculty body.

Morelock et al. [10] created a novel research platform to collect the experience of students, faculty members and staff (for a total of 70 participants, of which 25 were faculty members). The study identifies that students and instructors struggled to recover a sense of connectedness in a remote environment, as well as a disconnect between faculty members' and students' experiences. Students and faculty members faced a range of COVID-19- related challenges within and outside of academia.

The results in this paper are part of a larger study completed at SJSU University which looked at the impact of COVID-19 on students and faculty members [11-13]. We surveyed all the faculty members that taught a class in the College of Engineering at SJSU in Spring 2020 (more than a hundred of responses) [11], and interviewed 23 of them. We surveyed all the students enrolled in the College of Engineering at SJSU in Spring 2020, and interviewed about 40 students [12-13]. This paper describes the results of a set of interviews with engineering faculty members at SJSU University after the end of Spring 2020 semester, and explores faculty members' experiences as well as the novel teaching approaches they used in the remote environment.

Methodology

The interviews described in this paper followed an initial survey distributed to all engineering faculty members at the end of Spring 2020. The survey's questions were based on the students' survey developed by the researchers at Georgetown and HEDS [14-15] , and modified according to the peculiar aspects of our university. Because many of the engineering classes at SJSU include laboratories, projects or other group experiences, we wanted to create our own survey to ask faculty members about these experiences. The research questions of the study are:

1. What are the impressions of faculty members to the learning environments in engineering courses after the switch to remote learning in Spring 2020?
2. What was the impact of the switch online in Spring 2020 to lab classes?

COVID-19 forced many universities to transition quickly to remote teaching. Since Spring 2020, there has been many articles that indicated that this transition to remote or online teaching could continue after the pandemic ends [16]. According to Kim [17], there are three likely scenarios for online instruction in the future: an increase in blended or hybrid learning, implementation of online education as a strategic priority for universities, and an exploration of new and existing online learning partnerships for universities. It is the authors' perspective that understanding the views of engineering faculty members to remote learning can help engineering colleges plan more effective hybrid and online courses in the future.

The team submitted an IRB application and it was approved on 5/28/20. The results of the survey on faculty members are presented in Backer et al. [11]. A final question in the faculty survey asked for volunteers to participate in an interview. All volunteers were contacted by our team to be interviewed, except for faculty members that were acting as Chair of a department in the college. A total of 23 interviews were conducted.

Interview protocol

Our interview protocol was informed by the interview protocol that was used by Pawley [18] at Purdue University. The interview consisted of two questions: “How did you do in your classes in Spring 2020?” and “How did SJSU as an institution do in this transition?”. According to Pawley, open questions allow “participants to tell their stories in whatever way they chose” [18]. We have included the prompts below for this interview protocol.

Interview guide

- How did you do in your classes in Spring 2020?
Prompts as needed: Tell me a little about yourself. Tell me about your experiences at SJSU after the transition to 100% online instruction. Has COVID 19 made any impact on your life? Let’s talk about that for a minute; Tell me more about that; So, just to clarify...How did you learn about this? What was important to you? Any regrets? Anything you wish you had done differently? Anything else you would like to tell me?”
- How did SJSU as an institution do in this transition
Prompts on institutional structures—financial, community service, student support, rules and regulations at SJSU

The interviews lasted about 15-30 minutes. The interview recordings were completed through Zoom cloud, and Zoom automatically created a transcript of the recording. Our team reviewed the transcripts and recordings together to correct errors in the transcripts, which were generated automatically. We then pseudonymized the transcript, masking names, places, ages, organizations, ethnic groups (replacing them with broader racial categories), nationalities, languages, and religious affiliations or communities for those participants who desired it and the names of people participants mentioned. We sent the participants both the original (for their records) and the pseudonymized transcripts to review for inaccuracies or things they regretted saying. The revised transcripts were coded by two persons in the team, a faculty member and a graduate student [19]. The coding was defined using NVivo 12, a qualitative data analysis tool, to code response and identify outstanding themes of perceived in the student and faculty interviews. An iterative inductive stage was used that involved several close readings of the transcribed interviews to code the results. This reading provided a holistic perspective of the responses. Initially, points of interest and interpreted significance were coded by the team. A faculty member and a graduate student coded the same transcript and then compared and arbitrated their results until they achieved a valence of consistency that approximated near complete calibration. Then, the team performed a step-by-step analysis that described the analytic themes derived from stage 1. In the third stage, a thematic analysis of the transcript was conducted to identify themes and experiences of the participants.

