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The impact of covid-19 on education: a three-phase study on students' attitudes toward transformative modes of instruction

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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 synchronous teaching and learning, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms. Many institutions adjusted their traditional instructional format to synchronous online instruction in early Spring, 2020 semester. To better understand the impact of transformative modes of instructions on the learning process and to investigate factors that may affect the effectiveness of synchronous online instruction and serve as input to instructional process improvements in the future, surveys were conducted in three phases: phase I: during the second and third week after all F2F courses were transformed to synchronous online instruction in March, 2020; phase II: during the last week of the Spring semester 2020; and phase III: in the middle of Spring, 2021 semester. The surveys set out to measure students' perceived satisfaction and effectiveness of synchronous learning experiences and to capture the underlying factors that contribute to the perceived satisfaction levels as they gained more experiences with the synchronous online learning process. The results show students overwhelmingly prefer being in a physical classroom when they first transformed to synchronous instruction mode in Spring, 2020. However, after one year's practice with the synchronous online instruction, almost all dimensions observed in this study have been changed significantly, including satisfaction with the synchronous online instruction, perceived grade, interaction, comprehension of learning contents, engagement and perceived learning outcomes.

Keywords: synchronous online instruction, impact of covid-19 on education, 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 found 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 faced 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 opted to cancel all face-to-face (f2f) classes, including labs and other learning experiences, and 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 synchronous online teaching. What millions of students around the world are experiencing right now on Zoom and other conferencing platforms is not online learning, but rather synchronous online 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, synchronous online learning is different from online learning. Synchronous online learning strives to re-create 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 synchronous online 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. Synchronous online learning mirrors the traditional classroom activities, including live lecture, synchronous Q/A sessions, interaction during live lecture sessions, and virtual office hours. Similar to online learning, all activities in synchronous online instruction happen online, but it doesn't provide the flexibility of online learning. On the other hand, even though synchronous online 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, the institution where the data were collected, transformed to synchronous online instruction two weeks after Spring break in March, 2020. During this pandemic, there was no option but to transform all f2f classroom lectures to remote instruction using video conferencing. How ready were the students for this sudden change? In a research summary of 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 synchronous online instruction on the learning process and to investigate factors that may affect the effectiveness of synchronous online instruction and improve instructional processes in the future, surveys were conducted after the second and third week of synchronous online instruction in March, 2020 (Phase I), during the last week of the Spring semester, in May, 2020 (Phase II), and at the end of Spring, 2021 (Phase III). The surveys set out to measure students' perceived satisfaction and effectiveness of their synchronous online 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 in a 4-year academic institution. To examine whether students' perceived learning effectiveness with the new learning experience would change over the time period, data were collected during three different phases: phase I-during the second and third week after all f2f classes were transformed to synchronous online instruction in March, 2020; phase II: during the last week of the Spring, 2020 semester, after students experienced synchronous online instructions for almost two months; and phase III: at the end of Spring, 2021 semester, after one year of transformation to synchronous online instruction. Emails were sent to all students through the Office of Marketing and Communications in the institution. In hope of receiving more responses, upon the research team's request, some faculty sent separate emails to encourage their students to participate in the survey. The survey form (Appendix) includes thirty-one 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 synchronous online 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 synchronous online learning experiences. Students were provided a free-response question that allowed them to give reasons of their preference of instructional modes and to share their experiences with synchronous online instruction from various perspectives including engagement, effectiveness of live lectures, and advantages and disadvantages of synchronous online instruction. The free response questions were also used to help get insight into students' experiences with synchronous online 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 at a regional 4-year university who participated in at least one online synchronous instruction class. In the first phase of data collection, there were 458 responses, which represent 10% of students who were enrolled in Spring, 2020. During the second phase of data collection, there were 428 responses, which is also about a 10% response rate. In the third phase, there were 343 responses. Incomplete responses where respondents answered only a portion of the survey questions were eliminated. Responses from participants who took less than 3 minutes to complete thirty questions were discarded. After eliminating the invalid responses, there were 224 valid responses from the first phase, 239 from the second phase, and 186 valid responses in the third phase. Table 1 summarizes participant distribution according to classification.

Table 1: Student Distribution According to Classification

	Phase I		Phase II		Phase III	
Classification	n	%	n	%	n	%
Freshman	41	18.30	46	19.25	33	17.74
Sophomore	43	19.20	60	25.10	49	26.34
Junior	55	24.55	63	26.36	43	23.12
Senior	84	37.50	63	26.36	40	21.51
Graduate	1	0.45	6	2.51	20	1075
Others	0	0.00	1	0.42	1	0.54

Frequency analyses were performed on every item for descriptive purposes and two dimensional line charts were used to display a trend of observed dimensions over three phases. ANOVA tests with p-values of less

than or equal to 0.05 were considered significant. As a follow-up discussion, students' responses to the free-response questions on their preference of teaching format were analyzed. Based on text-mining of those free response questions, some of the most important factors that may affect students' perceived satisfaction with transformative modes of instruction were identified and presented in Table 2.

Results

An examination of whether the students' perceived satisfaction had changed over the one year synchronous online instruction period is reported in Table 2. An ANOVA was conducted to determine the difference among three means-satisfactions for phase I, phase II and phase III.

