

# **ANALYZING THE EFFECTS OF COVID-19 ONLINE INSTRUCTION ON INSTRUCTOR EFFECTIVENESS AND LEARNING OUTCOMES**

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## **ABSTRACT**

In March 2020, COVID-19 forced college campuses to close and pivot to offering classes in an online format. For nearly two years, students learned in these alternative modes of instruction. This study analyzes ten years' worth of instructional data from a California business school to determine the effects of online instruction on quality of instruction. The results of this analysis show that online instructional modes were strongly correlated with lower instructor effectiveness, lower student engagement, and lower instructional rigor. These findings have implications for the future of online instruction in higher education.

## **INTRODUCTION**

Online learning is not a new trend in higher education. According to data from the National Center for Education Statistics (NCES), enrollment in online courses and programs increased by 29% between 2012 to 2018. In 2018, 79% of colleges offered some form of online learning, ranging from single courses to exclusively online degree programs, and approximately 35% of all students in postsecondary institutions enrolled in some form of distance education. Face-to-face instruction was still the predominant delivery mode, especially for public and private not-for-profit postsecondary institutions (NCES Blog, 2021).

This changed in March 2020, when the COVID-19 pandemic forced colleges to close and quickly pivot to offering classes in an online format. In Fall 2020, 75% of all undergraduate students were enrolled in at least one online course and 44% of undergraduate students were exclusively enrolled in online courses. While some campuses returned to in-person instruction by Fall 2021, approximately 60% of students nationwide were still taking some form of online courses (NCES Fast Facts, 2021).

As we now move into the “post-pandemic” era, the future of online learning is in question. While both faculty and students may have found online courses to offer more flexibility (Almahasees et al., 2021, Garris and Fleck, 2022), there are also concerns about the quality of instruction and level of student engagement in the online environment (Goyal et al., 2022, Lemay et al., 2021).

The purpose of this study is to critically examine the efficacy of online instruction through analysis of ten years' worth of data from a business school in California. The findings herein provide valuable insight for higher education administrators when making decisions about offering online courses and programs.

## LITERATURE REVIEW

### **Pre-Pandemic Online Learning**

Research on online learning prior to 2020 focuses on student success in online courses compared to face-to-face courses. The findings vary widely by study; some researchers find students to be more successful in online courses (Bennett et al., 2011, Wilson and Allen, 2011), where others find students to be less successful, especially when considering student demographic and academic characteristics (Bettinger and Loeb, 2017, Vella et al., 2016). A US Department of Education meta-analysis of 99 studies comparing online and face-to-face instruction published between 1996 and 2008 on online learning concluded that students in online courses performed better than students in face-to-face courses (Means et al., 2009). However, the researchers noted that many of the studies included in the meta-analysis had small sample sizes and results were not generalizable across institutions or student populations.

Research on pre-pandemic online learning also examines the student experience in online courses. Whereas studies on student success used objective measures such as GPA and course completion rate (Bennett et al., 2011, Wilson and Allen, 2011, Bettinger and Loeb, 2017, Vella 2016, Wilson 2011), studies that analyzed student experience used more subjective measures. Fedynich, Bradley, and Bradley (2015) examined student perceptions of online instruction by surveying graduate students in online courses across disciplines. Their overall findings were that students had a positive experience with online courses and attributed their satisfaction primarily to the role of the instructor in designing and facilitating online instruction. While this study provided insight on how instructors and institutions can improve the online learning experiences of students, the study was limited in that the students voluntarily completed the survey and there was no comparison of student experience in face-to-face courses.

In another study, Lowenthal, Bauer, and Chen (2015) analyzed student evaluations of teaching and compared the responses between online and face-to-face courses. Their findings showed that students rated the quality of instruction and the overall course experience higher in face-to-face courses than online courses. The researchers note that while the results were statistically significant, the much smaller number of online courses in comparison to face-to-face courses made the results not ‘practically significant’. The present study also uses student evaluations of teaching as an indicator of quality of instruction, and has a much larger sample size of over 6,000 courses over a ten-year period.

### **Pivot to Online Learning During COVID-19 Pandemic**

In Spring 2020, college campuses across the nation closed due to the COVID-19 pandemic and pivoted to offering face-to-face courses online. According to the 2019–20 National Postsecondary Student Aid Study, 84% of students nationwide experienced at least one of their courses transition from in-person to online during this period (Cameron et al., 2021).

