

A STUDY OF THE EFFECTIVENESS OF REMOTE INSTRUCTION FROM STUDENTS' PERSPECTIVES

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ABSTRACT

The global coronavirus disease 2019 (COVID-19) pandemic has resulted in countless changes to daily life. This has included the move to emergency remote learning for PreK-12 and post-secondary education around the world. The impact of COVID-19 resulted in extensive periods of emergency remote teaching and learning, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms. As many institutions adjusted their class teaching methods, our institution transformed to remote instruction two weeks after Spring break in March, 2020. To better understand the impact of remote instruction on the learning process and to investigate factors that may affect the effectiveness of remote instruction and serve as input to instructional process improvement in the future, we conducted surveys after the first week of remote instruction and during the last week of the Spring semester. The surveys set out to measure students' perceived satisfaction and effectiveness of remote learning experience and to capture the underlying factors that contribute to the perceived satisfaction levels. The results show students overwhelmingly prefer being in a physical classroom. Of all the factors examined, less interaction during live lecture, more distraction, less engaged in virtual classroom, and less effective in understanding lectures in remote instruction contribute the most to students' perceived satisfaction in the remote instruction setting.

Keywords: remote instruction, online learning, online education

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has resulted in countless changes to daily life, with schools being closed, travel being upended and sporting events being canceled or postponed. Numerous districts and schools across the country suddenly find themselves in the position of having to teach students at home due to changes introduced by the national response to COVID-19 (Hartshorne, Baumgartner, Kaplan-Rakowski, Mouza, and Ferdig, 2020; Hodges, Moore, Lockee, Trust, and Bond, 2020). Due to the threat of COVID-19, colleges and universities are facing decisions about how to continue teaching and learning while keeping their faculty, staff, and students safe from a public health emergency that is moving fast and not well understood. Many institutions have opted to cancel all face-to-face (f2f) classes, including labs and other learning experiences, and have mandated that faculty move their courses online to help prevent the spread of the virus that causes COVID-19 (Hodges et al., 2020). While every school has its share of a constituent of early adopters who have been flipping classes and using blended learning for years, well-planned online learning experiences are different from courses offered online in response to a crisis or disaster. Colleges and universities working to maintain instruction during the COVID-19 pandemic should understand those differences when evaluating this emergency remote teaching. What millions of students around the world are experiencing right now on Zoom and other conferencing platforms is not online learning, but rather remote learning (Craig, 2020). Online learning takes place entirely online. Courseware may include video lectures and self-paced modules to guide students through their learning experiences. Online learning is flexible; it is the form of internet-based learning process that allows students to work on their education in their own time (Archambault, Kennedy, Shelton, Dalal, McAllister, & Huyett, 2016). However, online education faces some challenges. Some students struggle with the lack of structure, leaving their work to the last minute and then scrambling to finish it on time (Augar, Naomi, Raitman, Ruth and Zhou, Wanlei, 2004, Calvert, 2001). Other barriers of online learning include lack of face-to-face interaction with their instructor, social interaction, academic

skills, technical skills, and learner motivation (Bacow, Bowen, Guthrie, Lack, and Long, 2012; Muilenburg & Berg, 2005).

Although it also takes place online, remote learning is different from online learning. Remote learning strives to recreate the classroom environment as students learn through the computer. This means the student logs in to the virtual classroom environment at scheduled times to participate in virtual classroom learning activities, using video conferencing tools such as Zoom, Microsoft Team, and Blackboard Collaborate. The coronavirus pandemic has caused a rise in emergency remote learning. As colleges and universities have had to shut their doors to protect their faculty and students, they sent students home to study remotely. Many of these schools continue to have their faculty teach at the pre-determined times, but students participate in live online lectures rather than sitting in the classroom. Remote learning mirrors the traditional classroom activities, including live lecture, synchronous Q/A sessions, interaction during live lecture sessions, and office hours. Similar to online learning, all activities in remote instruction happen online, but it doesn't provide the flexibility of online learning. On the other hand, even though remote learning tries to mirror the traditional classroom, it cannot bring all of the benefits of f2f classroom settings to online live lectures through video conferencing.