The main limitation of the current analysis stands in the limited number of participants, that represent a small portion of the total number of faculty members in the college of engineering at SJSU. In addition, the participants were self-selected and not randomly selected, as we interviewed all the volunteers that offered to participate in the interview process. These limitations are common practice for qualitative analysis. To our knowledge, this study represents the largest qualitative study of the experience of engineering faculty members during the online transition due to the coronavirus pandemic. All interviews were conducted by one author, who is

a white female engineering educator, an engineering education researcher and an advocate for active learning and active communication. This epistemological commitments and positionality of the interviewer might have affected the follow up questions asked to the participants, although the interviewer kept the follow up questions as consistent as possible.

Participants

We conducted 23 interviews among the faculty members of SJSU College of Engineering of which 6 are female, 16 male, 1 unassigned. Most of the participants were lecturers (18/23), with also 2 tenure track participants and 3 tenured faculty members. Of these faculty members, nine have been teaching at SJSU less than five years, six participants for 6-10 years, two for 11-15 years, and six faculty members for more than 15 years, as can be seen in Table . All the departments were represented by the participants, but we have not included the information of the department in which each faculty members primary teaches out of concern of being identifiable due to small number of teaching faculty members. Each participant has been assigned a pseudonym, according to the Atlantic Tropical Cyclone names for 2020 and 2021 [20].

Table 1. Faculty members interviewed

Participant	Gender	Faculty Status	Years Teaching at SJSU
Josephine	Female	Lecturer	6-10 years
Dolly	Female	Lecturer	more than15 years
Hanna	Female	Tenure-track	0-5 years
Laura	Female	Lecturer	6-10 years
Paulette	Female	Lecturer	6-10 years
Vicky	Female	Lecturer	11-15 years
Kyle	Male	Tenured	more than15 years
Arthur	Male	Tenured	0-5 years
Isaia	Male	Lecturer	0-5 years
Cristobal	Male	Lecturer	0-5 years
Edouard	Male	Tenured	more than15 years
Victor	Male	Lecturer	6-10 years
Gonzalo	Male	Lecturer	0-5 years
Peter	Male	Lecturer	11-15 years
Nicholas	Male	Lecturer	0-5 years
Omar	Male	Lecturer	6-10 years
Marco	Male	Lecturer	more than15 years
Larry	Male	Tenure-track	0-5 years
Henri	Male	Lecturer	0-5 years
Bill	Male	Lecturer	more than15 years
Fred	Male	Lecturer	more than15 years
Wilfred	Male	Lecturer	0-5 years
Bertha	Non-binary	Lecturer	6-10 years

Results

The majority of the faculty members that were interviewed never taught online before, and were therefore required to transition to the remote learning format with very little preparation and formal training. Faculty members got quickly up to speed in online teaching, attended brief trainings offered by the university during Spring 2020, looked for IT and instructional designers' support, and turned for help to other faculty members. The analysis of the interviews has been divided into four main themes: "Testing and assessment", "Experience", "Teaching approach", "Hands-on laboratories" that will be discussed in the following sections.

Testing and assessment

Testing and assessment has been the main point of discussion during the faculty interviews. We identified the following codes as part of this category:

- Online testing: 15 out of 23 faculty members
- Concerns about Cheating: 9 out of 23 faculty members
- Grading Issues: 8 out of 23 faculty members
- Students had higher grades: 6 out of 23 faculty members
- Students had lower grades: 4 out of 23 faculty members
- Faculty made more exceptions to students: 3 out of 23 faculty members

Faculty members in Engineering are highly concerned about finding assessments that are meaningful and allow them to assess both lower taxonomy and higher taxonomy skills [21]. Most of the faculty members changed their assessment strategies, moving from traditional closed book exams, to open books exams, and experimented with different types of assessment strategies such as open-ended exams, multiple choice or take-home exams. Kyle, for example, discusses the need to experiment with different types of online assessment strategies during the semester.