Several studies in online learning during the COVID-19 pandemic administered surveys to students to assess their experience with the sudden transition to online course formats (Almahasees et al., 2021, Garris and Fleck, 2022, Goyal et al, 2022, Lemay et al., 2021, Means et al., 2020). In most cases, students expressed some form of dissatisfaction with the sudden transition to online learning during the pandemic (Almahasees et al., 2021, Garris and Fleck, 2022, Goyal et al., 2022, Means et al., 2020). In one study,

students indicated that the transition to online was successful, but they also had increased stress levels and other challenges related to well-being (Lemay et al., 2021).

Several of these studies were again limited by small sample size at a single institution (Almahasees et al., 2021, Chen et al., 2022, Goyal et al., 2022, Lemay et al., 2021). Garris and Fleck (2022) had a larger sample size of 435 students from 16 institutions nationwide. Students in this study indicated a decrease in quality of their courses that transitioned from face-to-face to online. In another nationwide study (Means et. al, 2020), researchers from Digital Promise and Langer Research Associates administered a survey to over 1000 students about their experiences with the transition to online learning during the COVID-19 pandemic. 40% of respondents in this study rated low levels of satisfaction with the move to online and 42% rated low levels of satisfaction with their overall learning.

While these studies provide valuable insight about students' perceptions of the transition to online learning during the COVID-19 pandemic, the results are more indicative of the abrupt transition to the online format rather than an evaluation of the quality of instruction in online courses generally. Students were surveyed during or immediately after the transition in Spring 2020, and there were no comparisons to data collected pre-pandemic. The present study measures quality of instruction through student evaluations of teaching data from Fall 2012 through Spring 2022, allowing for comparisons pre-, during, and post-COVID.

### **Post-Pandemic Online Learning**

Empirical studies on the directions of online learning in a post-COVID era are limited. The term post-COVID itself is controversial for some, as the coronavirus continues to be present in the population, even though the severity of the virus appears to have abated. With regard to modes of instruction at universities, most campuses have restored some level of in-person instruction since Spring 2020; however, the restoration of on-campus activities has been gradual and has varied across institutions. While campuses continue to restore more on-campus activities and services, the number of online and hybrid options is generally significantly greater than prior to Spring 2020. Traditional in-person options also have higher technological content (e.g., adopting e-texts, using campus learning management systems, etc.).

This study analyzed data from a business school in California that has both undergraduate and graduate programs in five departments: Accounting, Finance, Information Systems, Management, and Marketing. This study aims to answer the following research questions:

1. Is there a statistically significant difference in quality of instruction when comparing face-to-face, online, and hybrid instruction modes?
2. Is there a statistically significant difference in learning outcomes when comparing face-to-face, online, and hybrid instruction modes?

## METHODS AND DATA

### Dataset

The data spans 20 semesters from Fall 2012 through Spring 2022 and includes information from the class schedule (course subject, days and times offered, enrollment figures, instruction mode, location, etc.), data from student evaluations of teaching and average GPA for each course. There are three types of instruction modes for courses, which are defined below:

- **Face-to-Face:** The course is held in-person at a location on campus on specific days and times.
- **Hybrid:** The course is held both in-person at a location on campus and online. The course must meet in-person at least four times in a semester to be considered hybrid. Beyond that, the instructor determines how many meetings are held in-person or online, which lends to a lot of variation in course delivery. The students may only meet in-person for exams, which means that all content is delivered in an online format. Additionally, the online component of the course may be held either synchronously on Zoom or asynchronously where students complete coursework on their own time.
- **Online:** The course is held completely online. Some courses are held completely asynchronously where students complete coursework on their own time; however, the vast majority of online courses in this sample are held synchronously via Zoom.

Prior to Spring 2020, the vast majority of courses were offered in a face-to-face instruction mode. Due to COVID-19, courses in the Spring 2020 term were moved to emergency online instruction. Fall 2020 and Spring 2021 were also completely online to comply with local and state health guidelines. In Fall 2021, face-to-face instruction resumed. Table 1 shows the breakdown of the number of course section offered by instruction mode and term in this dataset.