Table 2: ANOVA: Satisfaction with Synchronous Online Instruction

Summary

Groups	*Count*	*Sum*	*Average*	*Variance*
Phase I	224	546	2.4375	1.52074
Phase II	239	517	2.16318	1.557294
Phase III	186	575	3.091398	1.802412

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	92.6726	2	46.3363	28.69348	1.15E-12	3.009668
Within Groups	1043.207	646	1.614872			
Total	1135.88	648				

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 transformative instruction modes changed over the one year COVID-19 pandemic period.

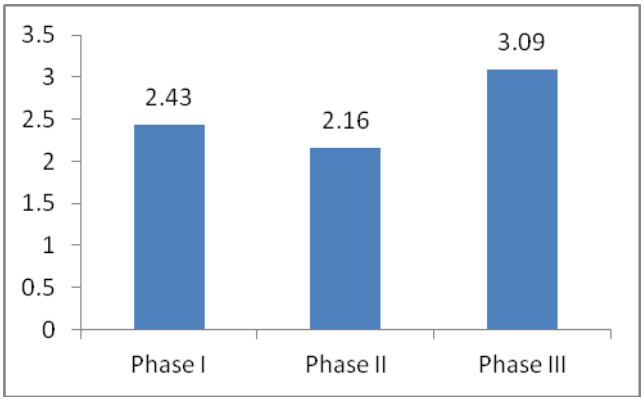

Figure 1: Mean of Satisfaction with Synchronous Online Instruction over Three Phases

As shown in Figure 1, the satisfaction with synchronous online has changed. Since higher scores represent more satisfaction with the synchronous online learning experience, it was concluded that students'

perceived satisfaction was improved significantly as they gained more experiences with the new instructional mode.

In the above ANOVA test, there was an assumption of homogeneity of variance for the three phases. To verify the assumption, an F-test was performed. The results are presented in Table 3.

Table 3: ANOVA F Test for Variance

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Phase I	224	241.875	1.079799	0.349545
Phase II	239	253.2803	1.05975	0.429504
Phase III	186	209.5591	1.126662	0.526183

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.480812	2	0.240406	0.559618	0.571704	3.009668
Within Groups	277.5146	646	0.429589			
Total	277.9954	648				

Using α= 0.05 level of significance and p=value of 0.57, there is no evidence of a significant difference among three variances. Therefore, it can be concluded with high confidence that the assumption in the ANOVA test is reasonable. In order to examine whether the satisfaction with synchronous online instruction was related to the number of years of college experiences, the satisfaction rate based on classifications was analyzed as shown in Figure 2. The percentages represented the percentage of students in each classification who indicated they were satisfied with the synchronous online instruction mode. Among the four classifications, senior students had the highest satisfaction rate across all three phases, and junior students had the second highest satisfaction rate. Sophomore students had the lowest satisfaction rate at phase II, but the rate increased significantly from 2% to 39% at phase III.

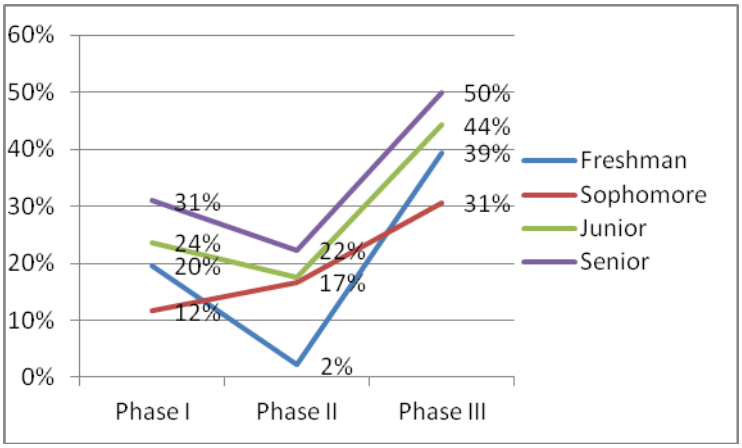

Figure 2: Satisfaction Rate of Each Classification Group

To further investigate which factors impact the most on satisfaction of the instructional mode changes over a one year period, correlations between selected dimensions and satisfaction for the three phases are summarized in Table 4. The Table includes only those dimensions whose correlation coefficients with satisfaction is 0.3 and above in at least one phase. Q22 is the overall satisfaction with synchronous instruction. A full list of the questions is available in Appendix A.

Since the correlation coefficients of overall satisfaction with all other dimensions are less than 0.3 during all three phases, the following discussions focused on those dimensions listed in Table 4 only.

Table 4: Correlation Coefficient with Satisfaction

		Q2	Q3	Q5	Q6	Q8	Q14	Q21
Phase I	Q22	0.29	0.28	0.37	0.37	0.42	-0.25	0.26
Phase II	Q22	0.27	0.24	0.32	0.33	0.30	-0.39	0.30
Phase III	Q22	0.30	0.44	0.44	0.35	0.23	-0.35	0.28

Figure 3 summarized instructional mode preference over a one year period after transforming to synchronous online instruction. As shown in Figure 3, the majority of students preferred the f2f teaching format. However, the percentage of students who preferred the synchronous online instructional mode increased significantly over the one year period. The percentage of students who preferred synchronous online instructions increased from about 4% to 18% after a one year experience with the transformative instructional mode. The result is consistent with the data displayed in Figure 1, where students' satisfaction with synchronous online instruction increased significantly after one year. Students' preferences on instructional modes remained unchanged during phase I and phase II. However, after one year's experience, the percentage of students who preferred f2f dropped from 69% to 37%, which counted for a 44.4% decrease, while the percentage for synchronous online increased by 350%. Preferences on the hybrid mode remained unchanged. Preferences on the online mode increased by 100%. It was concluded that students were used to the online mode after being intensively exposed to the online learning environment after the COVID-19 pandemic in Spring, 2020.