The exam I mean that that was a little bit difficult experience the exam, the first exam, which we did we use Zoom [...] Now the second exam that I use a different process. I use the lockdown. [...] And then I change it to a multiple-choice question and now with the multiple choice question the computer can generate the answers randomly. - Kyle

Many faculty members are concerned about students cheating and academic dishonesty, and were not very confident in their ability to truly assess individual students' skills. Faculty members felt responsible about preventing cheating but in many cases, they are not sure about best practices for online testing, or find that it takes excessive faculty members time to prepare the assessment.

I think I think exam integrity is a big, big challenge, for engineering for the engineering curriculum. - Peter

In order to minimize cheating, some of the faculty members experimented using video proctoring during assessment, either using software such as LockDown browser, ProctorU, Impendus or monitoring students using synchronous Zoom meetings. In some cases, this has resulted in

students' push back, with faculty members feeling under pressure about their assessment strategies.

And they were saying like why I'm only using this because many other faculty are giving take home exam and I'm the only one who does like who tortures them...– Hanna

Faculty Experiences in Remote Teaching

The faculty were generally positive about their experiences in a remote mode after the move online in Spring 2020. We included the following codes in this category:

- SJSU acted appropriately as an institution: 14 out of 23 faculty members
- Positive Experience: 14 out of 23 faculty members
- Online teaching and learning difficulties: 13 out of 23 faculty members
- Faculty found easy to transition to online teaching: 11 out of 23 faculty members
- SJSU should provide more support: 6 out of 23 faculty members
- End of semester student evaluations: 3 out of 23 faculty members

Faculty members in general report had a positive experience teaching in the online environment, and considered the transition easy. For some faculty members, online teaching is convenient. The transition to online teaching was defined by the interviewed faculty members as “smooth”, “seamless”, “pretty easy”, “not that hard”, “not as challenging”, “convenient”. However, it is evident from the faculty transcripts that many faculty members just ported their classes to a remote teaching mode without considering best practices in teaching online [1-2].

I just continued with the lectures, you know, didn't really skip a beat and it went well and went really well. [...] It was good. [...] With respect to the class. I think, I think it went fine. [...] I was able to get through those this time so I did find the online format, more efficient and it was definitely easier for me. You know, I didn't have to drive to commute and I didn't have to walk over to the class set up the audio visual. [...] So I, I liked it.” – Fred

At the same time, faculty members note that the transition brought challenges to their teaching approaches, such as grading and assessment, forming a personal connection with the students, listening and supporting students who were struggling because of their personal situation, maintain students' engagement, and Zoom drain. Faculty members noted that students struggled because of the difficult situation:

“They were thrown into this mess. They had family problems and stress because people were losing the jobs. It was just a mess...But it was so there was a lot of stress, our students suffered a lot of stress, more than I thought would happen...I didn't realize that they would be out of work or the parents would have been laid off. Then they felt the stress that they had to work to help their families...And what one of them was even my best student, I mean, he was a solid A up to that point. And because of family pressure. He had to quit. That one broke my heart. – Vicky

For some faculty members, meeting students' need came at a cost of personal well-being.

“That it helped them, but it was incredibly draining for me because I would be on Zoom for five hours every Monday and Wednesday. I have, a five minute break here and there they go get another drink and use the facilities and rush back and get started again. So, the Zoom drain was incredible...And my students seem to have very similar reactions to having to be engaged with their classes online, whether it was my class or another class but many times I heard that they were struggling to keep up with the dates, because there wasn't always that engagement directly with their instructors and even with the engagement with me. It was hard for them to keep up.” – Josephine

Some faculty members noted a discrepancy in their experience as a faculty members and the students' experience .

It turned out that, I thought okay, I thought in terms of delivery from my side, I did not see any difference. But then students did not like it at all. [...] They had difficulty and I had to a lot of times I had to go over things repeatedly, they wouldn't get it so it take, it's, most of them did not like that. – Arthur

SJSU as an institution has been effective at how it responded to the difficult circumstances. Many faculty members praised the IT team for the quick transition and the many trainings regarding online teaching resources and software offered to faculty members. At the same time, some faculty members note that SJSU could have been more supportive of their faculty members and students. First, SJSU could have asked faculty members what they needed and how they could be best supported in their teaching, by promptly providing devices needed to teach (laptops, tablets, printers, scanners where needed), and providing some guidance and best practices in terms of grading and assessment strategies.