As many institutions adjusted their class teaching methods, our institution transformed to remote instruction two weeks after Spring break in March, 2020. During this pandemic, we had no option but to transform all f2f classroom lectures to remote instruction using video conferencing. How ready are the students for this sudden change? In a research summary higher education's readiness to move teaching and learning online (Brooks and Graeiek, 2020), nearly all students prefer at least some face-to-face contact, with a majority preferring that their classes be mostly face-to-face. In another survey (Lederman, 2020), students overwhelmingly prefer being in a physical classroom, rating it on average as a four on a five-point scale. To better understand the impact of remote instruction on the learning process and to investigate factors that may affect the effectiveness of remote instruction and improve instructional processes in the future, we conducted surveys after the first week of remote instruction (Phase I) and during the last week of the Spring semester (Phase II). The surveys set out to measure students' perceived satisfaction and effectiveness of their remote learning experience and to capture the underlying factors that contribute to their perceived satisfaction levels.

RESEARCH METHODOLOGY

Data were collected from a convenience sample of students after Spring break in 2020. As aforementioned, we adopted remote instruction after the second week of Spring semester. To examine whether students' perceived learning effectiveness with the new learning experience would change over the time period, data were collected after the first week of remote instruction and again during the last week of Spring semester. Emails were sent to all students through the Office of Marketing and Communications. In hope of receiving more responses, upon our research team's request, some faculty sent separate emails to encourage their students to participate in the survey. The survey form (Appendix) includes thirty questions. Survey questions were mixed with multiple choices, free responses and a five-point Likert scale ranging from Strongly Disagree to Strongly Agree. The last question in the survey form was used to measure the students' overall satisfaction with remote instruction. Therefore, bivariate correlations between the underlying dimensions and the user's satisfaction could be calculated and used to assess the marginal importance of each dimension with respect to impact on remote learning experiences. Students were provided a free-response question that allowed them to give reasons of their preference of teaching formats and to share their experiences with the remote instruction from various perspectives including engagement, effectiveness of live lectures, and advantages and disadvantages of remote instruction. Those free response questions were also used to help get insight into students' experiences with remote instruction during the COVID-19 pandemic.

The study participants were enrolled in undergraduate and graduate courses across various disciplines. Participation was entirely voluntary and no course marks were awarded for completing the survey. The study employed students enrolled in Spring 2020 at a regional university in the South-Central region. In the first phase data collection, there were 458 responses, which represent 10% of students who were enrolled in Spring 2020 and participated in at least one remote instruction class. During the second phase of data collection, there were 428 responses, which is also about a 10% response rate. We eliminated incomplete responses, where respondents answered only a portion of the survey questions. We also discarded responses from respondents who took less than 3 minutes to complete thirty

questions. After eliminating the invalid responses, there were 224 valid responses from the first phase, and 239 from the second phase. Table 1 summarizes participant distribution according to classification.

Table 1: Student Distribution According to Classification

Classification	First Phase		Second Phase	
	n	%	n	%
Freshman	41	18.30	46	19.25
Sophomore	43	19.20	60	25.10
Junior	55	24.55	63	26.36
Senior	84	37.50	63	26.36
Graduate	1	0.45	6	2.51
Others	0	0.00	1	0.42

Frequency analyses were performed on every item for descriptive purposes and cross-tabulations were created for every item with perceived satisfaction of remote instruction. The cross-tabulations were visually inspected and chi-square analyses were run on selected comparisons. Chi-square tests with p-values of less than or equal to 0.05 were considered significant. As a follow-up discussion, we analyzed students' responses to the free-response questions on their preference of teaching format. Based on text-mining of those free response questions, we identified and presented some of the most important factors that may affect students' perceived satisfaction with remote instruction.

RESULTS

At first, we examined whether the students' perceived satisfaction had changed over the remote instruction period. A t-test was conducted to determine the difference between two means-satisfactions for phase I and phase II.

Table 2: t-Test: Two-Sample Assuming Equal Variances

	<i>Phase I</i>	<i>Phase II</i>
Mean	2.44	2.16
Variance	1.52	1.56
Observations	224	239
Pooled Variance	1.54	
Hypothesized Mean Difference	0	
df	461	
t Stat	2.38	
P(T<=t) one-tail	0.01	
t Critical one-tail	1.65	
P(T<=t) two-tail	0.02	
t Critical two-tail	1.96	

Using $\alpha = 0.05$ level of significance, the p-value is far less than $\alpha = 0.05$; so there is sufficient evidence to conclude that students' satisfaction on the remote instruction changed over the remote instruction period. Since higher scores represent more satisfaction with the remote learning experience, we concluded that students' perceived satisfaction was lower during this period.