**TABLE 1: Number of Courses by Instruction Mode and Term**

**TABLE 1**  
Number of Courses by Instruction Mode and Term

<i>Term</i>	<i>Face-to-Face</i>	<i>Hybrid</i>	<i>Online</i>	<i>Total</i>
Fall 2012	237	0	2	239
Spring 2013	243	0	2	245
Fall 2013	243	0	3	245
Spring 2014	250	1	3	254
Fall 2014	269	2	3	274
Spring 2015	280	1	5	286
Fall 2015	288	5	6	299
Spring 2016	298	4	6	308
Fall 2016	322	5	6	333
Spring 2017	327	4	5	336
Fall 2017	329	6	6	341
Spring 2018	329	5	7	341
Fall 2018	319	7	5	331
Spring 2019	328	8	4	340
Fall 2019	329	11	9	349

Spring 2020	0	0	362	362
Fall 2020	0	0	391	391
Spring 2021	0	0	405	405
Fall 2021	82	86	232	400
Spring 2022	291	19	69	379
<b>Total (% of Total)</b>	<b>4764 (73.8%)</b>	<b>164 (2.5%)</b>	<b>1531 (23.7%)</b>	<b>6459</b>

## Student Perceptions of Teaching

We used the Student Perceptions of Teaching (SPOT) faculty evaluation tool as an indicator of quality of instruction. Students complete an evaluation of each course they take at the end of the semester. The SPOT evaluations include questions about the course content, instructor, and course materials, and have both Likert scale measures (from 1 – “Strongly Disagree” to 6 – “Strongly Agree”) and open-ended questions. We used the average score on the item “The instructor was effective at teaching the subject matter in this course” in the analysis of this study.

Prior to Spring 2020, SPOT evaluations were administered on paper for in-person courses. Starting in the Spring 2020 semester, SPOT was administered online. Completion of the SPOT is voluntary, and faculty are not allowed to directly proctor student evaluations. Consequently, the number of students who complete the evaluation varies. We include the rate of participation of SPOT as a control.

In addition, we control for class size with a categorical variable that separates smaller seminar classes (<30 students), traditional classes (~30 students) and large sections ( $\geq 80$  students). We include a binary control for graduate vs undergraduate classes and a binary faculty measure distinguishing between tenured/tenure-track faculty and lecturers. We include a dummy variable for departments to distinguish discipline-specific content. We include a categorical measure for time of day (morning, afternoon, evening), and for meetings per week (asynchronous, once, twice).

## Analysis

This study incorporates two dependent variables in four separate models. The SPOT score and the course GPA are treated as separate dependent variables. Historically, these two items have been highly correlated, and in our sample, they are correlated (0.2). Evaluation scores are negative or ‘left’ skewed, so we use a generalized linear model with robust standard errors. GPA is normally distributed.

In our first iteration of analysis, we noted that two of our controls, class meeting time and number of sessions per week, are highly correlated. Evening sections always meet once a week, and daytime sections nearly always meet twice a week. Thus, we omit meetings per week from our subsequent analysis. After this adjustment, we also ran traditional OLS models to check variance inflation factors and found little evidence of multicollinearity (our highest VIF was 1.71, with a mean VIF of 1.3).

Generally, California had strict lockdown procedures relative to other states in the nation, and the CSU system remained in an online mode longer than universities in other states. CSU campuses still maintained preventative restrictions such as masking and vaccination requirements into the 2022 calendar year. The shift to return to campus can best be seen in the numbers of course sections in each term during the 2021-2022 academic year, as listed below.

