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## Comparing student perceptions of in-class, online synchronous, and online asynchronous instruction

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### Abstract

This article compares the efficacy of undergraduate teaching for in-class, online synchronous, and online asynchronous modes of instruction with implications for adapting the modes of instruction in computer information processing. The study uses a repeated measures design with pairwise comparisons while controlling for instructor, students, and course content across these modes of instruction. The study examines the following six perceptions held by students: instructional aspects such as instructor facilitation, student-to-student interaction, instructor-to-student interaction, course design, learning outcomes, and student satisfaction. The study also examines actual student performance on homework, quizzes, and exams. All findings were interesting and insightful. Student perceptions of almost all instructional aspects were significantly higher for the in-class mode than the two online modes of instruction. However, actual student performance was significantly better for online modes of instruction. The discussion section triangulates these statistical results with a review of 3000+ open-ended student responses to explain results, provide guidelines, and suggest future research.

**Keywords:** Asynchronous instruction; distance education; E-learning; in-class; online; synchronous instruction

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## 1. Introduction

Online education has grown steadily during the last 20+ years. The following data in the context of the USA is sourced from periodic studies by the Babson Research Group; The percentage of students enrolled in any online course at the undergraduate level increased from 15.6% in 2003-04 to 26.6 % in 2013. During the same period, the percentage of graduate students increased from 16.5% to 30.9 %; By 2016, more than six million students in the USA were enrolled in at least one online education course, representing 31.6% of all students (Seaman et al., 2018).

There have been varying degrees of acceptance for online education among students, faculty, and administrators in educational institutions (Cox & Prestridge 2020; Lewohl, 2023; Hart et al., 2021). Inadequate technology infrastructure, resistance to change, and low quality of past online experiences may explain this variation in the adoption of online learning. The coronavirus pandemic since 2020 mandated the adoption of online education in some form and brought about several structural and cultural transformations in not only education but almost all organizations (Fairlie & Loyalka 2020).

Online education has been evolving due to changing economic factors, student demographics, and technologies. Kumar et al. (2017) attribute the introduction of the new model of online education, namely, “Massive Open Online Courses” in 2012 as a turning point in the growth of online education. This led to increased online offerings and various models of programs like competency-based education, and alternate credentials such as badges, or industry certifications. The years 2020 and 2021 will go down as the years of rapid and revolutionary adoption of online education at all levels due to the coronavirus pandemic. Delivery of education at the tertiary level was transformed, warranting institutions and instructors to quickly adopt online teaching and learning. Faculty and administration have been evaluating their experiences of online instruction during the pandemic. The insights gained from these evaluations will facilitate the development of a student profile-centric education delivery model.

Given the availability of different modes of education delivery and their varying levels of acceptance, it becomes crucial to evaluate these modes for students’ perceptions and performance (Segbenya et al., 2022; Soliman et al., 2022). Our research leverages feedback from students to better understand perceptions and nuances of each instructional mode. The next section discusses background research on the topic that helps build the model for investigation. This is followed by the research methodology and setup, quantitative analysis of the data, and qualitative analysis of student commentary that helps provide some context. The article ends with a set of suggestions for online education in post-pandemic times.

### 1.1. Theoretical Framework

In-person instruction refers to classroom instruction that takes place face-to-face (Driscoll et al., 2012). For the sake of clarity, in-person or face-to-face instruction will be addressed as in-class instruction in the rest of this paper. In contrast, online instruction can be offered asynchronously or synchronously, or a combination of the two modes (Hrastinski, 2008). The asynchronous delivery mode allows participants to interact and engage with the course content at different times using learning management systems (LMS) enabled discussion forums, messages, blogs, etc. A synchronous delivery mode uses real-time, instructor-facilitated interactions such as live lectures, presentations, and review sessions using video conferencing tools like Zoom, MS Teams, WebEx, and Google Meet sessions.

The term “blended” has been used interchangeably as being analogous to hybrid, in that, it is a format where instruction is delivered using a combination of in-class and online sessions (Garrison & Kanuka, 2004). In an in-class format, instruction and interaction are provided primarily in a physical classroom setting, and it may or may not use technology to supplement in-class instruction. Lessons from online teaching during the pandemic have given rise to a new variant called Hyflex mode abbreviated for hybrid flexible. This mode signifies flexibility in a hybrid mode allowing students to

be either online or offline and the professor to be mostly in-class but can be online if necessary. There has been much research on diverse aspects of the different modes of instruction. Some studies are focused on best practices and efficacy, while others explore the impact on outcomes such as learning, interaction, motivation, and satisfaction. For instance, in a study of undergraduate students from South Korea and India, Baber (2020) found that interaction in the classroom (in person), student motivation, course structure, instructor knowledge, and instructor facilitation—positively influence students' perceived learning outcomes and student satisfaction.