In the above two sample t-test, we assume the same variance for both phase I and phase II. To verify the assumption, F-test was performed. The results are presented in Table 3.

Table 3: F-Test Two-Sample for Variances

	<i>Phase I</i>	<i>Phase II</i>
Mean	2.44	2.16
Variance	1.52	1.56
Observations	224	239
df	223	238
F	0.98	
P(F<=f) one-tail	0.43	
F Critical one-tail	0.80	

Using $\alpha= 0.05$ level of significance and p-value of 0.43, in combination with the sample size, we can conclude with high confidence that our assumption in the t-test is reasonable.

Tables 4 and 5 show the correlations among selected dimensions in the survey. The Tables do not include those dimensions for which correlation coefficients with others are within the range of [-0.1, 0.1].

Table 4: Correlation Coefficients Among Selected Dimensions-Phase I

	<i>Format</i>	<i>Focused</i>	<i>Text.</i>	<i>Und.</i>	<i>Engaged</i>	<i>Time</i>	<i>Better Grade</i>	<i>Eff.</i>	<i>Rec. Vid.</i>	<i>Rep. Vid.</i>	<i>Int.</i>	<i>Sat.</i>
Format	1.0											
Focused	0.4	1.0										
Texting	0.2	0.2	1.0									
Understanding	0.4	0.5	0.2	1.0								
Engaged	0.6	0.4	0.1	0.5	1.0							
Time Spent on Homework	0.1	0.1	0.2	0.2	0.2	1.0						
Better Grade	0.4	0.3	0.2	0.4	0.4	0.3	1.0					
Effectiveness	0.2	0.2	0.2	0.3	0.1	0.2	0.2	1.0				
Record Video	-0.1	-0.1	-0.1	-0.1	-0.2	0.0	-0.1	0.0	1.0			
Replay Video	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.2	-0.4	1.0		
Interaction	0.2	0.2	0.0	0.1	0.2	0.1	0.1	0.2	0.0	0.1	1.0	
Satisfaction	0.3	0.3	0.2	0.4	0.4	0.2	0.4	0.2	-0.2	0.3	0.3	1.0

Table 5: Correlation Coefficients Among Selected Dimensions-Phase II

	<i>Format</i>	<i>Focused</i>	<i>Text.</i>	<i>Und.</i>	<i>Engaged</i>	<i>Time</i>	<i>Better Grade</i>	<i>Eff.</i>	<i>Rec. Vid.</i>	<i>Rep. Vid.</i>	<i>Int.</i>	<i>Sat.</i>
Format	1.0											
Focused	0.5	1.0										
Texting	0.3	0.3	1.0									
Understanding	0.3	0.6	0.3	1.0								
Engaged	0.5	0.6	0.4	0.5	1.0							
Time Spent on Homework	0.1	0.2	0.2	0.1	0.1	1.0						
Better Grade	0.3	0.4	0.4	0.4	0.5	0.2	1.0					
Effectiveness	0.2	0.3	0.2	0.3	0.4	0.2	0.3	1.0				
Record Video	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	0.0	1.0			
Replay Video	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	-0.4	1.0		
Interaction	0.1	0.2	0.0	0.2	0.1	0.0	0.1	0.3	0.0	0.1	1.0	
Satisfaction	0.3	0.2	0.2	0.3	0.3	0.0	0.3	0.1	-0.4	0.2	0.3	1.0

As shown in Table 6, the majority of the students preferred the f2f teaching format. Even though the perceived satisfaction over the period had changed significantly, the percentage of teaching format preference remained almost at the same level for both phase I and phase II data collection periods.

Table 6: Teaching Format Preference

	n	%
F2F	165	69.04
Online	22	9.21
Remote	9	3.77
Hybrid	39	16.32
na*	4	1.67

*Answered no difference

Figures 1 and 2 show teaching format preferences by classifications. Regardless of classification, f2f was the preferred teaching format.