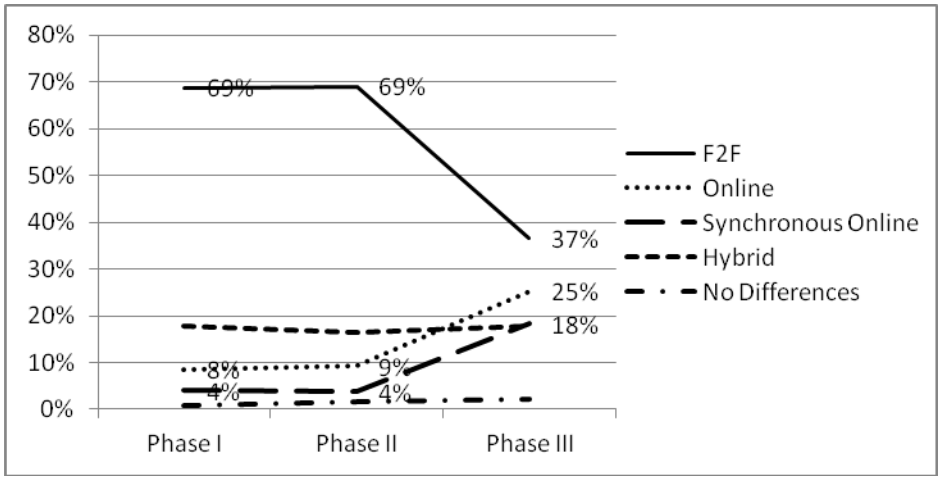

Figure 3: Instructional Mode Preference Changes over Three Phases

Students were asked to indicate under which instructional mode (f2f and synchronous online) they were more focused. As shown in Figure 4, most responded that they tend to be more focused in the f2f teaching environment. However, the number of students who reported they tended to be more focused in synchronous online instructions increased significantly.

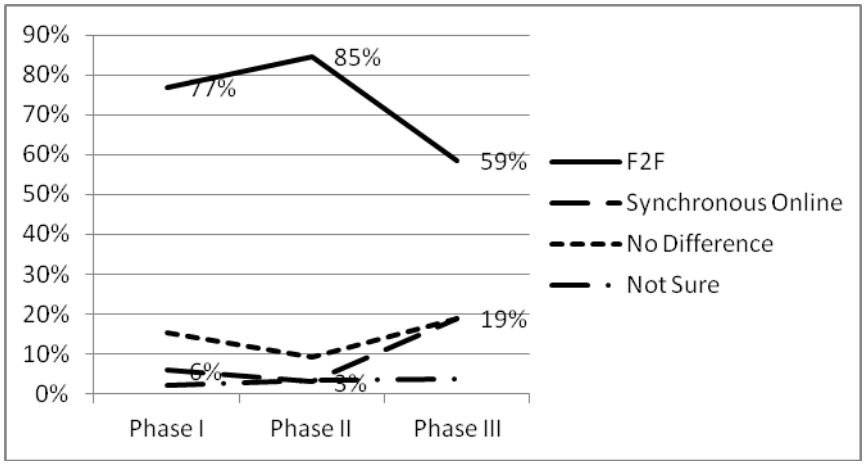

Figure 4: Instructional Modes Versus Focus

Figure 5 illustrated if instructional modes affected students' understanding of the course materials. Most students claimed that they had a better understanding of course content in f2f instructional modes. However, the number in the synchronous instructional mode increased significantly.

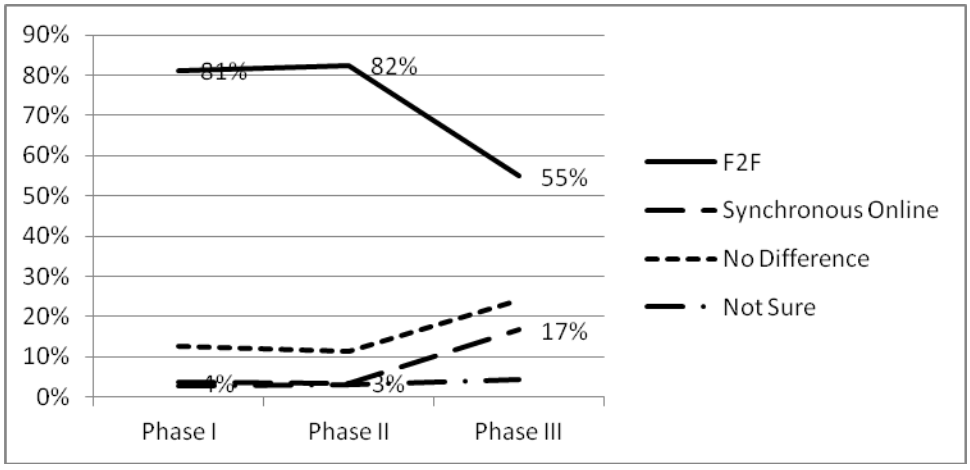

Figure 5: Comprehension and Instructional Mode

Students tend to be more engaged by taking notes, asking questions, etc., when they attended f2f and hybrid classes. Figure 6 shows that more than 80% (combined f2f and hybrid) of students claimed they were more engaged in the in-person teaching environment in phase I and phase II. The percentage was reduced to less than 60% (58% after combining both f2f and hybrid) after the one year experience with synchronous online instruction. The percentage for synchronous online increased from 3% to 14%, which is an increase by almost 400%.