**TABLE 2: Number of Courses by Instruction Mode in ‘Post Pandemic Period’**

**TABLE 2**  
Number of Courses by Instruction Mode in ‘Post-Pandemic’ Period (2021-2022 Academic Year)

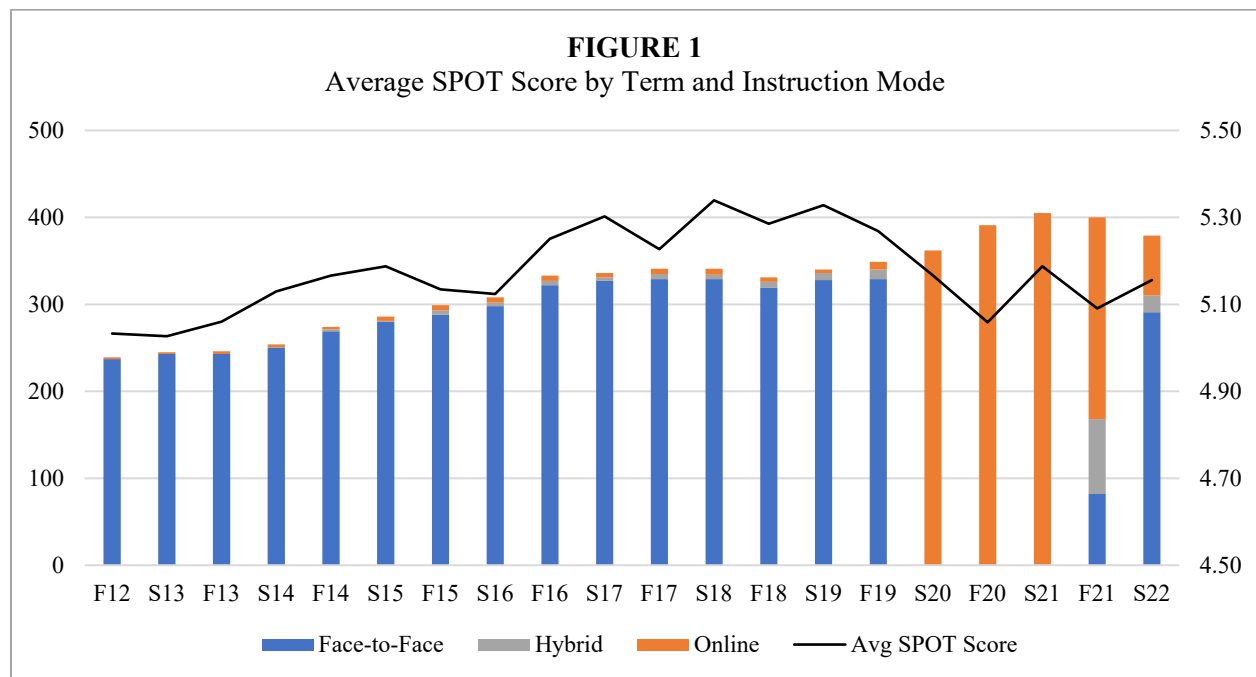
<i>Term</i>	<i>Face-to-Face</i>	<i>Hybrid</i>	<i>Online</i>	<i>Total</i>
Fall 2021	82	86	232	400
Spring 2022	291	19	69	379
Total (% of Total)	373 (47.9%)	105 (13.5%)	301 (38.6%)	779

Over the year, we see a roughly balanced number of online and in-person sections, which makes this year a rough approximation of a balanced simultaneous comparison between modes of instruction. Thus, we present two models of SPOT and GPA data. The first model includes all data across the college over a 20-semester period, where the first 15 semesters represent the ‘traditional’ pre-pandemic period, the next three semesters represent the lockdown online period, and the last two represent the ‘post-pandemic’ return to campus. The second model is a subset of the first, focusing only on the ‘post-pandemic’ period, where students had choices in which class mode to enroll in and faculty had some say in which mode they would prefer to teach.