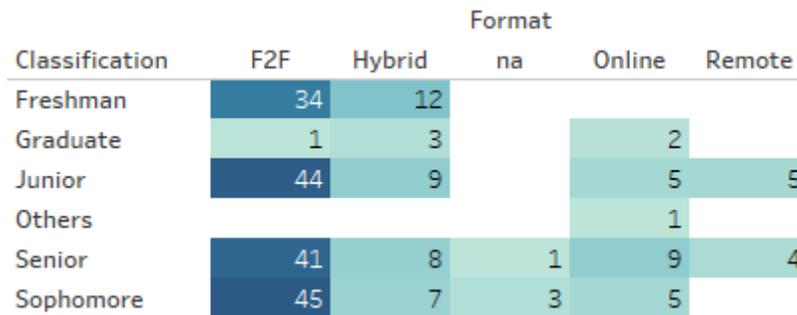


Figure 1: Teaching Format Preference by Classifications

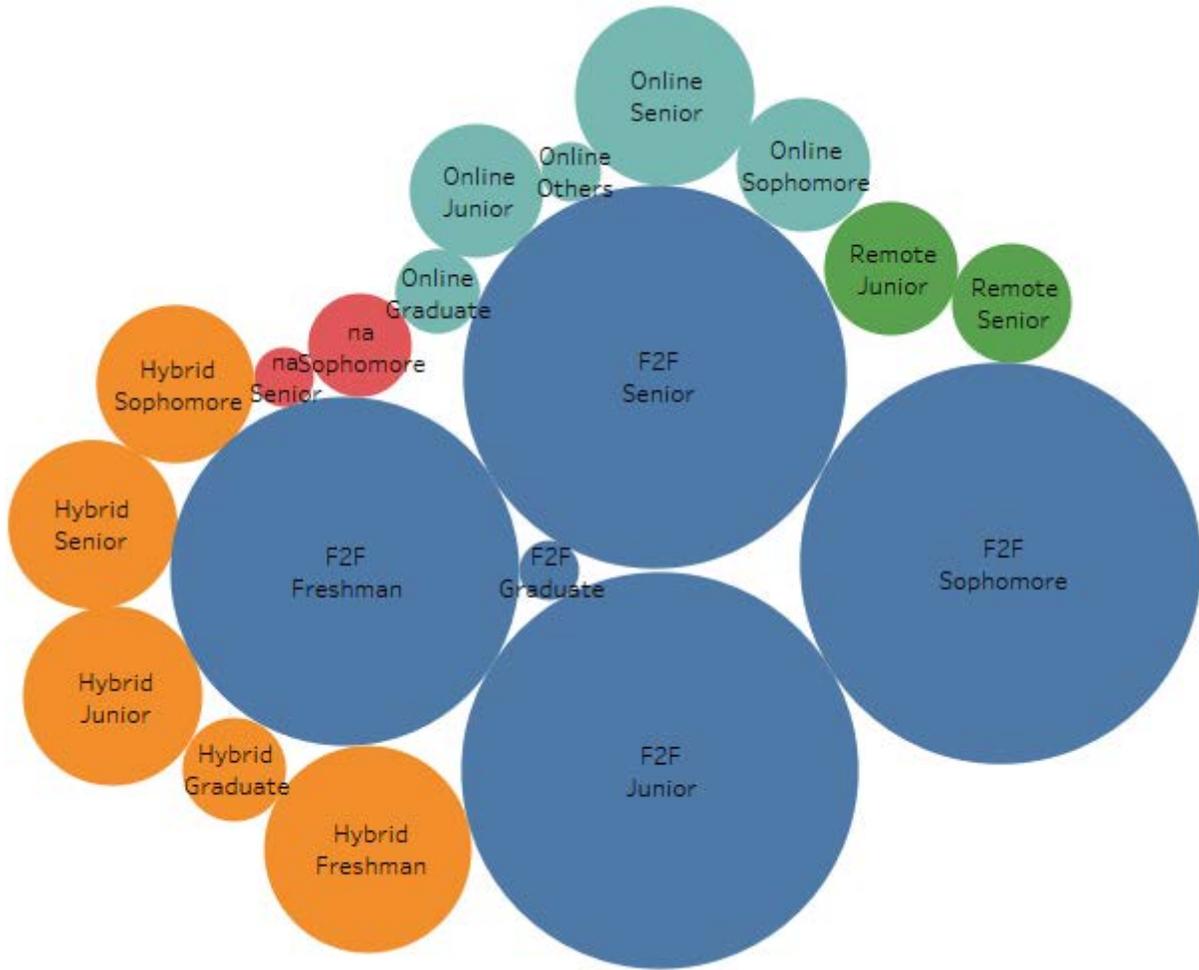


Figure 2: Teaching Format Preference by Classifications

Students were asked to indicate which teaching format (f2f or remote instruction) tend to allow them to be more focused. As shown in Table 7, about 85% responded that they tend to be more focused in the f2f teaching environment.

