

# Student Preference: ONLINE or Face-To-Face Instruction in a Year of COVID-19

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**Abstract**—This full paper, in the research to practice category, focuses on student preferences for online versus face-to-face instruction. Spring Semester, 2020 started as usual but proved to be anything but usual. Instead, in a seven-day turnaround, the first-year engineering program at Michigan Technological University moved from a face-to-face, highly interactive studio environment to a remote/synchronous environment. At the end of the semester, our University and many others across the United States conducted a short survey of undergraduate students on their preference of face-to-face versus online instruction. Results showed a strong preference for face-to-face instruction. However, to adequately consider the extensive ranges of approach in both umbrella terms ("face-to-face instruction" and "online instruction"), we need to unpack the surface results. This paper reports on a short survey given to second-semester students in our College of Engineering, First-Year Engineering Program, and students in the first-year course in Systems Engineering. The survey sought to gather student preferences for two variations of our instructional models in current use in our first-year program: (a) remote/synchronous instruction versus (b) a hybrid environment that included face-to-face instruction with mandatory masking and social distancing. Results showed that students, at worst, held preferences that were generally not statistically different in terms of preferences. The several exceptions that did show significance showed numerical differences that were not of practical importance, with one exception. The core takeaway from our study is that determining student preferences for "face-to-face instruction" versus "distance learning" needs to be unpacked to enable students to register reasoned judgments and set the stage for meaningful results.

**Keywords**—face-to-face learning, remote learning, distance learning, student preferences, COVID-19, first-year engineering

## I. INTRODUCTION

Spring semester 2020 began as a "normal" second semester within our Michigan Technological University (MTU), College of Engineering first-year engineering program (FYEP), and as the starting semester for our Systems Engineering thread. It did not remain "normal" – in any sense of the word. In March 2020, our environment changed drastically as the global pandemic forced the secession of normal academic operations. The vast majority of higher education institutions were in the same circumstances. We moved from face-to-face instruction to remote education in one week. Our experience largely matched most of higher education as the entire community found ways to meet COVID restrictions.

At the end of the Spring Semester 2020, university officials surveyed all undergraduate students. The one question asked was, "Do you prefer *remote* or *face-to-face* instruction." The result was skewed towards *face-to-face* instruction and against *remote* instruction. A similar pattern of simple surveying was repeated at many institutions and with generally the same result.

However, we can view the results of these early surveys asking for the characterization of student preferences between *face-to-face instruction* and *remote instruction* as simplistic and the results as questionable. The more realistic question would have been to ask student preferences between *face-to-face instruction with distancing and masking* versus *remote instruction*, including *remote/synchronous* and *remote/asynchronous*.

This report focuses on the two specific modes of instruction that our FYEP moved to because of COVID, as described in the section below.

## II. BACKGROUND: OUR LOCAL FIRST-YEAR ENGINEERING PROGRAM

In September 2017, we completed a significant upgrade in our FYEP. The core of the updated FYEP is a systems-level approach to first-year engineering resting on four pillars: a streamlined curriculum with a spine in computational problem solving; an inverted classroom delivery model; an emphasis on active, cooperative learning during class sessions coupled with adequate pre-class work by students ("flipped classroom"); and a well-trained team of near-peer mentors who each lead a cohort of 24 first-year Engineering students embedded in a 120 seat studio instructional space. More detail of the systems-level instructional model are in [1, 2, 3, 4]. By the fall semester of 2019, our first-year program was functioning at scale for the approximately 1,000 FYEP students who matriculate to our College of Engineering each year.

Our instructional environment radically changed in March 2020. The scope and breadth of the COVID pandemic led to a mandated programmatic change that took us out of our designed instructional model. Some sections moved to a straightforward remote/synchronous learning environment. The use of ZOOM enabled this move, and, in particular, the ZOOM facility for break-out rooms was the critical enabler. The base instructional environment still consisted of the same building blocks as noted in the paragraph just above. The only difference was that students met as a class and in their cooperative work teams in the ZOOM environment.