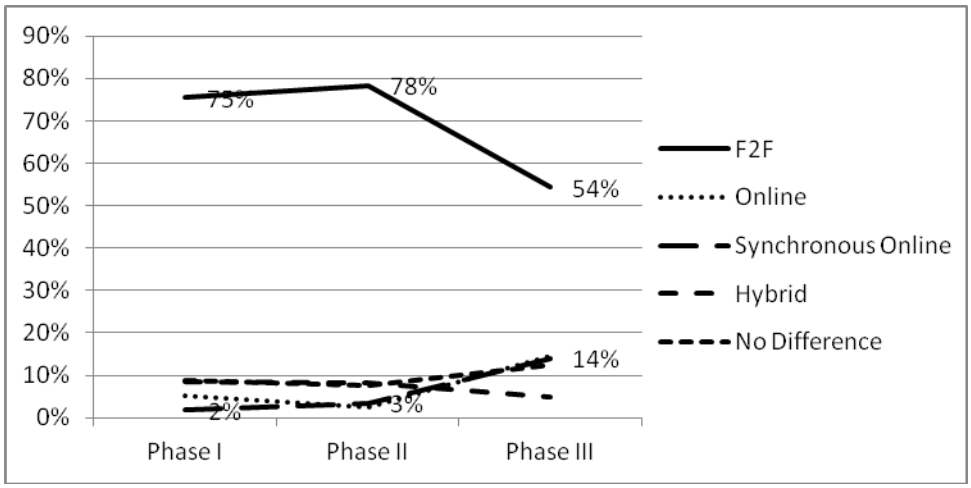

Figure 6: Engagement and Instructional Mode

Figure 7 shows grade expectations in different instructional modes. 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% in phase I and phase II, and 40% in phase III, which is significantly higher than all others combined. However, the percentage of students who expected a better grade in synchronous online tripled. After one year of exposure to the synchronous online instructional mode, the percentage of better grade expectation under both the f2f and hybrid modes reduced significantly. This implied that students had more confidence in the synchronous mode after their one year experience.

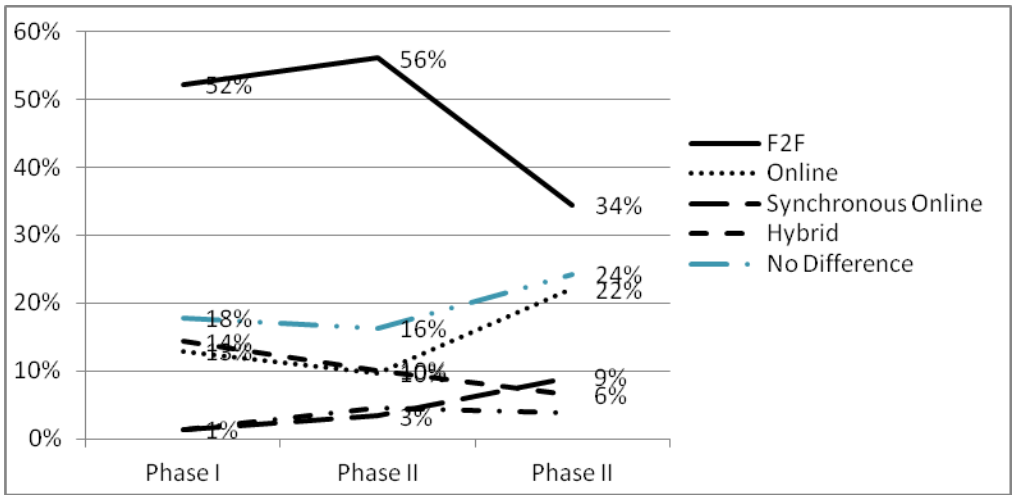

Figure 7: Grade Expectation

The synchronous online teaching mode was adversely affected by whether or not students could find a quiet place to participate. As previously shown in Table 4, the correlation coefficients between satisfaction with synchronous online mode and if they can find a quiet place are -0.25, -0.39, and -0.35, for phase I, phase II and phase III. Finding a quiet place to participate in synchronous online instruction was challenging for some students. As shown in Figure 8, across three phases, more than 40% of students reported that they could not always find a quiet place to participate in synchronous online instruction. Consequently, their performance and satisfaction were affected adversely.