Table 7: Teaching Format and Focus

Teaching Format	n	%
F2F	202	84.52
Remote	7	2.93
No Difference	22	9.21
Not Sure	8	3.35

Students tend to be more engaged by taking notes, asking questions, etc., when they attended F2F and hybrid in-person classes. Table 8 shows that about 86% (combined F2F and hybrid) of students claimed they were more engaged in the in-person teaching environment.

Table 8: Engagement

	n	%
F2F	187	78.24
Online	6	2.51
Remote	8	3.35
Hybrid	20	8.37
No Difference	18	7.53

As shown in Table 9, students were much more likely to check messages, text, email, etc., when they attended remote instruction classes.

Table 9: Check for Messages, Text, Email, etc.

	n	%
F2F	48	20.08
Remote	99	41.42
Didn't	16	6.69
No Difference	36	15.06
Didn't Affect My Learning Outcome	35	14.64
Not Sure	5	2.09

As shown in Table 10, 82.43% of students claimed they have a better understanding of lectures when they attended F2F classes. Only 3.35% of students reported they learned better in a remote instruction setting.

Table 10: Compare Comprehension in Different Teaching Format

	n	%
F2F	197	82.43
Remote	8	3.35
No Difference	27	11.30
Not Sure	7	2.93

To understand the impact of remote instruction on the understanding of lectures, students were asked to compare time spent on homework assignments. As shown in Table 11, more students claimed they tend to spend less time on homework assignments in a remote instruction setting. These findings are in contrast with data presented in Tables 9 and 10. As shown in Tables 9 and 10, students seemed to get more distracted, be less engaged and less effective in understanding lectures in remote instruction, but they claimed they spent less time completing homework assignments. We are not sure whether this is due to less amount of homework or easier assignments in the remote instruction setting. We will add questions to the questionnaire in the future to allow us to investigate the discrepancy.

Table 11: Comparison of Time Spent on Homework

	n	%
F2F	63	26.36
Remote	84	35.15
No Difference	83	34.73
Not Sure	9	3.77

Table 12 shows grade expectation in different teaching formats. Not surprisingly, the majority of the students indicated that they expect to get better grades in f2f settings. The combined percentage of f2f and hybrid represents 66%, which is significantly higher than all others combined.

Table 12: Grade Expectation

	n	%
F2F	134	56.07
Online	23	9.62
Remote	8	3.35
Hybrid	24	10.04
No Difference	39	16.32
Not Sure	11	4.60

In terms of effectiveness of learning outcomes, most students (81.17%) responded they learned better in a F2F teaching format. As shown in Table 13, this result is consistent with the data present in Tables 9 and 10.

Table 13: Comparison of Effectiveness of Learning Outcome

	n	%
Remote	13	5.44
F2F	194	81.17
No Significant Difference	21	8.79
Not Sure	11	4.60

Remote lectures rely on a stable Internet connection. In our survey, all participants had high-speed internet connection; so, lack of Internet access was not an issue. The correlation coefficients also show that internet connections were not highly correlated with any aspects of remote instruction. So those factors are not presented here.

The remote instructions were delivered through either Zoom or Blackboard Collaborate tools, and lectures could be recorded. Based on the data, more than 50% of students (138 out of 239) responded that their professors recorded live lectures and made them available for replay. Students were also asked how often they used recorded live lectures to facilitate their learning during the remote instruction period. Tables 14 and 15 show how the recorded videos were used.