Cooperative learning was still center stage. **For simplicity, we will call this COVID model simply REMOTE.**

Sections that did not make the COVID change to the **REMOTE** model above went over to a more complicated model but still within the broad instruction framework for FYEP as described above. In this second alternative, FYEP faculty developed a hybrid model in which students had one-third of their class contact time face-to-face in a distanced and masked classroom. The remaining two-thirds of classroom time was in a remote/synchronous classroom. Thus, one-third of all students would be in the face-to-face distanced and masked classroom on a given class day, while the remaining two-thirds were in front of a computer in a remote learning classroom. In the next class session, the roles would rotate such that, on average, one-third of student time was face-to-face, and two-thirds was remote/synchronous. **For simplicity, we will call this COVID model simply F2F.**

There is one further degree of freedom that students in the **F2F** model had. Reiterating the key logistical ingredient of the **F2F** model: students were divided into three groups in the **F2F** model, and one of the three groups would nominally be scheduled for face-to-face with masking and distancing instruction in the FYEP studio space on a given class day. However, these in-person sessions were not mandatory. Students basically could vote with their feet if they preferred to be REMOTE. This non-mandatory option for the student in the **F2F** model proved to be important in understanding the results of our survey.

In March 2020, some MTU faculty who were most comfortable with lecture models of instruction chose to put up videos of lectures and give their remote students the appropriate URLs: following a model of REMOTE/Asynchronous instruction. Programs such as FYEP were better-positioned to transition from on-campus instruction to internet-based education because our students were familiar with both a "flipped" instructional delivery model and with active classrooms in which teams of students worked together on problem sets or projects or discussed questions in class. The team-based collaborative learning environment was implemented via the ZOOM break-out room facility. The near-peer mentors retained their role for in-class help and management of their teams, and the instructor kept the role of manager of the class enterprise. As our first-year engineering program went over to fully online instruction, our instructional model remained relatively intact. From a pedagogical perspective and a technological perspective, we could not have accomplished this change for our FYEP students if we had the more lecture-intensive approach that FYEP employed before the 2017 upgrade.

In terms we established above, our core research question is the following:

***For students in the two treatments we surveyed, do students have a measurable and practically meaningful preference for the F2F instructional model versus the REMOTE instructional model?***

### III. BACKGROUND: LITERATURE

Overall, the literature is sparse on the topic we address - student perception of remote versus face-to-face instruction.

There are, however, a handful of studies in print on the subject. Abbassi et al. discuss this issue in the context of a Pakistani medical school. [5] The result these authors found was that approximately 75% of students had a preference for F2F learning. The authors do not state the type of e-learning being considered. Not specifying the type of e-learning was the same issue that characterized many campus surveys taken across the U.S. at the end of the spring semester, 2020. Aguilera-Hermida came roughly to the same conclusion, with the same issue of not specifying the type of online learning compared to face-to-face learning. Interestingly this author characterized the use of online learning as "Emergency Use," which is accurate – the instructional community would not have gone over to "remote learning" wholesale short of a challenge like the COVID pandemic. [6]

In a somewhat contrarian result by Almuraqab, in the context of students at the University of Dubai, and again without specifying the type of distance learning, 26% of students surveyed wanted to have 100% of their classes online. In comparison, 49% of students wanted to have blended learning alternatives. Thus, the result here is less unfavorable to distance learning but still with no sense of what type of distance learning is being responded to by students taking the instrument. [7]

In another paper, Baker et al. surveyed business students, with a significant study goal to find student factors that favored blended learning. They found that students preferred blended learning approaches because it enabled students to have more scheduling flexibility. Expectations of earning a higher course grade in online courses did not play a role, nor did gender or age. This paper was a 2020 journal paper, but with no connection between online learning and COVID-19. Presumably, it was written before the pandemic struck the U.S. around March 1, 2020. [8]

As an interesting counterpoint, Starke and his colleagues investigated ways of making distance learning provide more communication connections among students and instructors in an online environment [9]. This report is very well motivated because it sets out to increase communication and hence connectedness among faculty and students in an online environment. In effect, the authors were looking for characteristics of online environments that would encourage and enable interaction. However, it is not a paper relevant to the question of what students prefer now.