### 1.1.1. *Learning Theories in Online Education*

Contemporary theories regarding traditional in-class instruction are based on social constructivism according to which learning takes place as a result of complex interactive social phenomena between teachers and students. In this context, learning entails problem-solving and the social construction of solutions (Vygotsky, 1980). Vygotsky describes the learning process as the establishment of a “*zone of proximal development*” in which the teacher provides the social environment as a facilitator and the learner constructs solutions while reflecting and interacting with the teacher and other students. Online Collaborative Learning (OCL) theory proposed by Harasim (2012), a “*new theory of learning that focuses on collaborative learning, knowledge building, and Internet use as a means to reshape formal, non-formal, and informal education for the Knowledge Age*” is a classic example of a theory rooted in social constructivism. It encourages students to use discourse to collaboratively solve problems.

The primary addition to social constructivism is the use of Internet infrastructure consisting of synchronous collaboration platforms like Zoom, and Google Meet, and asynchronous platforms like Blackboard and Moodle. In the OCL model, the teacher is an active facilitator of learning, making this model an effective format for small class sizes (Lo, 2023). Kumar et al., (2019) reinforce this OCL model by depicting the relationship between critical macro and micro factors in online education. The macro-level factors relate to the status of global, national, and local environmental conditions, whereas micro-level factors relate to the instructor, student, course, and technology and their interactions. According to Garrison (2007), these factors work together to create a community of inquiry that constitutes three elements essential to an educational transaction—cognitive presence, social presence, and teaching presence.

### 1.1.2. *Student Perceptions of Learning*

If students perceive instruction as favorable, they learn better, and their overall performance improves (Buzzetto-More, 2008). Student perceptions are also well correlated with teacher quality. There has been considerable research on student perceptions in the past 15+ years. One of the dominant themes has been a comparison of online, blended/hybrid, and face-to-face (F2F) modes. Studies have focused on assessing and comparing students' perceptions and learning across different modes and understanding the factors that impact these perceptions and learning. While some studies have reported that students have more favorable perceptions of in-class instruction compared to online instruction, others have reported that students prefer online, or blended formats compared to in-class.

The first group of studies found in-class learning to be more effective. Higher learning outcomes in in-class courses compared to online have also been reported (Evans, 2013; Flanagan, 2012). Fish & Snodgrass (2015) surveyed 64 undergraduate and 47 graduate business students' perceptions of value for online and in-class modes based on students' academic level, prior online experience, and gender. In general, students valued in-class modes more than online courses, probably because most of them were enrolled only for in-class instruction. The preference for the in-class instructional mode was consistent across student characteristics including gender and graduate versus undergraduate status. Weldy (2018) a survey administered to 165 undergraduate business students enrolled in either in-class, blended, or online modes. More than 76% of the students indicated a preference for in-class

modes. Additionally, students reported having a more positive experience in in-class mode compared to blended or online modes. It is important to note that before this survey only 40% of these students had taken an online class and only 66% had taken a blended class. Most students were thus comparing their perceptions of the three modes primarily based on their in-class experiences. Based on an analysis of 269 undergraduate students' learning in an International Business course that was taught both, online and in class, Sanford (2017) reported that students in face-to-face courses learned better than those in online classes. The study also found that the overall academic performance of students had a moderating effect on these differences. Students with higher GPAs learned the same in in-class and online formats, but students with lower GPAs learned significantly less in online formats suggesting that online learning environments may be better suited for students with higher GPAs.

The second group of studies found different results. Bowers and Kumar (2015) compared undergraduate students' satisfaction and perceptions of learning and engagement in online and in-class modes. The students were enrolled in either an in-class or online section of the same course taught by the same instructor. Students' satisfaction and perception of learning and engagement were significantly higher in the online section compared to the in-class section. This may suggest that not just the mode of delivery, but also the instructor's role influences students' perceptions of the experience with the mode of learning. Also, student profiles in the two sections could have been different. Similarly, a recent study (Fadol et al., 2018), compared the performance and perceptions of 122 female students enrolled in a management course that was divided into three delivery modes: traditional, online, and flipped. The flipped format utilized a combination of online and in-class sessions by providing lectures and materials online and engaging students in active learning during the in-class sessions. The results showed that actual student performance in the online and flipped section was significantly better than that for the traditional section, and the performance for the flipped section was better than that of the online section. Again, it should be noted that there was no control over students' profiles.