Table 14: How Many Times to Replay Videos

	n	%
None	58	24.27
1 Time	50	20.92
2 Times	39	16.32
3 Times	10	4.18
More than 3 Times	9	3.77
Not Application, no videos are available	73	30.54

Table 15: Helpfulness of Recorded Videos

	n	%
Yes, it significantly improved my understanding.	36	15.06
Yes, but the improvement is marginal (not that much).	53	22.18
No, I don't think the recorded videos are that much helpful.	33	13.81
Not helpful at all.	17	7.11
I don't need the videos because I already understood the materials well.	23	9.62
Not applicable, no videos are made available.	77	32.22

To further investigate how the availability of recorded videos affect perceived satisfaction with remote instruction, interaction between satisfaction and availability of videos are presented in Table 16 and Figure 3. Table 16 and Figure 3 show that recorded videos affect students' perceived satisfaction more when they were not available than when they were recorded and made available.

Table 16: Interaction Between Satisfaction and Availability of Video

Video Recorded and Available	Satisfaction (%)				
	SD	D	N	A	SA
Yes	42.75	15.94	22.46	13.04	5.80
No	42.57	26.73	17.82	6.93	5.94

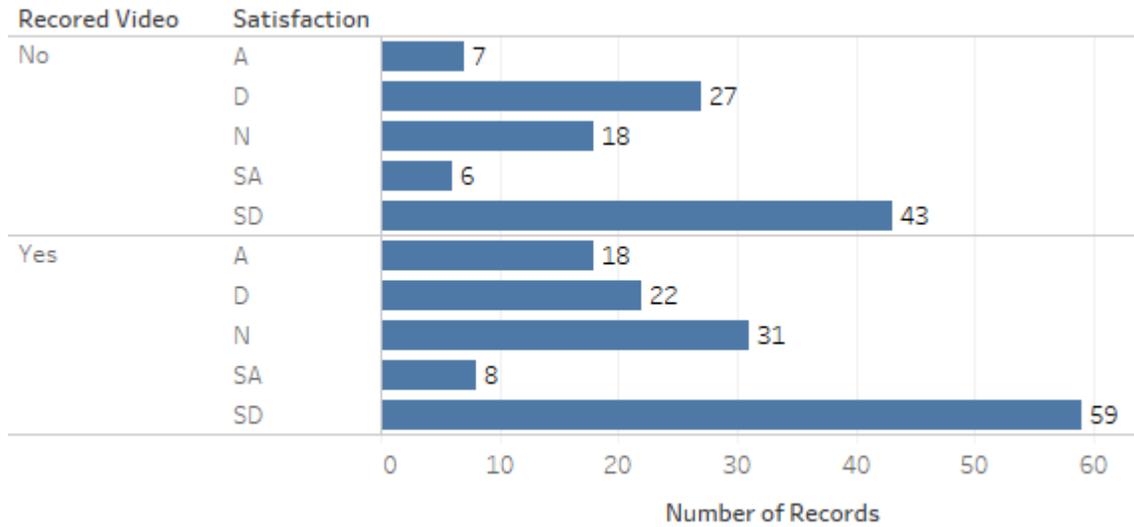


Figure 3: Interaction Between Satisfaction and Availability of Video

As shown in Table 17, most students claimed that the interaction reduced significantly in the remote instruction environment.

Table 17: Compare Interaction in Remote to that in F2F

	n	%
Reduced significantly	144	60.25
About the same	49	20.50
Increased significantly	17	7.11
Not sure	17	7.11
Not applicable	12	5.02

Table 18 shows the overall satisfaction with remote instruction. There were only about 16% of students satisfied with remote instruction, while the majority were unhappy when we transformed F2F to remote instruction. As presented in previous Tables, distraction, less effectiveness in understanding lectures, and less interaction in remote teaching format may contribute to the dissatisfaction of students in remote teaching settings.

Table 18: Satisfaction with Remote Instruction		
	n	%
I strongly disagree with this statement (SD)	102	42.68
I disagree with this statement (D)	49	20.50
I neither agree nor disagree with this statement (N)	49	20.50
I agree with this statement (A)	25	10.46
I strongly agree with this statement (SA)	14	5.86

To investigate how the perceived interaction affected students' satisfaction with the remote instruction, a two-dimensional horizontal bar chart is presented in Figure 4.