Somewhat relevant to the current research are the early findings of Paechter and Maier, who sought to identify aspects or components that led to the preference of e-learning or F2F. They found that students preferred the structure and distribution of the material in support of self-regulated learning from online courses, whereas they preferred F2F for communication of shared information and the establishment of interpersonal relationships. The relevance of this work is in recognizing that both types of learning can be preferred for different reasons - thus the importance of providing various aspects of learning as the basis for reported judgements [10].

To summarize, the literature is sparse in reports of student preferences for a specified type of online instruction versus a specified kind of face-to-face instruction.

#### IV. SURVEY INSTRUMENT

The authors created the survey instrument for this study, and placed the survey within a context for participants; the survey was introduced as designed to assess their views on modes of instruction they experienced during the pandemic. Specifically, it stated, “As we emerge from the COVID pandemic, students have experienced several different learning modes. In pre-COVID times, the dominant mode of learning was face-to-face. The COVID experience has been rough on everyone, faculty and students included. This survey is to help determine student views on modes of learning that were utilized during COVID times”. Demographic items inquired about student gender, previous exposure to F2F with masking/distancing during the pandemic (between Spring 2020 and the current semester), and who their engineering instructor was (which allowed us to tag participants in either the F2F or REMOTE sections of courses). The final demographic items were provided to F2F students only, and were designed to assess how frequently they attended their assigned “in class” times ( $\frac{1}{3}$  of all course days). Two usability items were asked regarding problems they may have encountered when working remotely: 1.) Did you have a reliable computer to use while working remotely?; and 2.) Did you have a reliable internet connection while working remotely? Both of these items utilized a 4-item agreement scale ranging from “Yes, it never caused me any difficulty” to “No, I finally gave up trying to use it (computer or internet). Mid-scale response choices allowed participants to report occasional problems or weekly problems with their computer and/or internet connection.

Recognizing the importance of soliciting ratings on various outcomes of the course, the remaining survey items inquired about how well the various modes of instruction (pre-pandemic instruction, current F2F, and current REMOTE) had served students across four dimensions, or areas of relevance to learning:

1. Ease of learning,
2. Communication with Instructors,
3. Communication with Classmates/Teammates, and
4. Overall satisfaction.

Students rated each of these four dimensions on a four-point Likert type scale, with 1 = served me very well; 2 = served me well; 3 = did not serve me well, and 4 = served me very poorly. Thus, across analyses, lower scores represent ratings of more favorable ratings. For example, students rated how well the current semester’s FYEP courses, presented **F2F or REMOTELY**, “served their needs” in terms of the ease of learning, communication with instructors and classmates, and overall satisfaction with the course. They also rated pre-pandemic **F2F** experiences along the same dimensions.

The survey was open for students’ input from April 19, 2021, until April 26, 2021; those dates covered the last week of regular classes in the MTU spring semester. The survey was delivered to volunteer participants as a Google Form, and responses were collected anonymously. A PDF copy of the survey is available on request from the first author.

#### V. RESEARCH DESIGN

Respondents were enrolled in either a **F2F** or **REMOTE** FYEP course during the spring 2021 semester. Specifically, 398 participants were from three separate courses in our College of Engineering: (a) students enrolled in the second semester of our first-year engineering program (346 students), students enrolled in the first semester of the same program in our trailer section consisting of primarily transfer students (40), and students enrolled in our first course in systems engineering (12). All students were invited to take the survey with its weighted credit equal to one “extra credit” homework assignment.

Enrollment in these sections was conducted by the University (out of students’ control). The exception was that those students who reported wanting to learn from home were enrolled in a remote section. Student concerns about being on campus during COVID were the typical reason for the exception. Course delivery method served as an independent variable (IV) in our design. Additionally, a repeated measures IV was included such that respondents were asked to rate how well their pre-pandemic instruction methods (i.e., face-to-face with no restrictions) met their learning needs, as well as to rate their current semester instructional method (either **REMOTE** or **F2F**) in terms of how well their learning needs were met. Thus, a 2x2 mixed methods design was used. Dependent variables were ratings across the various survey items, including demographics, and usability items.