The third group of studies has reported mixed results in comparing online, traditional, and in-class formats (Al-Zahrani, 2015; Yong et al., 2015). Adding to the confusion, some studies have found no significant difference in learning across the different formats. DiRienzo and Lilly (2014) found that delivery methods did not have any significant difference in the learning outcomes. They compared students' learning outcomes on "basic" and "complex" assignments for the same undergraduate business course using in-class and online delivery methods. Callister and Love (2016) compared learning outcomes in a negotiations graduate course offered online versus face-to-face modes and found that in both modes students were mastering the course at the same level. Similarly, in a systematic review comparing the learning of clinical skills in undergraduate nursing students in online and traditional formats, the study found no statistically significant difference between the two formats (McCutcheon et al., 2015). Such mixed findings make it challenging to reach a clear understanding of students' perceptions and satisfaction across different modes of learning.

### *1.1.3. Factors that Impact Student Satisfaction and Learning in Different Modes*

Several studies comparing students' experiences in online, blended, and in-class modes have also investigated factors that impact students' satisfaction and learning in these learning modes (Jones et al., 2022). Previous studies have identified course content, student and instructor characteristics, interactions, and technology impacting student perceptions and learning as significant factors.

Building on prior research and focusing on the content and interaction-related elements of a course, Sebastianelli et al., (2015) examined the impact of six factors—course content, course structure, course rigor, professor-student interaction, student-student interaction, and mentoring support on three outcomes: learning, satisfaction, and quality. Using survey data from 169 MBA students enrolled in online and in-class programs at a private university, the authors found the course content to be the strongest predictor of all three outcomes (perceived learning, satisfaction, and

quality) in an online course. Results revealed statistical significance for course content on learning; course content and professor-student interaction on satisfaction; and course content, student-student interaction, and mentoring support on the perceived quality of the outcome. Professor-student interactions had a significant impact on student satisfaction, but not on perceptions of the quality of the outcome.

Eom and Ashill (2016) examined factors that predict students' satisfaction and their perceived learning outcomes in online courses. Using a sample of 372 students at a Midwestern University, they investigated the impact of student motivation, student self-regulation, interaction (instructor-student, and student-student), instructor activities/facilitation, and course design on student perceptions and online learning outcomes. Their findings suggest that instructor-student interaction, student-student interaction, instructor facilitation, and course design significantly impact students' satisfaction and learning outcomes. Extrinsic motivation refers to doing something because it leads to a separable outcome (Ryan & Deci, 2000), and student-self-regulation has no significant impact on student satisfaction and learning outcomes. Intrinsic motivation, which refers to doing something because it is inherently interesting or enjoyable (Ryan & Deci, 2000), impacts student learning outcomes but not satisfaction. These findings are consistent with other research suggesting that instructor facilitation and instructor-student and student-student interactions impact student satisfaction and learning outcomes in online formats (Garrison, 2016).

A review of the above existing literature shows that research findings regarding student learning and perceptions in different modes have been inconsistent, mixed, and inconclusive. The lack of a consistent research methodology and teaching approaches in several comparison studies results in divergent and inconclusive findings (Arbaugh et al., 2009; Nguyen, 2015). Comparing student satisfaction and learning in different modes becomes even more complicated due to factors that might influence student learning such as technology, student characteristics, instructor activities, course content, etc. The complexity of factors that influence student perceptions and the inconsistency of results warrants an examination of students' perceptions and learning across modes where the same students experience different modes from the same instructor and with the same course rigor.

Results of previous studies need to be interpreted with caution as students' perceptions, satisfaction, and performance were not based on their exposure to different modes while controlling for instructor, student, and course rigor. Our study is unique in many aspects and extends previous research. First, previous studies have been conducted with multiple groups of students receiving instruction in different modes; our study examines student satisfaction and learning outcomes in all three modes (in-class, online synchronous, and online asynchronous) with the professor and the same group of students in one semester during the pandemic. This provides control over student variation. Second, the pandemic situation forced both instructors and students to experience the three modes allowing us to eliminate self-selection bias that can impact instructor experience and student satisfaction and learning (perceived as well as actual). Third, this study was conducted during the mandatory and hasty transition to online instruction. Fourth, in addition to comparing student satisfaction and learning outcomes, we also compare course-related constructs (course design, instructor-student interaction, and student-student interaction) across the three modes. Fifth, like few other studies, besides learning outcomes, we also compare actual student performance using examinations, homework assignments, and class participation across the three modes. Sixth, the rigor of the course content was consistent throughout the semester as evidenced by the instructor's experience of having taught this course for 20+ years.