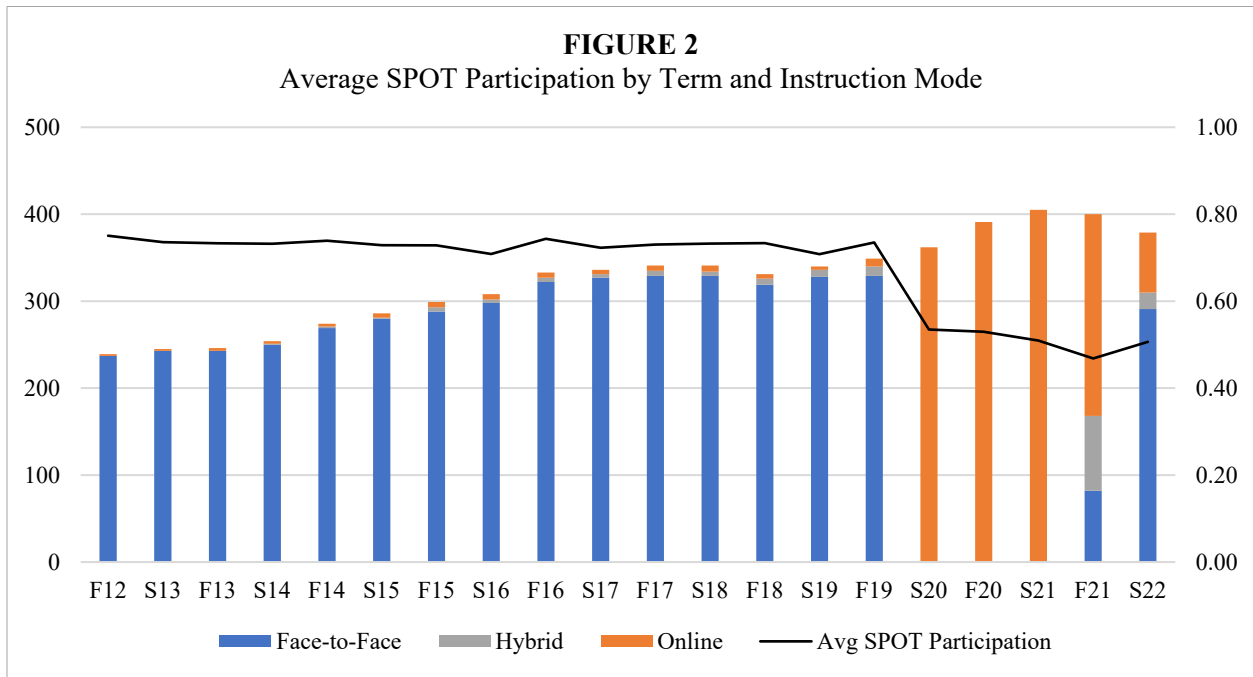
**RESULTS**

The following figures provide illustrations of the effects of the transition to online instruction on SPOT score, SPOT rate of participation, and average course GPA.