#### VI. ANALYSIS AND RESULTS

Participants included 92 women, 205 men, 4 non-binary, and 6 students who did not care to share their gender, for a total of 307. Of those enrolled in the remote-synchronous course ( $n = 165$ ), almost two-thirds (64.8%) were men, and one-third were women (31.5%), non-binary (1.2%), or chose not to report (2.4%). Men accounted for 69% of the modified F2F class, with 28.2% women, 1.4% non-binary, and 1.4% choosing not to report their gender.

Before conducting planned analyses, we sought to identify any differences in responses based upon gender (male v. female) across the items using a series of independent samples t-tests with an alpha level of .05. No gender differences existed in response to ratings on the various modified instructional techniques (ease of learning, communication with instructor, communication with students, or overall satisfaction). Interestingly, gender differences did exist in response to the items inquiring about having a reliable computer [ $t(295) = 3.269$ ,  $p = .001$ ] and having reliable internet connection [ $t(295) = 2.126$ ,  $p = .034$ ] for remote work. On both items, women reported more computer problems ( $m = 1.52$  vs.  $1.31$  on the 4-point scale) and more internet connection problems ( $m = 1.62$  vs.  $1.47$  on the 4-point scale) than men. Finally, of those enrolled in the **F2F** sections (98 men and 40 women), women reported attending more of the available face-to-face sessions [ $t(136) = 2.891$ ,  $p = .004$ ; mean rating =  $3.90$ ] than did men (mean rating =  $2.36$ ). Responses to this item were solicited on a scale of 1 (attended almost none) to 10 (attended almost all). Given the lack of gender differences in response to the items of interest in the following analyses, data were collapsed across gender.

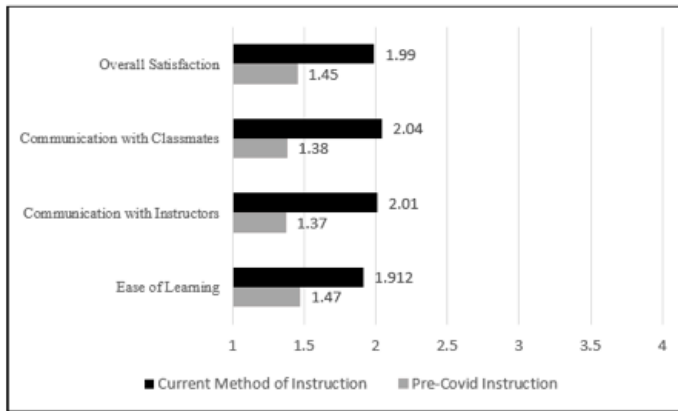


Figure 1. Ratings of Pre-COVID and Current Instructional Methods on 4-pt Scale\*

\*Lower numbers reflect more favorable ratings, with 1 = method of instruction served me very well; 4 = method of instruction served me very poorly

\*All differences significant at  $p = .05$  level

The first analysis conducted was a 2 (type of class presently enrolled in) vs. 2 (type of class asked to rate) mixed methods ANOVA. The between subject's variable, type of class presently enrolled in, represented respondents' current enrollment in a **F2F** ( $n=165$ ) vs. **REMOTE** ( $n=142$ ) first-year engineering course. The within subject's variable was the type of class students were instructed to rate - Pre-COVID "normal" instruction vs. the instructional technique the respondents were currently enrolled in. The four dimensions of learning, rated on a 4-point scale (1 = most positive rating, 4 = least positive rating) served as the dependent variables. Students were asked to rate the different types of instructional modes on the following dimensions: ease of learning, communication with the instructor, communication with classmates, and overall satisfaction.

The 2 x 2 mixed methods ANOVA resulted in a non-significant interaction between the type of class enrolled in and type of class asked to rate [ $F(4, 302) = 1.412, p = .230$ ]. Significant main effects were indicated for both the type of class enrolled in [ $F(4, 302) = 3.843, p = .005$ ] and type of class asked to rate [ $F(4, 302) = 51.695, p < .000$ ]. For the main effect of the type of class rated, respondents, rated the Pre-Covid instructional method more positively on all of the dependent variables (ease of learning, communication with instructor, communication with classmates, and overall satisfaction) compared to the current semester method of instruction (either modified F2F or remote synchronous; see Figure 1). The main effect of the type of class currently enrolled in revealed significant differences in ratings for 3 of the 4 dependent variables (communication with the instructor, communication with classmates, and overall satisfaction) with **F2F** respondents rating courses (Non-covid and currently enrolled instructional method) more positively by a small but statistically significant margin (see Figure 2). The mean response regarding ease of learning for **F2F** students was 1.585 vs the **REMOTE** student mean rating of 1.791 or an approximate difference of 0.20 points on the 4-point rating scale.