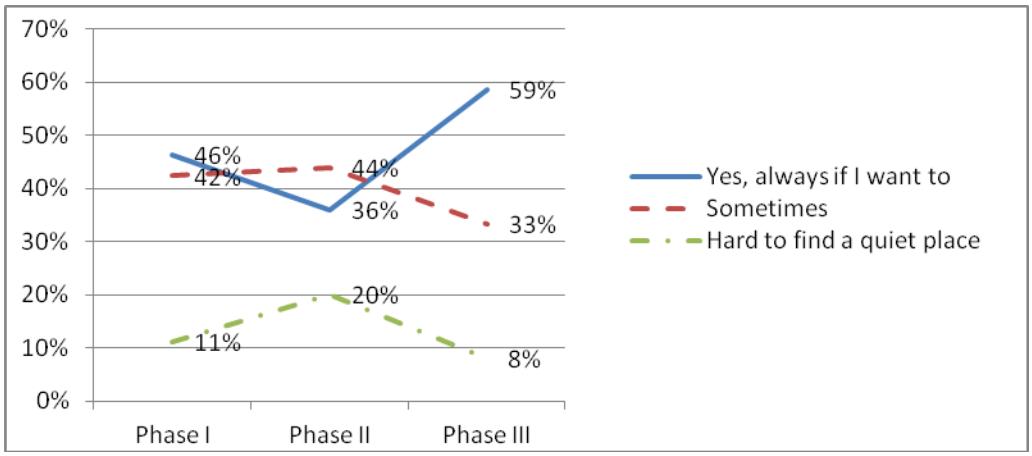

Figure 8: Find Quiet Place to Participate in Synchronous Online Instruction

Interaction is needed in the classroom activity. It helps the teaching and learning process run smoothly and it can improve learners' engagement, as well as learning outcomes. However, providing effective interaction in synchronous online instruction has been challenging. As shown in Figure 9, most students claimed that the interaction reduced significantly in the synchronous online instruction environment across the entire data collection period. However, the gap between reduced significantly and increased significantly was reduced dramatically over the three phases.

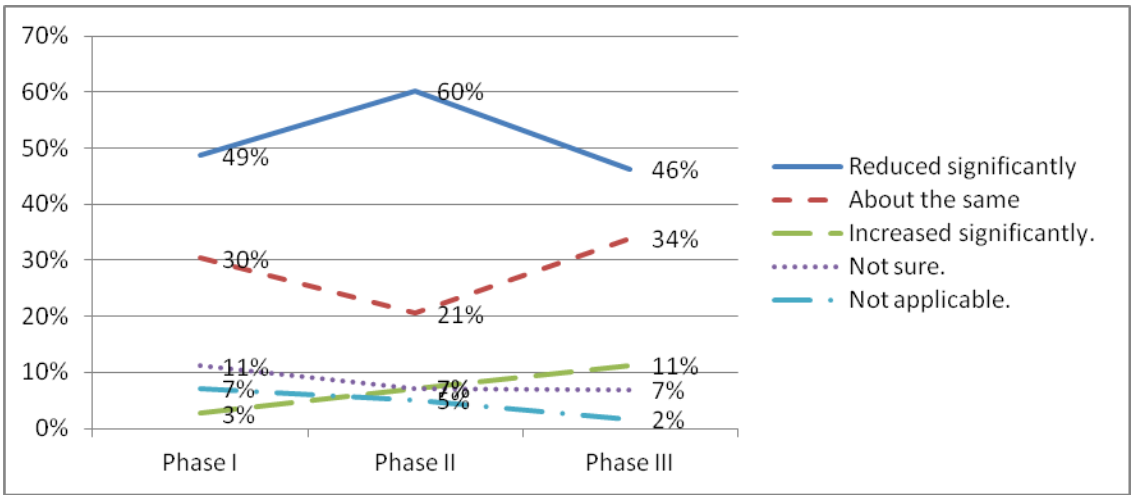

Figure 9: Compare Interaction in Synchronous Online to that in F2F

Figure 10 shows the overall satisfaction with synchronous online instruction over three data collection periods.

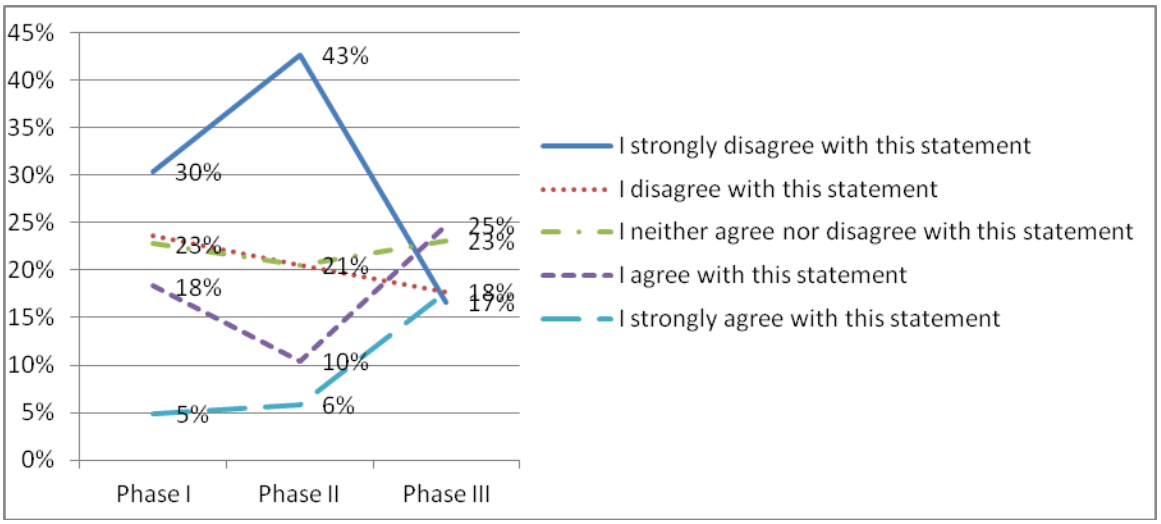

Figure 10: Satisfaction with Synchronous Online Instruction

Figure 11 shows the overall satisfaction after combining strongly disagree and disagree into the disagree group and agree and strongly agree into the agree group. There were only about 16% of students satisfied with synchronous online instruction in phase II (combined both agree and strongly agree categories), while the majority (63%-combined both disagree and strongly disagree categories) were unhappy when f2f was transformed to synchronous online mode during the Spring, 2020 phase II data collection period. However, as shown in Figure 11, after one year's experience with synchronous online mode, more students were satisfied with synchronous online instruction. As presented in previous Tables and Figures, distraction, effectiveness in understanding lectures, and interaction in synchronous online mode have been improved significantly over the data collection period. All of these factors may contribute to the improvement of satisfaction of students in synchronous online instructional settings.