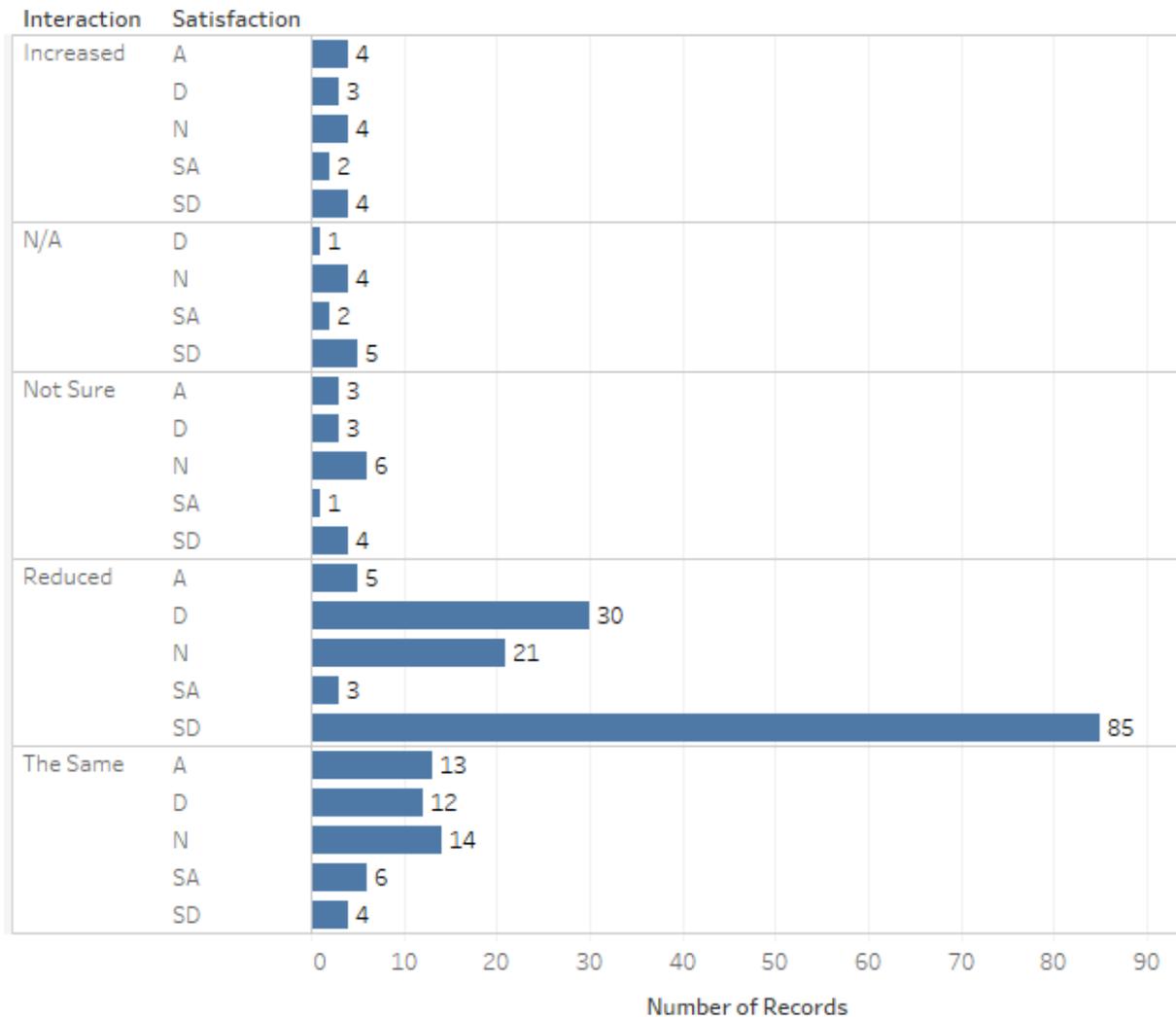


Figure 4: Interaction Between Perceived Interaction In Remote Instruction And Satisfaction

It can be observed in Figure 4 that perceived interaction during remote instruction significantly affected satisfaction with remote instruction. When students' perceived interactions increased, their satisfaction levels were not significantly affected. However, satisfaction was drastically affected when there was a reduction in interaction.

Further investigation is necessary to determine what other factors may affect students' satisfaction. This should help us improve remote instruction in the future.