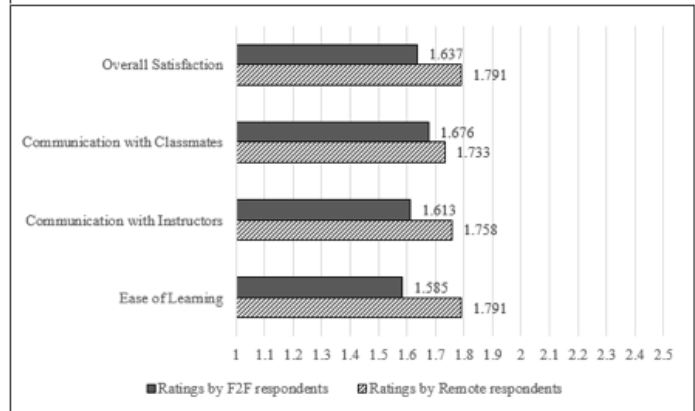


Figure 2. Main Effect of Current Instructional Method Ratings of Instructional Methods

\*Lower numbers reflect more favorable ratings, with 1 = method of instruction served me very well; 4 = method of instruction served me very poorly

\*Differences significant at  $p = .05$  level for all except *Communication with Classmates* (not sig. dif)

To examine whether differences in ratings of the current semester class methods or Pre-COVID methods existed based upon respondent course type (**F2F** or **REMOTE**), t-tests were used. With the independent variable being the type of class the respondent was currently enrolled in (F2F vs. REMOTE), differences in the dependent variables were examined for both Pre-COVID and current methods. When rating Pre-COVID methods, significant differences existed between groups across all 4 measures. Given a significant Levene's test for equality of variances across all items (more variability existed in the REMOTE students' responses), the results for equal variances not assumed are presented. F2F respondents rated Pre-COVID courses more favorably on Ease of Learning [ $t(303.589) = 3.673, p < .000$ ], more favorably on Communication with Instructor [ $t(296.830) = 2.850, p = .005$ ], more favorably on Communication with Classmates [ $t(301.351) = 2.334, p = .020$ ] and more favorably on overall satisfaction with the Pre-COVID method of instruction [ $t(302.676) = 2.363, p = .019$ ]. Figure 3 displays the mean ratings by group. Similarly, t-tests were also conducted between groups (**F2F** vs. **REMOTE**) on the ratings of their current instructional method. In other words, **F2F** students rated how well the current **F2F** method served their needs, and **REMOTE** students rated how well their current remote/synchronous class served their needs. No significant differences existed between groups in respondents' ratings of the method of instruction they were enrolled in across 3 of the 4 items. The only item with significant differences was Ease of Learning [ $t(305) = 2.092, p = .037$ ], with **F2F** students rating this item slightly more positively ( $m=1.8310, s=.61853$ ) than did REMOTE students ( $m=2.0000, s=.77302$ ).

Due to differences that existed between student groups (**F2F** vs. **REMOTE**) in their ratings of Pre-COVID instructional methods, the final statistical analysis sought to control for these differences by examining differences in change scores to better understand the groups' ratings of their current course method. Change scores were calculated by subtracting the Pre-COVID ratings from current semester

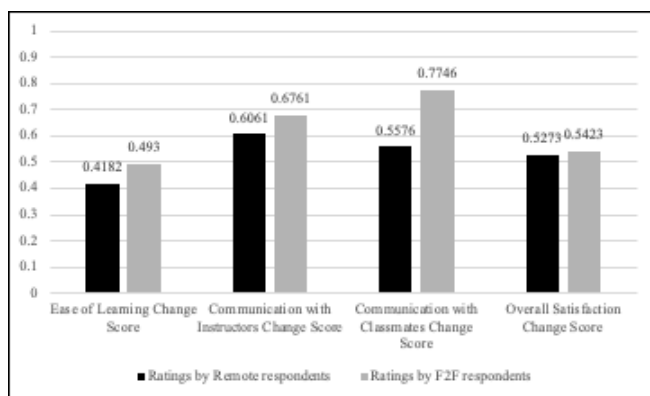


Figure 3. Remote vs. F2F Students' Ratings of Pre-COVID instructional methods.