**FIGURE 1: Average SPOT Score by Term and Instruction Mode**



**FIGURE 2: Average SPOT Participation by Term and Instruction Mode**



**FIGURE 3: Average GPA by Term and Instruction Mode**

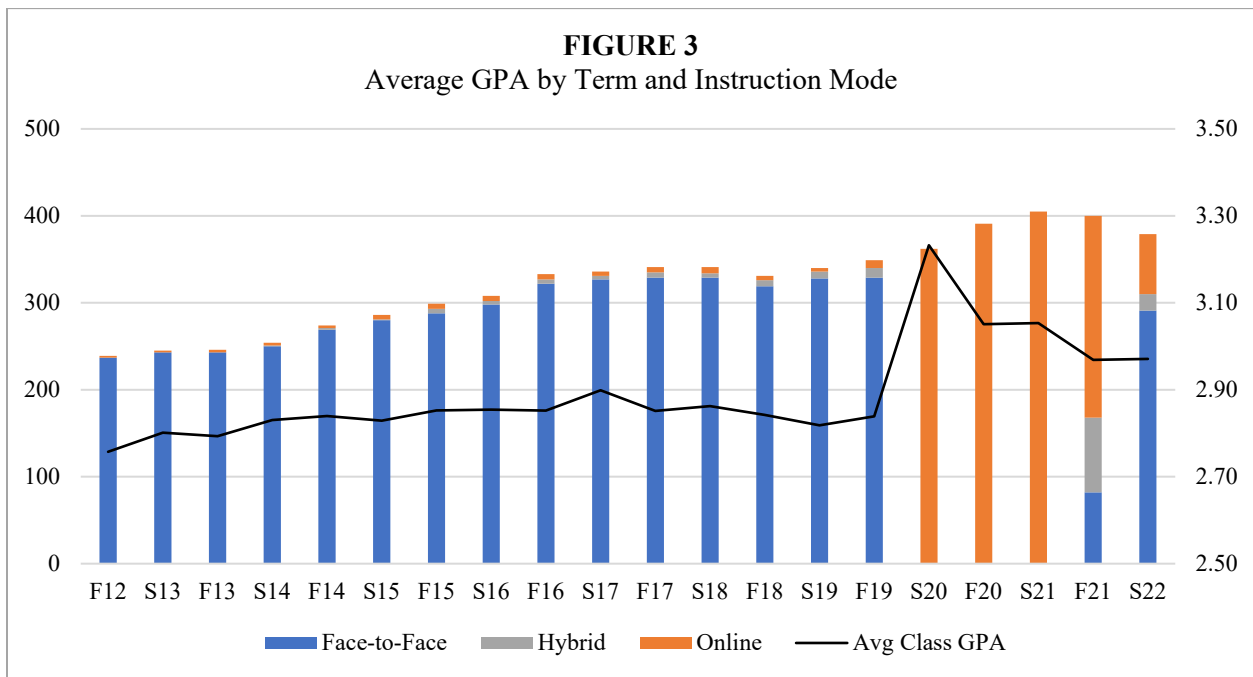


Table 3 provides descriptive statistics and correlations. We include both Meetings Per Week and Meeting Time in this table but omit Meetings Per Week from estimation.

**TABLE 3: Descriptive Statistics and Correlations**

**TABLE 3**  
Descriptive Statistics and Correlations

<i>Variable</i>	<i>Mean</i>	<i>S.D.</i>	1	2	3	4	5	6	7	8	9	10
1 SPOT	5.18	0.63										
2 GPA	2.89	0.44	0.20									
3 Mode	0.51	0.86	-0.06	0.25								
4 Participation	0.67	0.20	0.16	0.07	-0.45							
5 Graduate Level	0.09	0.29	-0.02	0.49	0.10	0.10						
6 Term	10.63	5.63	0.03	0.19	0.60	-0.45	0.05					
7 Faculty (T/TT, Lect)	0.58	0.49	0.05	0.15	0.09	-0.07	-0.01	0.11				
8 Meeting Time	1.10	0.83	-0.04	0.22	0.01	0.04	0.31	-0.01	0.09			
9 Department	3.55	2.04	-0.09	0.02	0.00	0.06	-0.04	0.02	0.06	0.07		
10 Class Size	0.76	0.64	-0.08	-0.31	-0.01	-0.23	-0.30	0.00	-0.19	-0.16	-0.14	
11 Meetings Per Week	1.58	0.51	0.05	-0.26	-0.09	0.01	-0.38	-0.02	-0.08	-0.70	-0.05	0.17

*N* = 5960

Table 4 provides the estimations of the effects of mode of instruction on student perceptions of teaching and course GPAs. The majority of our variables are categorical or binary, such that a significant difference represents a difference between two or more groups. The baseline mode of instruction is traditional in-person instruction in the undergraduate program in a morning session.

**TABLE 4: Effect of Mode of Instruction on Teaching Effectiveness and GPA**

**TABLE 4**  
Effect of Mode of Instruction on Teaching Effectiveness and GPA

	Full Sample (20 semester terms)						Post-COVID (2021-2022 Academic Year)					
	GPA		SPOT		GPA		SPOT		GPA		SPOT	
	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>
Mode												
Hybrid	0.088	0.032	**	-0.093	0.059		-0.005	0.051		-0.216	0.094	*
Online	0.208	0.015	***	-0.107	0.026	***	-0.019	0.038		-0.215	0.070	**
Participation	0.314	0.031	***	0.634	0.054	***	0.137	0.088		0.660	0.158	***
Graduate Level	0.008	0.001	***	0.018	0.002	***	0.684	0.040	***	0.033	0.085	
Term	0.606	0.015	***	-0.106	0.033	**	-0.024	0.035		-0.084	0.066	
Faculty (T/TT, Lect)	0.096	0.010	***	0.069	0.017	***	0.096	0.031	**	0.074	0.058	
Meeting Time	0.034	0.006	***	-0.024	0.010	**	0.066	0.019	**	0.057	0.035	
Department	0.000	0.002		-0.035	0.004	***	0.013	0.007	*	-0.026	0.013	*
Class Size	-0.083	0.008	***	-0.057	0.015	***	-0.023	0.025		0.009	0.047	
_cons	2.457	0.031	***	4.753	0.054	***	3.078	0.656	***	6.451	1.241	***
N	5,960		5,960		756		756					
psuedo LL	-2294.99		-5526.45		-340.623		-802.869					
AIC	0.77		1.86		0.927575		2.150446					