SUMMARY

The coronavirus has resulted in countless changes to the teaching and learning process in such a short period of time. Numerous districts and schools across the country suddenly find themselves in the position of having to teach students at home due to changes introduced by the national response to COVID-19. Remote instruction has a long way to go in terms of incorporating principles of instructional design to improve student outcomes. We can learn from the experiences of students who are suddenly endeavoring to learn in a synchronous online mode. As many institutions adjusted their class teaching methods, our institution transformed to remote instruction two weeks after Spring break in March, 2020. To better understand the impact of remote instruction on the learning process and to investigate factors that may affect the effectiveness of remote instruction and serve as input to instructional process improvement in the future, we conducted surveys after the first week of remote instruction and during the last week of the Spring semester. The surveys set out to measure students' perceived satisfaction and effectiveness of remote learning experience and to capture the underlying factors that contribute to the perceived satisfaction levels. The results showed students overwhelmingly prefer being in a physical classroom. Of all the factors examined, less interaction during live lecture, more distraction, less engaged in virtual classroom, and less effective in understanding lectures in remote instruction contribute the most to students' perceived satisfaction in the remote instruction setting. However, the results revealed that the impact of perceived interaction on satisfaction depends on their perceived interaction. When students' perceived interactions increased, their satisfaction levels were not significantly affected; but satisfaction was drastically affected when there is reduction in perceived interaction. Some results are contradictory. As shown in Table 11, more students claimed they tend to spend less time on homework assignments in the remote instruction setting. These findings are in contrast with the data presented in Tables 9 and 10. As shown in Tables 9 and 10, students claimed they seem to get more distracted, be less engaged and be less effective in understanding lectures in remote instruction, but they also indicated they spent less time completing homework assignments. We are not sure whether this is due to less amount of homework or easier assignments in the remote instruction setting. These questions will be added to a future questionnaire to allow us to investigate the discrepancy. Further investigation is necessary to determine what other factors may affect students' satisfaction; this should help us improve remote instruction in the future.

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APPENDIX: SURVEY QUESTIONS

(Full list of survey questions is available upon request)

1. Which college/school are you from? What is your major?
2. What is your classification?
3. If you have options, which of the following teaching formats would you prefer?
4. You made your choice of the teaching format preference in the previous question (face to face classroom, online, remote instruction, or hybrid). Explain why you prefer that teaching format?
5. You tend to be more focused in which of the following teaching formats.
6. I check for messages, texting, email, etc., on my phone MORE OFTEN when I take _____?
7. I understand instructor's lectures better in _____.
8. I tend to be more engaged (asking questions, taking notes, etc.) in the learning process in which of the following teaching formats.
9. I tend to spend less time on homework assignments when I take _____.
10. I expect to get better grades when I take _____.
11. Compared to face-to-face classroom, how do you feel about the effectiveness of the learning outcome of remote instructions (better understanding of contents, engagement, etc.).
12. How do you access the Internet to participate in live lectures?
13. What kind of Internet connection do you have at home?
14. What tools do your professors use to deliver virtual lectures (live lectures delivered through Internet)?
15. Do you prefer to turn on video (camera to show your face) when you participate on the remote instruction?
16. Do you prefer the instructor to turn on video (camera to show his/her face) during live lectures?
17. I can find a quiet place so I won't be distracted when I participate in remote instruction.
18. I was frequently distracted when participating in live lectures (remote instructions) because ____.
19. When participating in live lectures (through remote instruction),_____.
20. What do you like the most about remote instruction?
21. What do you DISLIKE the most about remote instruction?
22. I have high speed and stable Internet connection when I participate in the remote instructions.
23. About the quality of audio and video during live lecture.
24. Did your instructors record live lectures and make them available for replay?
25. If recorded videos are available, how many times did you replay them?
26. Did the recorded videos help you understand the materials better?
27. Compared to face-to-face classroom, the amount of interaction between you and professors in remote instructions.

28. Please indicate the extent to which you agree or disagree with the following statement: I am very satisfied with remote Instructions.
29. Please share your experiences with the remote instruction during the most recent weeks. You may focus on: a) engagement; b) effectiveness of live lectures; c) advantages and disadvantages of the remote instruction; d) any suggestions
30. What is the first thing you are going to do when the pandemic is over? Please limit your response to a few words, no more than 100 characters.