We need more support from the university to the student [...] Okay, so, if a faculty doesn't have a computer. Then this is a problem. The second thing a faculty need a scanner and then needs a printer. Well, I do have a printer. Okay. And it's a fast printer. I didn't have a problem. I did have a page by page scanner but I have one at work, which is a fast, fast scanner, you can do 50 pages per minute. – Kyle

I wish that the purchasing for things would be a little bit easier I requested to get like a tablets that I could work through some laboratory problems and structures, just to be able to write and draw. Because if not, I'm gonna have to set up a camera. – Nicholas

Teaching approach

Many participants discussed how their teaching approach changed in the transition from in-person to online classes. The following codes are part of this theme:

- Faculty used PowerPoint: 9 out of 23 faculty members
- Faculty recorded classes: 9 out of 23 faculty members
- Use of Technology in the Classroom: 9 out of 23 faculty members
- Faculty changed teaching approach in online class: 8 out of 23 faculty members
- Faculty lectured entire time: 8 out of 23 faculty members

- Faculty assigned project: 7 out of 23 faculty members
- Faculty run office hours: 6 out of 23 faculty members
- Internet or Connection issues: 5 out of 23 faculty members
- Faculty used active learning: 4 out of 23 faculty members
- Faculty taught synchronously: 17 out of 23 faculty members
- Faculty taught asynchronously: 3 out of 23 faculty members
- Students were highly engaged during class: 6 out of 23 faculty members

In many cases, faculty members changed their teaching approach “*a whole 180 degree*” (Dolly) as they recognized that the online format requires different strategies to keep students’ engaged. The majority of the interviewed faculty members taught synchronously with the same schedule as during in person teaching (17 faculty members out of 23), used Power Point slides to present their lesson plan and recorded their lecture and made it available to students, and had office hours. Eight out of 23 faculty members lectured for the entire class time, finding it difficult to incorporate active learning activities to keep students engaged.

A few faculty members (4/23) discussed that they were instead able to incorporate active learning into their online classes, taking advantage of the digital environment they were suddenly teaching in. Six faculty members found that students were highly engaged during their online classes, and this is especially true for faculty members that experimented with active learning.

Probably for about 45 minutes, at the beginning of the class I will separate the class into groups, then I'll be joining each of the rooms in a rotating manner, and I'll go and you know ask questions and see if they were struggling with the material...I will create another poll and run a comparison between this is where you started in class. - Wilfred

Hands-on laboratories

In the College of Engineering at SJSU, a number of classes have hands-on activities and laboratories are present into the schedule. Transitioning laboratories activities in an online format was particularly challenging, given the sudden transition and the inability to provide hardware material to the students because of campus closure and safety concerns. Faculty members used different strategies to conduct their laboratory activities, like using “a simulator” (Larry), and conducting demonstrations.

So, what I did is I personally went to the lab, took the data for them, took images of the setup, and went through my normal in text format, my normal spiel that I would give to them at the beginning of the lab. you know, generally what we're doing what we're looking for, etc. And basically, handed the photos and the data off to them for them to process as they normally would and write a report on it...So, really, the part that got lost in that was they weren't physically there to see the setup themselves or actually run the equipment. And ideally, I would have liked to actually record the entire process of the lab. But because it was basically required that I'd be the only one in the lab for that. That really wasn't a practical possibility with the ad hoc nature of the online transition. – Cristobal

Preparing for the Fall semester

Many faculty members (11 out of 23) discussed their plans for Fall 2020, which were, for the vast majority of faculty, online. They planned to make changes after the lessons learnt in Spring 2020 both in delivering the class material and in their teaching approach as well as how to conduct labs.

I am actually making fairly extensive changes to the way it's being taught and part of that is based, it's it's it's because of the experiences in the spring. I'm gonna I'm making it a lot more interactive. So, students would not have, you know, those who who want to have you know the the opportunity to to take part in in in even during the lectures in a more interactive way. And then the lab part that I mentioned earlier, the hardware lab revamping that so instead of building it ourselves, we identified I've identified a piece of hardware that they could order on the web, which is just as cheap, if not cheaper. So, I think that would be that would also be a little, should run a little, more smoothly. - Bill

Some faculty members described their plans to move to asynchronous teaching, so that class material and videos can be prepared beforehand, and the class sessions can be used to engage students in problem solving activities, answer questions or meet in small groups to review projects.