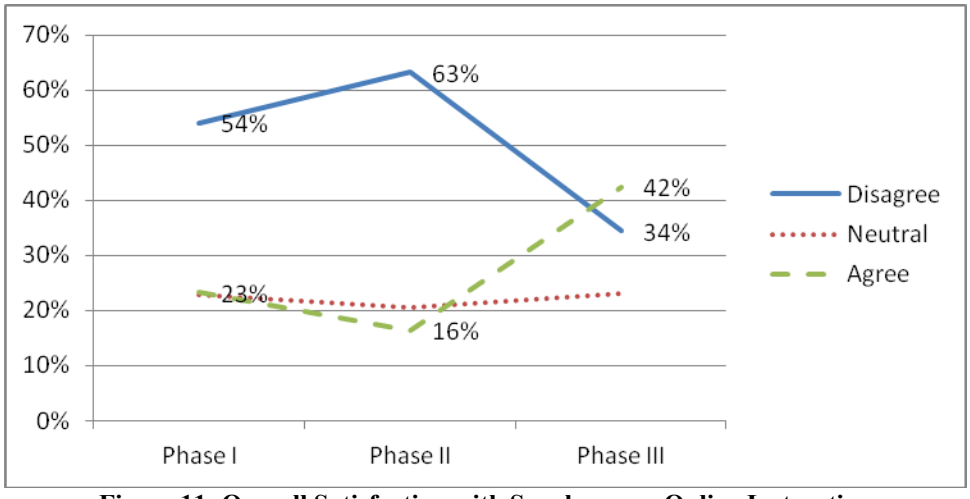

Figure 11: Overall Satisfaction with Synchronous Online Instruction

Text mining of open-ended questions (phase ii & phase iii)

In the following section, text mining analysis was performed on the data collected for open ended questions for phase II, in an effort to understand what are the underlying factors affecting students' satisfaction with the synchronous online mode. Three open-ended questions were designed to elicit from the students any pertinent information, which might not have been captured by other survey questions, to explain students' preferences and perceived satisfaction levels. The first question deals with students' preferences of instructional setting. The second and third questions invite the students to describe what they liked the most about synchronous online instruction and what they disliked the most (refer to survey questionnaire for details).

Analyses based on predefined phrases

In order to perform text data mining of students' responses to the instructional setting question, an application with java programming was developed that allowed predefined phrases to be entered and input text to be checked for similarity against the predefined phrases. The results of the text data mining are presented in Tables 5 through 7.

The top five reasons why students prefer the f2f setting, as shown in Table 5, are:
students could ask questions and get responses immediately;
students felt they would learn better and have a better understanding of subject matter content;
students could interact with professors and peers;
students felt it was easy and more effective; and
students could be more focused in f2f instructional settings.

Table 5 indicates that the major reason for students' preference for online settings was the flexibility provided, which supports balancing employment and learning. The main reason students preferred remote instruction is that they can take class from home and avoid traveling to campus. Hybrid seems to be an ideal combination of f2f and online formats. As indicated by many students, hybrid was preferred because it allows students to interact with professors and peers when wanted or needed while still completing assignments online and working from home. The fact that hybrid combines the benefits of both f2f and remote instruction was the major reason that the hybrid format was the second choice among all of the instructional setting options.

Table 5: Reasons for students' preferences of instructional setting

Instructional setting	Reasons for their preference	Frequency
F2F	Ask questions and immediate response	45
	Learn better/better understanding	43
	Interaction/Develop relationship/communication	30
	Easy and effective	26
	Focus	20
	Hands-on learning experience	14
	Used to it	5
	Engaged	4
	Quality is better	2
Online	Flexibility/manage time/convenient/fit my work schedule	14
	Self-paced learning	3
	Better learning through reading steps	1

Table 5 (Continued)

Instructional setting	Reasons for their preference	Frequency
Remote	Stay home/comfortable	3
	Get work done on your own time	1
Hybrid	Interaction when needed	14
	Able to see professor as well as do my assignments online	9
	Like going to class and also learn from home	8
	Work at own pace	5
	Save time	2

The accompanying Pareto chart in Figure 12 shows that the top 5 factors accounted for 87% of all reasons why students preferred f2f instructional settings.