## **1.2. Purpose of study**

The current study focuses on the micro-level factors arising out of the OCL theory discussed by Kumar et al., (2019). Specifically, our study seeks to understand the differences in student satisfaction, learning outcomes, academic performance, student-to-student interaction, students to instructor

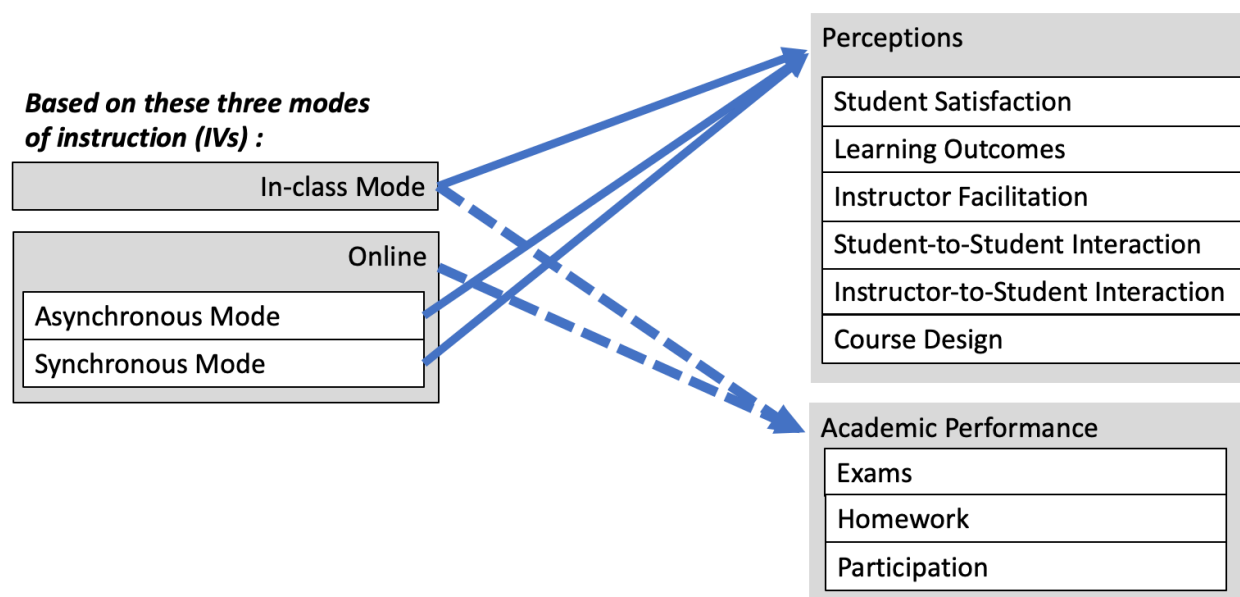
interaction, and course design across three modes of instruction in a repeated measures design i.e., same students going through the three modes of learning for the same course taught by the same instructor. We investigate the following research questions across these three learning modes - in-class, online synchronous, and online asynchronous - in a two-tailed format. Specifically,

- 1) Are there any differences in student satisfaction and learning outcomes?
- 2) Are there any differences in the four constructs - instructor facilitation, student-to-student interaction, instructor-to-student interaction, and course design?
- 3) Are there differences in terms of actual student performance across in-class and online modes – examinations, homework assignments, and class participation?

### 1.3. Conceptual model

The resulting research model is depicted in Figure 1. Specifically, we hypothesize, given the earlier mixed and inconclusive evidence, that there will be no significant differences in the dependent variables across different learning modes:

**Figure 1**  
*Research Model*



**H1:** There will be no significant difference in perceptions of *instructor facilitation* across the three modes: IC (in-class), AS (asynchronous), SN (Synchronous)

**H2:** There will be no significant difference in perceptions of *student-to-student interaction* construct across the three modes

**H3:** There will be no significant difference in perceptions of *instructor-to-student interaction* construct across the three modes