Okay, I'm going to teach online, but now it will be asynchronous. So, what I'm doing now I'm spending all the time to do some lectures and it will be posted on YouTube. And then I download it to Canvas and then I'm going to make, make some meetings with them because this is a design class. So, I have to see how do they do? So, It will be regular meetings with each group. So, I, I will have next semester 12 groups. So, that will be 12 meetings for these groups. – Omar

Faculty members plan to incorporate more active learning activities, such as synchronous group activities using breakout rooms and “*to really do more to encourage discussion amongst them and with me*” (Gonzalo). In terms of testing and assessment, faculty members plan to be clearer with the students from the beginning of the semester, in particular if they plan to use video proctoring.

Discussion

For the discussion, we related the results of our interviews back to the research questions. We will summarize the results in this manner.

Research Question 1: What are the impressions of faculty members to the learning environments in engineering courses after the switch to remote learning in Spring 2020?

Faculty members in general report had a positive experience teaching in the online environment, and defined the transition easy. For some faculty members, online teaching is convenient. The transition to online teaching was defined by the interviewed faculty members as “smooth”, “seamless”, “pretty easy”, “not that hard”, “not as challenging”, “convenient”.

Faculty members in Engineering are highly concerned about finding assessments that are meaningful and allow them to assess both lower taxonomy and higher taxonomy skills. Most of the faculty members changed their assessment strategies, moving from traditional closed book exams, to open books exams, and experimented with different types of assessment strategies such as open-ended exams, multiple choice or take-home exams. Kyle (see comment above), for example, discussed the need to experiment with different types of online assessment strategies during the semester.

Research Question 2: What was the impact of the switch online in Spring 2020 to lab classes?

The faculty members interviewed found that moving laboratories to a remote mode was difficult. Specifically, the faculty members found it challenging to provide hardware to the students because of campus closure and safety concerns: Faculty members used different strategies to conduct their laboratory activities, like using “a simulator” (Larry), and conducting demonstrations (Cristobal). Some faculty members discussed about their frustration on the inability to conduct labs in a safe environment (Edouard).

Conclusion

Most of the faculty members in engineering have always viewed online teaching with skepticism, and prior to Spring 2020, very few classes in the STEM disciplines were taught fully online. A total of 23 interviews were conducted of the impact of COVID-19 on engineering faculty members. The traditional teaching approach was completely shifted by the COVID-19 pandemic and all engineering classes at SJSU transitioned to online learning in Spring 2020, with limited training and planning for the faculty members. As a result, faculty members experienced an increase in workload at a time in which many also experience an increase in personal needs. Faculty members were also challenged to keep students engaged online, and by the organization of hands-on laboratories in a fully online environment.

Overall, despite the challenges, at the end of the semester faculty members shared a positive experience in how they were able to transition their classes. The general positive experience identified by the engineering faculty members is in clear contrast to the experience described by the students in the transition to online learning, which struggled both from an academic and non-academic perspective [11], [12].

Both the surveys and the interviews of engineering students point to a large disconnect between the faculty members and students’ experiences in remote learning in Spring 2020. Our faculty interviews indicated that faculty members generally were unaware of best practices in teaching online including best practices in terms of presentations, grading and assessment strategies. This aspect is fundamental in an online environment, in which visual clues are eliminated and the student-faculty contact time is diminished.

As faculty members reflected about the challenges of the Spring 2020 semester, they also described their plans to improve their teaching pedagogy in Fall 2020. We have conducted a

follow-up study at the end of Fall 2020 and the results of this additional study, as well as the comparison with the analysis in this paper, will be presented in future publications.