\*\*Lower numbers reflect more favorable ratings, with  
1 = method of instruction served me very well;  
4 = method of instruction served me very poorly

\*All measures significantly different between respondent groups at the alpha = .05 level.

ratings across the 4 dimensions of interest. Thus, each student had a difference score representing the degree of difference in ratings of Pre-COVID and their current instruction methods. Positive scores indicate more positive ratings of the Pre-COVID instructional method. An Independent Samples t-test was calculated to examine these difference scores by student group. Across the four learning dimensions, no significant differences existed in difference scores by the current REMOTE respondents (n=165) in comparison to the current F2F respondents (n=142). Refer to Figure 4, which shows the mean difference score by group.

Finally, to enhance our understanding of the dynamics of our F2F instructional method, F2F students were asked if they attended live F2F classes during the last 3 weeks of the spring semester. Almost seventy-five percent (73.9%) of F2F students reported not attending any live classes during the last 3 weeks of the semester (See Figure 5). When asked to estimate how many of the live class sessions they attended throughout the semester on a scale of 1-10, with 1 = Almost none, and 10 = Almost all, fifty-seven percent (57%) of students selected "1" on the scale (meaning they attended almost none), 70% selected 2 or lower on the scale, with 82.4% of students selecting a 5 or less. Assuming a direct interpretation, over eighty percent (80%) of the F2F students report attending less than fifty percent (50%) of the 9 sessions they were invited to participate in. A correlational analysis revealed that F2F students who reported attending more of the "live" F2F sessions rated communication with their instructor more favorably ( $r=0.225$ ,  $p=.07$ ). No other significant relationships existed between attendance and ratings on dimensions, a point which will be considered in the discussion.

## VII. DISCUSSION

Our survey focused students on various aspects of learning, rather than simply inquiring about a broad preference for REMOTE or F2F. For example, in the broader question

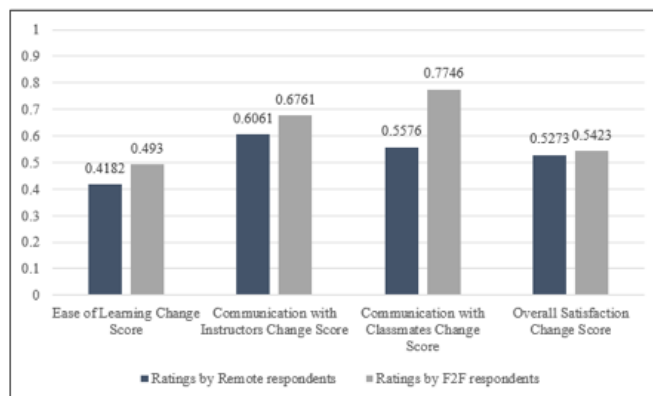


Figure 4. Change Scores Current method of instruction rating – Pre-COVID method rating by respondent group

No significant differences existed by respondent group

student preferences may be a function of the broader University environment associated with the F2F vs. REMOTE models. Students who preferred attending class in person, with classmates, while living and recreating on campus, may have been biased in the direction of providing a more positive rating of the F2F model as it allowed the other activities to occur.

Overall, an examination of distance scores showed no difference in the magnitude of change in ratings by REMOTE vs. F2F students. In other words, while F2F respondents reported more favorable preferences for Pre-COVID instruction, the change in ratings to the current semester were statistically the same as changes in REMOTE respondent ratings.

We found the gender differences in reports of computer problems and internet connectivity to be of some concern and will follow up with more studies on that particular question.