**H4:** There will be no significant difference in perceptions of *course design* construct across the three modes

**H5:** There will be no significant difference in perceptions of *learning outcomes* across the three modes

**H6:** There will be no significant difference in perceptions of *student satisfaction* across the three modes

**H7:** There will be no significant difference in *academic performance* across in-class and online modes

## **2. Materials and methods**

This study is an experimental investigation into the effectiveness of teaching and learning in the traditional and online education modes with the online mode further divided into synchronous and asynchronous components. This is a mixed-methods empirical study that compares student perceptions of three instructional modes based on quantitative data collected via a questionnaire survey, and by analyzing the qualitative data comprising of the open-ended feedback from students about several aspects of the modes of instruction. We conducted this study in an undergraduate class in computer information processing at a college of business in a northeastern university in the USA. We used the Blackboard learning management system and the Zoom video conferencing tool. We collected data from students on the efficacy of learning effectiveness with three modes of teaching/learning, in-class, online synchronous, and online asynchronous. Face-to-face learning occurred in the first half of the spring semester. Online learning took place in synchronous as well as asynchronous modes over the second half of the semester. The data collected from the students included their perceptions of instructional aspects as well as their actual performance across these modes within a week before the end of the semester to minimize errors in recall. All responses were received before the final exam in the last week of the semester. All data was collected and analyzed ethically and anonymized before analysis by the co-author who is not familiar with the class.

### **2.1. Procedure**

During the first half of the semester, intermediate skills of MS-PPT, MS Word, and important utilities of Windows were covered. These concepts included details about computer inputs, outputs, processing, and storage; computer applications software; Internet and WWW browsers; Windows operating system and utilities; programs, and file management. Class participation was strongly encouraged with class participation points being noted immediately in class. Some student participation comments prompted further comments from other students (counter-comments). Class participation points were saved for final grade computation despite these being added to a prior quiz score. Three homework assignments two quizzes and midterm examinations were administered during this period.

During the second half of the semester, intermediate-level MS Excel features and functions were covered, which included several descriptive analytics using basic built-in functions and data manipulation. These concepts included networking and security of computer devices; managing digital lifestyle; managing and protecting digital data; careers in information technology; and personal computer history. Class participation was strongly encouraged and was mostly based on asynchronous student discussion on the Blackboard platform. As before student participation comments prompted further comments from other students (counter-comments). Class participation points were saved for final grade computation despite these being added to a prior quiz score. Four homework assignments, two quizzes, and a final examination were administered. During this period, there was one synchronous class each week for lectures and some class discussions based on students' questions.

### **2.2. Data collection instrument**

A questionnaire was used to collect data. The instrument was adapted from Eom and Ashill (2016). Their model had already integrated the Virtual Learning Environment (VLE) effectiveness model (Piccoli et al., 2001) and the Technology-Mediated Learning (TML) framework (Alavi & Leidner, 2001). In the model, e-learning is viewed as an open system of three entities: students, instructors, and learning management systems (LMS) that interact with one another to impact learning outcomes and student satisfaction. Our resulting survey instrument consisted of nine sections: student motivation; self-regulation; instructor activities; student-to-student interaction; instructor-to-student interaction; course design/structure; learning outcomes; user satisfaction; and student characteristics. The instrument was pilot-tested with three professors and three students. Minor changes were made to the questions (items) within each section. Students were provided clear

motivation and instructions for the survey conducted through Google forms at the end of the semester. Academic performance was measured with scores on tests (quizzes and examinations), homework assignments, and class participation.

### 2.3. Participants

Out of a total of 48 students, 45 responded (response rate = 94%), with 41 valid responses. For the in-class mode, academic performance measures included (a) average scores of three homework assignments, (b) average scores of two quizzes, (c) total class participation scores as measured by the quality and quantity of comments and counter-comments in the classroom (a measure of engagement) for all conceptual as well as skills topics covered in-class and (d) midterm examination score. For the online mode, academic performance measures included (a) average scores of four homework assignments, (b) average scores of two quizzes, (c) class participation scores as measured by the quality and quantity of comments and counter-comments in the discussion forums for chapters related to the coverage of concepts (a measure of engagement) and (d) final examination score. Data was collected and managed ethically, and all data were handled with appropriate anonymization as appropriate.

### 2.4. Ethics

This study ensured that no participant, the environment, or other stakeholders were harmed by the research and its findings. Participation in this study was voluntary.

## 3. Results

Demographics of the students in terms of age, gender, undergraduate status classification, major within the business program, and prior exposure to online education are displayed in Table 1. Age ranges from 18 to 26 years. Most students are in the 19-20 age group. Males outnumber females, 25 to 16 which is typical of the business school profile. Majors represented our finance, general business administration, management, and marketing. Only eight out of 41 had prior exposure to online education.