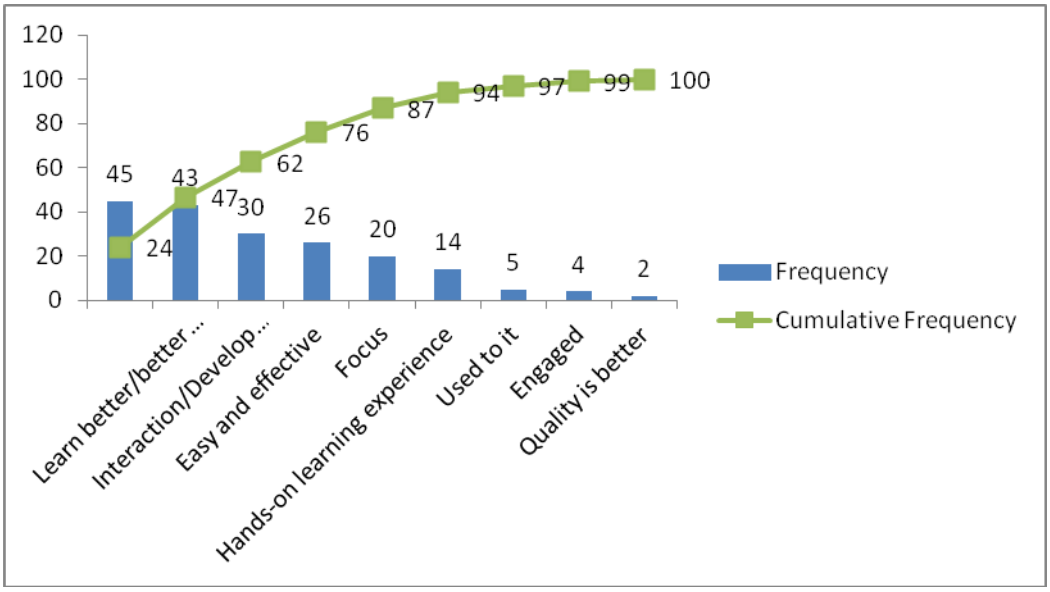

Figure 12: Pareto chart of frequency distribution for students' instructional setting preference

Table 6 summarizes students' responses regarding what they like the most about remote instruction. Note that students' responses were classified based on their preferred instructional setting. As can be observed in Table 6, the convenience of taking classes from home was what the students liked the most about remote instruction. Being able to attend class anywhere as long as they have internet connection was another key reason students preferred remote instruction.

Table 6: What students liked most about remote instruction

Preference Group	Like the most about remote instruction	Frequency
F2F	Nothing	69
	Learn from home/work/anywhere/comfortable/convenience	16
	Sleep more	6
	No need to dress up	4
	Easy to do other things	4
	See assignments in advance	3
	Deadline for assignments are extended	3
	Engaging learning	2
	Replay recorded lecture	2
	Easy to handle	1
	Share screen	1
	Get better grade	1
	Better access to information	1
	Instructors more lenient with remote	1
	Learn better	1
	More time to complete my work	1
Online	Nothing	5
	Learn from home/work/anywhere/comfortable/convenience	4
	Easy to do other things	2
	No need to dress up	1
	Take screenshot	1
	Replay recorded lecture	1
	Teachers response faster	1
	Better detailed assignment instructions	1
Remote	Learn from home/work/anywhere/comfortable/convenience	4
	Nothing	1
Hybrid	Learn from home/work/anywhere/comfortable/convenience	13
	Nothing	5
	More time for assignment	4
	Easy	3
	Flexibility/do other things	3
	Online homework	2
	Self-paced assignments	1
	No need to dress up	1
	Replay recorded lecture	1

As shown in Table 7, the top reasons why students disliked remote instruction included lack of interaction with professors and peers, increased opportunities to be distracted, difficulty focusing, and lack of engagement in the learning process. Delayed responses and lack of immediate assistance were also among the top reasons why students were not happy with remote instruction.

Table 7: What students disliked the most about remote instruction

Preference Group	Dislike the most about remote instruction	Frequency
F2F	Everything	68
	No interaction/lack interaction/hard to develop relationship/ Unable to get physical help	27
	No engagement/distraction/hard to focus	23
	Delayed responses/less immediate help/ Questions did not get answered quickly	13
	Harder to understand content	10
	Increase work load	7
	Internet connection issues	7
	No/lack of hands-on	3
Online	Not respond to emails	3
	Boring lecture	2
	Did not learning anything	2
	Hard to find quiet place at home	2
	Quality went down	1
	Hard to take notes	1
	Confusing instruction	1
	Everything	3
	No engagement/distraction/hard to focus	2
	Harder to understand content	1
	lack interaction	1
	Network issues	1
	Professors are not engaging	1
	Not respond to emails	1
Remote	Nothing	2
	Increased workload	1
Hybrid	Everything	6
	No engagement/distraction/hard to focus	6
	Less Interaction with professor	5
	Internet connection issues	5
	Cannot get immediate help/response	4
	Harder to understand content/ineffective to learn	3
	Increase work load	2
	Lack of communication	1
	Repeat lecture when some students show up late	1

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.

Synchronous online 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 synchronous online instruction two weeks after Spring break in March, 2020. To better understand the impact of transformative modes of instruction on the learning process and to investigate factors that may affect the effectiveness of synchronous online instruction and serve as input to instructional process improvements in the future, surveys were conducted after the first week of remote instruction during the Spring, 2020 semester (phase I), during the last week of the Spring, 2020 semester (phase II), and during the Spring, 2021 semester (phase III). The surveys set out to measure students' perceived satisfaction and effectiveness of their synchronous learning experience and to capture the underlying factors that contribute to their 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 effectiveness in understanding lectures in synchronous online instruction contributed the most to students' perceived satisfaction in the synchronous online instruction setting. However, the results revealed that students' satisfaction with synchronous online instructions significantly improved after one year's practice with the new instructional mode.