Figures 5 and 6 are interesting as observations, but that is all that they can be at this point. Overall, the actual live F2F attendance appeared to be low, endorsing anecdotal reports by instructors. The suggestion from them, however, remains: Because students basically in large measure stopped attending the face-to-face meetings in the F2F treatment, one interpretation may be that the students in the F2F model *voted* for the REMOTE model with their feet. Or, while students may like the *option* of attending class F2F, they did not appear to utilize it. Either way, this observation should be followed up on with further research, as the interpretation of findings on student ratings of instruction could be implicated. Regarding the absence of significant correlations between self-reported attendance and ratings on the dimensions of ease of learning, communication with peers, and overall satisfaction - a correlation is necessary for a causal relationship. This implies that something other than the F2F dimensions of learning that we assessed was responsible for the ratings. There could be other dimensions of learning that we did not assess, or it could

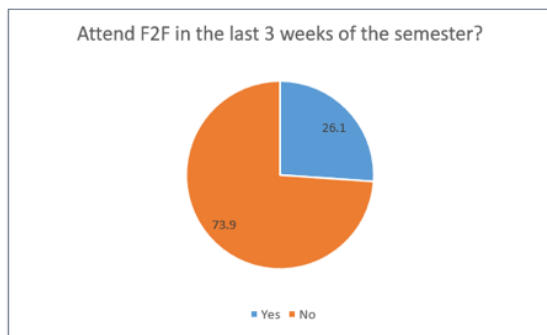


Figure 5. Percent of F2F students self-reporting class attendance during the last 3 weeks of the semester

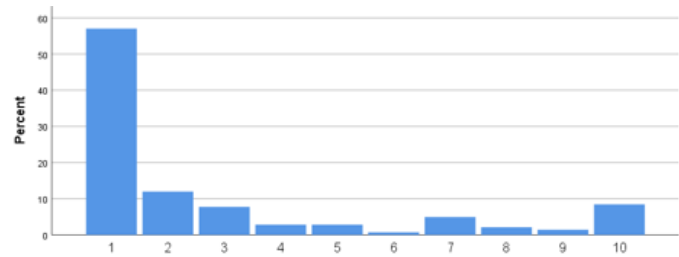


Figure 6. Distribution of responses: Percent of students self-reporting attendance in the F2F class  
1 = almost none; 10 = almost all

also bolster the earlier-mentioned hypothesis that students who attended **F2F**, with classmates, were biased in their assessments. It may, in fact, be these other factors (presence in the University environment) that were responsible for the ratings of **F2F** learning dimensions. Further research is needed.

## VII. CONCLUSION

Research reported here is motivated by the large numbers of surveys about student perceptions of face-to-face instruction *versus* online instruction following the first COVID semester, spring semester 2020. More specifically, the tendency of many of the student preference surveys to juxtapose the pre-COVID typical learning environment against online learning that was largely cobbled together over little more than a week as the U.S locked down in March 2020 may have biased the resulting conclusions from such surveys. The conclusion that many school officials had related (that students prefer face-to-face instruction) should be examined.

Our conclusions for our well-focused study are different. We see little difference in practical terms between the **F2F** instructional model and the **REMOTE** instructional model on the dimensions of learning in terms of student preferences. Although not definitive, the indirect evidence we noted is that engineering students in a 120 seat studio instructional space voted with their feet in favor of the **REMOTE** model. This may be the best indication that students found the flexibility and effectiveness of the **REMOTE** model to fit them.

Our larger message is that a nosology should be sought to help sharpen our descriptions of educational models, particularly internet-based models. If the STEM education community developed such an organization of well-formed instructional types. Educational research could then proceed to answer questions about the efficacy and efficiency of specific instructional models under varying contexts. This community effort could be pivotal as we emerge from the COVID experience to inform policy decisions on the use of remote forms of education.

The COVID experience has been horrific and hopefully never to be repeated. But it also is a catalyst for change. In the business world, the COVID experience has pointed the way towards a business environment that could include much more at-home work, much less business travel, and increasingly sophisticated computer environments that will support that

trend. Likewise, the experience with distance education on a mass level has taught parents and students alike that distance education is possible. We are hesitant to predict where that fact will lead in higher education. But, we are confident that changes in higher education are upon us.

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