Table 2 provides an overall summary in terms of mean and standard deviation for all dependent variables (scale from 1 to 5), student satisfaction, learning outcomes, instructor facilitation, student-to-student interaction, instructor-to-student interaction, and course design.

**Table 1**  
*Student Demographics and Responses*

Age	Count
18	2
19	17
20	12
21	7
22	1
25	1
26	1
Prior Online Learning	Count
None	33
Fully Online	8
Gender	Count
Male	25
Female	16
Major	Count
Bus. Admin.	9



Finance	13
Marketing	5
Management	7
Accounting	3
Other	1
Finance	1
Int'l Business	2
MIS	1
Rank	Count
Freshman	6
Sophomore	22
Junior	12
Senior	1

**Table 2**  
*Descriptive Statistics for All Measures*

Component	Mean	Std. Deviation
Student Satisfaction (IC)	4.226	0.70
Student Satisfaction (SN)	3.909	0.89
Student Satisfaction (AS)	4.055	0.79
Learning Outcomes (IC)	4.472	0.69
Learning Outcomes (SN)	3.927	0.97
Learning Outcomes (AS)	4.098	0.88
Instructor Facilitation (IC)	4.522	0.56
Instructor Facilitation (SN)	4.395	0.67
Instructor Facilitation (AS)	4.380	0.71
Student-to-Student Interaction (IC)	4.323	0.77
Student-to-Student Interaction (SN)	4.067	0.97
Student-to-Student Interaction (AS)	4.122	0.89
Instructor-to-Student Interaction (IC)	4.376	0.73
Instructor-to-Student Interaction (SN)	4.256	0.86
Instructor-to-Student Interaction (AS)	4.222	0.83
Course Design (IC)	4.390	0.64
Course Design (SN)	4.327	0.76
Course Design (AS)	4.312	0.73

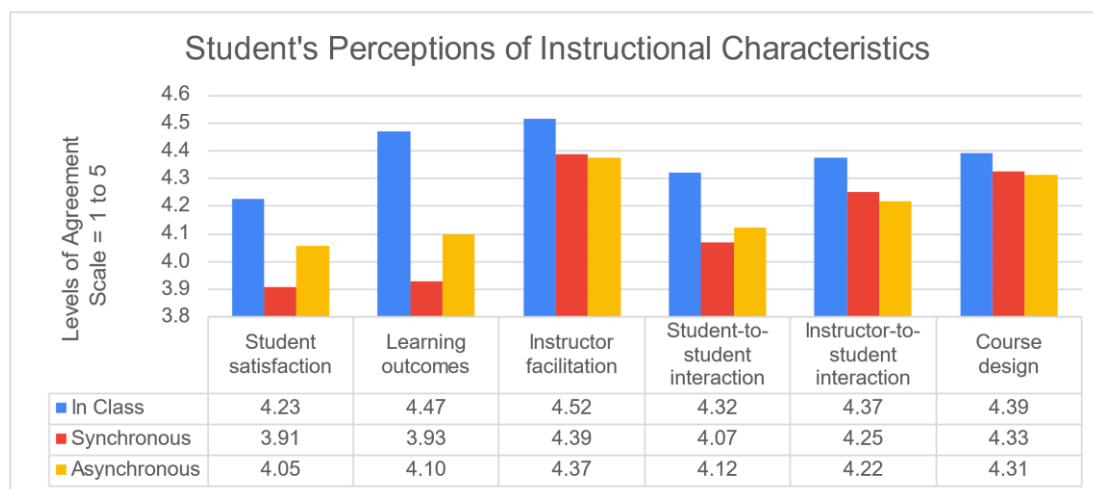
The observations were sampled randomly and independently of each other. The data included levels of agreement for each construct across the three modes: in-class (IC), synchronous online (SN), and asynchronous online (AS). These were analyzed using a repeated measures design. Academic performance was only measured across in-class and online modes and used as a composite of asynchronous and synchronous modes. Aggregate values for student perceptions were highest for the in-class mode (Figure 2). A visual inspection revealed that learning outcomes and student satisfaction dropped more sharply for the two online modes compared to the other instructional factors. Quizzes were delivered in the same format as exams throughout the semester and were aggregated as Tests. The visual inspection of aggregate values for academic performance did not reveal strong differences between the in-class and online modes of instruction. These are shown in Figures 2 and 3.