Further research

Further analysis revealed that perceived interaction during synchronous online instruction significantly affected satisfaction with the synchronous online instructional environment. 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 improve synchronous online instruction in the future.

References

Archambault, L., Kennedy, K., Shelton, C., Dalal, M., McAllister, L. & Huyett, S. (2016). Incremental progress: Re-examining field experiences in K-12 online learning contexts in the United States. Journal of Online Learning Research, 2(3), 303–326. Association for the Advancement of Computing in Education (AACE). Retrieved June 12, 2020, from https://www.learntechlib.org/primary/p/174116/

Augar, Naomi, Raitman, Ruth and Zhou, Wanlei 2004, Teaching and learning online withwikis, in Beyond the comfort zone : proceedings of the 21st ASCILITE Conference, Perth,5-8 December, Perth, Australia, 5-8 December 2004, pp. 95-104.

Bacow, L., Bowen, W., Guthrie, K., Lack, K., and Long, M.(2012). Barriers to Adoption of Online Learning Systems in U.S. Higher Education • May 1, 2012.

Brooks, D. C. and Graiek, S. (2020). Students' Readiness to Adopt Fully Remote Learning. Retrieved from https://er.educause.edu/blogs/2020/3/students-readiness-to-adopt-fully-remote-learning

Calvert, J. (2001). Deakin University: Going Online at a Dual Mode University. International Review of Research in Open and Distance Learning, January. Retrieve from http://www.irrodl.org/content/v1.2/deakin.html

Craig, R. (2020). What Students Are Doing Is Remote Learning, Not Online Learning. There's a Difference. EdSurge News. Retrieved from: https://www.edsurge.com/news/2020-04-02-what-students-are-doing-is-remote-learning-not-online-learning-there-s-a-difference on June 11, 2020.

Hartshorne, R., Baumgartner, E., Kaplan-Rakowski, R., Mouza, C. & Ferdig, R.E. (2020). Special Issue Editorial: Preservice and Inservice Professional Development During the COVID-19 Pandemic. Journal of echnology and Teacher Education, 28(2), 137-147. Waynesville, NC USA: Society for Information Technology & Teacher Education. Retrieved June 11, 2020 from https://www.learntechlib.org/primary/p/216910/.

Hodges, C., Moore, S., Barb Lockee, Trust, T., and Bond, A. (2020). The Difference Between Emergency Remote Teaching and Online Learning. Retrieved from https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning on June 11, 2020

Lederman, D. (2020). How College Students Viewed This Spring's Remote Learning. Retrieved from https://www.insidehighered.com/digital-learning/article/2020/05/20/student-view-springs-shift-remote-learning

Lin Y. Muilenburg & Zane L. Berge (2005) Student barriers to online learning: A factor analytic study, Distance Education, 26:1, 29-48, DOI: 10.1080/01587910500081269

Appendix: survey questions

(Full list of survey questions is available upon request)

1. Which college/school are you from?
2. What is your major?
3. (Q1) What is your classification?
4. (Q2) If you have options, which of the following teaching formats would you prefer?
5. You made your choice of the teaching format preference in the previous question (face to face classroom, online, synchronous online, or hybrid). Explain why you prefer that teaching format?
6. (Q3) You tend to be more focused in which of the following teaching formats.
7. (Q4) I check for messages, texting, email, etc., on my phone MORE OFTEN when I take _____?
8. (Q5) I understand instructor's lectures better in _____.
9. (Q6) I tend to be more engaged (asking questions, taking notes, etc.) in the learning process in which of the following teaching formats.
10. (Q7) I tend to spend less time on homework assignments when I take _____.
11. (Q8) I expect to get better grades when I take _____.
12. (Q9) Compared to face-to-face classroom, how do you feel about the effectiveness of the learning outcome of synchronous online instructions (better understanding of contents, engagement, etc.).
13. (Q10) How do you access the Internet to participate in live lectures?
14. What kind of Internet connection do you have at home?
15. (Q11) What tools do your professors use to deliver virtual lectures (live lectures delivered through Internet)?
16. (Q12) Do you prefer to turn on video (camera to show your face) when you participate on the synchronous online instruction?
17. (Q13) Do you prefer the instructor to turn on video (camera to show his/her face) during live lectures?
18. (Q14) I can find a quiet place so I won't be distracted when I participate in synchronous online instruction.
19. (Q15) I was frequently distracted when participating in live lectures (synchronous online instructions) because ___.
20. (Q16) When participating in live lectures (through synchronous online instruction),_____.
21. What do you like the most about synchronous online instruction?
22. What do you dislike the most about synchronous online instruction?
23. I have high speed and stable Internet connection when I participate in the synchronous online instructions.

24. (Q17) About the quality of audio and video during live lecture.
25. (Q18) Did your instructors record live lectures and make them available for replay?
26. (Q19) If recorded videos are available, how many times did you replay them?
27. (Q20) Did the recorded videos help you understand the materials better?
28. (Q21) Compared to face-to-face classroom, the amount of interaction between you and professors in synchronous online instructions.
29. Please share your experiences with the synchronous online 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.
31. (Q22) Please indicate the extent to which you agree or disagree with the following statement: I am very satisfied with synchronous online Instructions.