References

- [1] S. Eaton, B. Brown, M. Schroeder, J. Lock, and M. Jacobsen, "Signature pedagogies for e-learning in higher education and beyond."
- [2] Z. Akyol and D. R. Garrison, "The development of a community of inquiry over time in an online course: Understanding the progression and integration of social, cognitive and teaching presence.," *J. Asynchronous Learn. Networks*, vol. 12, no. 2–3, pp. 3–23, 2008.
- [3] A. Gillis, and L.M. Krull, "COVID-19 remote learning transition in Spring 2020: Class structures, student perceptions, and inequality in college courses," *Teach. Soc.*, vol. 48, no. 4, pp. 283-299, 2020.
- [4] T. C. of H. Education, "On the verge of burnout," 2020.
- [5] "Professors describe their experiences in the COVID-19 classroom this fall." [Online]. Available: <https://www.insidehighered.com/digital-learning/article/2020/08/26/professors-describe-their-experiences-covid-19-classroom-fall>. [Accessed: 03-Feb-2021].
- [6] D. Lederman, "How Teaching Changed in the (Forced) Shift to Remote Learning," 2020. [Online]. Available: <https://www.insidehighered.com/digital-learning/article/2020/04/22/how-professors-changed-their-teaching-springs-shift-remote>. [Accessed: 09-Feb-2021].
- [7] A. J. Williams, "Did the Scramble to Remote Learning Work? Here's What Higher Ed Thinks," 2020. [Online]. Available: <https://www.chronicle.com/article/did-the-scramble-to-remote-learning-work-heres-what-higher-ed-thinks>. [Accessed: 03-Feb-2021].
- [8] R. Kimmons and C. Veletsianos, G. VanLeeuwen, "What (Some) Faculty Are Saying about the Shift to Remote Teaching and Learning | EDUCAUSE," 2020. [Online]. Available: <https://er.educause.edu/blogs/2020/5/what-some-faculty-are-saying-about-the-shift-to-remote-teaching-and-learning>. [Accessed: 03-Feb-2021].
- [9] J. R. Deters, M. C. Paretto, and J. M. Case, "How Implicit Assumptions About Engineering Impacted Teaching and Learning During COVID-19," *Adv. Eng. Educ.*, vol. 8, no. 4, 2020.
- [10] J. R. Morelock et al., "Using a Novel Research Methodology to Study and Respond to Faculty and Student Experiences with COVID-19 in Real Time," *Adv. Eng. Educ.*, vol. 8, no. 4, 2020.
- [11] P. Backer, L. Sullivan-Green, M. Chierichetti, and L. Rosenfeld, "The effects of COVID 19 on faculty in the College of Engineering at SJSU University," in *ASEE Annual Conference & Exposition*, 2021.
- [12] M. Chierichetti, "Understanding the role that non-academic factors play on students' experience during the COVID-19 pandemic," in *2020 IFEES World Engineering Education Forum - Global Engineering Deans Council, WEEF-GEDC 2020*, 2020.
- [13] P. Backer, M. Chierichetti, L. Sullivan-Green, and L. Rosenfeld, "Learning from the student experience: Impact of the shelter-in-place on the learning experiences of engineering students at SJSU," in *ASEE Annual Conference & Exposition*, 2021.
- [14] B. Daniels, J. Das, A. Hamza, and B. Leydier, "Covid-19 Diaries: Early Impressions from an Online Questionnaire.," *Covid-19 and Student Focused Concerns: Threats and Possibilities*, Veena Das and Naveeda Khan, eds., American Ethnologist website, 2020. .
- [15] "HEDS COVID-19 Response Information." [Online]. Available: <https://www.hedsconsortium.org/heds-covid-19-response-information/>. [Accessed: 09-Feb-2021].
- [16] B. Lockee, "Online education in the post-COVID era," *Nature Electron*, vol. 4, pp. 5–6, 2021. Available: <https://doi.org/10.1038/s41928-020-00534-0>
- [17] J. Kim, "Teaching and learning after COVID-19," *Inside Higher Education*, April 1 2020 [Online]. Available: <https://www.insidehighered.com/digital-learning/blogs/learning-innovation/teaching-and-learning-after-covid-19>
- [18] A. L. Pawley, "Learning from small numbers: Studying ruling relations that gender and race the structure of U.S. engineering education," *J. Eng. Educ.*, vol. 108, no. 1, pp. 13–31, Jan. 2019.
- [19] J. Saldana, *The coding manual for qualitative researchers*. Thousand Oaks, CA: Sage, 2021.
- [20] "Tropical Cyclone Names." [Online]. Available: <https://www.nhc.noaa.gov/aboutnames.shtml>. [Accessed: 14-Nov-2020].
- [21] P. Armstrong, "Bloom's Taxonomy. Vanderbilt University Center for Teaching," 2021. [Online]. Available: <https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/>. [Accessed: 04-Jun-2021].