We tested for internal consistency across all measures using Cronbach Alpha and found it to range between 8.0 and 9.5, which was acceptable. We found that the data violated assumptions of normality and homogeneity of variance. Therefore, we conducted the non-parametric Friedman's test (Marino, 2018) to test for differences between the modes using a repeated measures design for each construct. To understand where the differences lay, we conducted pairwise comparisons using the

Wilcoxon Signed Rank test. The outputs in Table 3 show results of the Friedman’s test. Statistically significant differences in student perceptions are marked with an asterisk (\*). Overall, the results in Table 4 and Table 5 indicate that the students perceived the in-class mode better than both online modes on all constructs except course design.

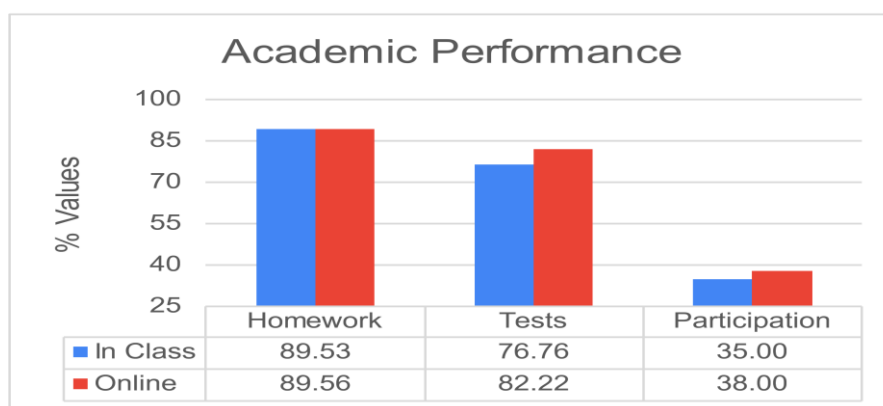
**Figure 2**

*Aggregate Values of Perceptions of Instructional Characteristics*



**Figure 3**

*Aggregate Values for Academic Performance*



Friedman’s test outputs used Chi-square results to confirm that in-class instruction held better perceptions for most constructs. Students perceived differences across the three modes of instruction for all dependent variables at a  $p < .05$ , except for the perception of quality of course design (Table 2). To further investigate where the differences existed, we conducted the Wilcoxon Signed Rank test (Table 3). We found that for each variable, the measures of all dependent variables for in-class mode were highest, followed by synchronous, and finally by asynchronous. In other words, perceptions of all characteristics were significantly higher for the in-class mode compared to either of the online modes. However, differences in these characteristics between the two online modes were not found to be significant. This is shown in Table 4.

Further, we captured student actual performance scores (as against perceived learning outcomes) for homework assignments, quizzes, examinations, and class participation across two

instructional modes: in-class and online (synchronous and asynchronous combined) as shown in Table 5.

**Table 3**  
*Results of Omnibus Friedman Test*

	Construct	Chi-Square	df	Asymp. Sig.
Instructional Characteristics	Student Satisfaction	5.77	2	0.056*
	Learning Outcomes	13.97	2	0.001**
	Instructor Facilitation	9.18	2	0.010**
	Student-to-Student Interaction	10.31	2	0.006**
	Instructor-to-Student Interaction	6.05	2	0.049**
	Course Design	2.54	2	0.281

\*\* indicates significance at alpha < .05

\* Indicates significance at alpha >0.50 but <=0.10

**Table 4**  
*Results of Wilcoxon's Signed Rank Test using Pairwise Comparisons*  
*IC → In-Class; AS → Online Asynchronous; SN → Online Synchronous*

	Difference between		Mode with higher values	Z values	Asymp. Sig. (2-tailed)
	First mode	Second Mode			
Student Satisfaction	IC**	AS	IC**	-1.982	0.048
	IC**	SN	IC**	-2.075	0.04
	SN	AS	AS	-1.214	0.23
Learning Outcomes	IC**	AS	IC**	-2.554	0.01
	IC**	SN	IC**	-2.997	0.00
	SN	AS*	AS	-1.415	0.10
Instructor Facilitation	IC	AS	IC**	-2.677	0.01
	IC	SN	IC**	-2.547	0.01
	SN	AS	SN	-0.279	0.78
Student-to-Student Interaction	IC	AS	IC**	-2.795	0.01
	IC	SN	IC**	-2.895	0.00
	SN	AS	AS	-0.956	0.34
Instructor-to-Student Interaction	IC	AS	IC**	-2.173	0.03
	IC	SN	IC*	-1.710	0.09
	SN	AS	SN	-0.604	0.55
Course Design	IC	AS	IC*	-1.811	0.07
	IC	SN	IC	-0.986	0.32
	SN	AS	SN	-0.431	0.67