BIC                    -50968.6                    -49493                    -4835.53                    -4574.28

\*\*\* p < .001, \*\* p<0.01, \* p< 0.05

Our principal question of interest was whether mode of instruction caused a significant difference in learning outcomes and quality. We proxy these with measures of SPOT and GPA, which are routinely used as comparable of comparison of teaching effectiveness conditioned by relative course difficulty. We test these relationships in a full model spanning 20 semesters and in a post-COVID model examining the last year of available instructional data. In the full sample, we find significant and positive effect of alternative modes of instruction on course GPAs. We find a significant negative effect of SPOT scores in online modes, but not in hybrid models. In the post-COVID year, we find the significant negative effect of alternative modes of instruction on SPOT scores persists, but the GPA differences do not. Generally, it appears that faculty are making attempts to make their online courses more robust while the courses continue to be less effective than in-person instruction.

Supplementary analysis revealed a full mediation effect concerning our independent variable of interest. We note that participation from students declined during the COVID-era, and generally remains lower in non-traditional courses. Following Barron and Kenny (1986), we examined how participation in the SPOT process influenced outcomes. The effect of mode of instruction on SPOT is fully mediated by class participation.

**TABLE 5: Mediation Effect of Participation on Mode of Instruction**

**TABLE 5**  
Mediation Effect of Participation on Mode of Instruction

<i>Step 1: SPOT ← Mode</i>		<i>Coef.</i>	<i>S.E.</i>	
Mode				
	Hybrid	-0.09	0.05	+
	Online	-0.09	0.02	***
Constant		5.21	0.01	***
R2			0.00	***
F(2, 5957)			12.98	
<i>Step 2: Participation ← Mode</i>		<i>Coef.</i>	<i>S.E.</i>	
Mode				
	Hybrid	-0.15	0.01	***
	Online	-0.21	0.01	***
Constant		0.72	0.00	***
R2			0.21	***
F(2, 5957)			779.76	
<i>Step 3: SPOT ← Participation ← Mode</i>		<i>Coef.</i>	<i>S.E.</i>	
Mode				
	Hybrid	-0.02	0.05	
	Online	0.01	0.02	
Participation		0.51	0.05	***
Constant		4.84	0.03	***
R2			0.02	***
F(3, 5956)			49.87	

*N* = 5960

\*\*\* p < .001, \*\* p<0.01, \* p< 0.05

## DISCUSSION

### Summary of Findings

Our findings largely support the conclusion that students react significantly more negatively to online courses than to traditional courses. Students rate online sections of courses lower than in-person sections, even when online sections have significantly higher GPAs. This effect occurs over time through the COVID-period and persists in the most recent balanced data after the COVID restrictions were largely lifted. Students do not prefer online instruction and assess these classes as less effective than in-person instruction.

One key relationship in our data is the connection between student engagement and perception of effectiveness. The SPOT instrument is made available to students online (regardless of course mode) for three weeks at the end of the term. Faculty are directed to remind students to complete the SPOT instrument and recommended to provide in-class time for students to do so. Our findings show that student engagement in SPOT assessment fully mediates the effect of mode of instruction. In our data, online courses had a notable drop in student SPOT participation rates. It appears that students are notably less engaged, and those that are engaged are more frustrated, in online courses.

Our findings are less consistent with hybrid instruction modes. While hybrid courses have a significant negative SPOT effect post-COVID, they do not have a significant effect in the full sample. This is most likely because the sample of hybrid courses is dramatically smaller than that of traditional and online courses (see [Table 1](#)). Another possible reason for this is that there is a great deal of variation in instructional delivery within the category of hybrid courses. Some hybrid courses only met for assessments (two to three times per term) while others met weekly.

The practical implication for these findings relates to faculty who are going through assessment processes. One common practice in assessing faculty is to review their overall effectiveness score, in comparison to department and college averages. Teaching in alternative modes may put faculty at a disadvantage by consistently providing them with lower performance scores.

### Limitations and Future Directions

This study did not include analysis of any student-level data such as demographics or academic profile, and therefore did not address how learning outcomes or perceptions of teaching might vary among different groups of students. Additionally, this study did not address differences in instruction such as an instructor's experience or training in online course design, or instructional pedagogy.

The body of research on the quality of online instruction in a post-COVID era is still in its infancy. While this study found that quality of instruction decreased in online courses, future research may examine how quality varies by instructor training and experience teaching online.

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