\*\* indicates if a mode was significantly higher at alpha < .05

\* Indicates if a mode was significantly higher at alpha >0.50 but <=0.10

**Table 5**  
*Wilcoxon Signed Rank tests*

		Tests (Online <sup>#</sup> – In-class)	HW (Online <sup>#</sup> – In-class)	Participation (Online <sup>#</sup> – In-class)
Academic Performance	Z	-2.216	-.894	-1.298
	Asymp. Sig. (2-tailed)	0.027*	0.371	0.194

# sign indicates the mode with higher scores

\* Asterisk indicates statistical significance

Results of our analyses indicate that students perceived differences in several factors between in-class and online education. Students perceived that student satisfaction, learning outcomes, instructor facilitation, student-to-student Interaction, and instructor-to-student interaction were significantly reduced in online instruction (synchronous/asynchronous). The post hoc tests (Table 3) showed reductions in student satisfaction while moving from in-class to either of the online modes, with the move to asynchronous showing the least satisfaction in most cases. Course design demonstrated less impact, likely because it does not inherently involve much interactivity, and therefore may exhibit less impact when delivery of instruction changes to online.

#### 4. Discussion

The following discussion includes a summary of comments from students regarding instructor facilitation, interaction with other students, interaction with the Professor, and course design. Actual student comments are listed in the Appendix.

##### 4.1. Instructor Facilitation

Student comments explained differences in Instructor Facilitation across the three modes. Their perceptions of instructional characteristics for the in-class mode generally expressed a preference for in-class instruction over both online modes. Students responded to questions about process improvement and the instructor's ability to make them. A common complaint was about content overload in the online mode.

- a. What aspects of the instructor impressed you the most to enjoy learning?
  - In their responses, students briefly appreciated the instructor's handling of the switch to the online mode – the organization, deliberation, dedication, engagement, involvement, responsiveness to email messages, flexibility, adjustment (to calm the nerves), encouragement for class participation through discussion boards, provision of discussion forum summaries, demonstrated care for student learning and grades, sense of humor, good knowledge of the subject, adroit use of detailed PowerPoint slides during lectures, and patience.
- b. What could have the instructor done differently to make the learning environment even better?
  - Students reiterated their dislike for strictly timed quizzes (10 minutes) outside of class time and suggested conducting these during the class. They also noted that in-class participation was dominated by extroverted students, which put introverted students at a disadvantage. Even though several students have confirmed that the instructions on the homework assignments were very clear and detailed, some students asked for more guidance. For online instructional modes, instructors may need to provide additional real-world examples. Instructors may need to remind about paying more attention to checking email messages, following directions, and working in quieter areas to reduce distractions.

##### 4.2. Interaction with Other Students

Students liked the online asynchronous discussion forum interactions among students, even though it was mostly driven by a couple of motivated students. Student presentations in both in-class

and online modes enabled useful interactions. However, students missed the in-class interactions which were not possible as several students kept their video cameras off. Without knowing fellow students during in-class sessions, it was not possible to interact during online classes. For these reasons, it is understandable that student-to-student interactions were significantly better in the in-class mode than in the online mode despite satisfying discussion board interactions.

- a. What aspects of the student-to-student interaction impressed you the most to enjoy learning?
  - Interactions among students increased with the online asynchronous discussion forum communications, especially when a few motivated students sent some useful information on almost every chapter in the textbook. Some students connected with additional peers during the online mode. They liked the Reply function on Blackboard. Student presentations, both in-class and online facilitated more interactions. Students felt very comfortable interacting in one small class with only eight students.
- b. What could have helped you to improve student-to-student interactions
  - Interaction among students would have been improved by requiring all video cameras to be turned on to emulate in-class discussions. Eye contact, despite being virtual, facilitates familiarity which encourages interaction. The discussion forum on Blackboard may also facilitate interaction among students.

#### **4.3. Interaction with the Professor**

Students perceived the professor to be sincere and prompt in communicating on the discussion board with summaries and replies to email messages from students. They claimed that they missed the ability to ask questions in the in-class mode and recommended having virtual office hours. Students cited some challenges due to inferior audio and video quality in the online mode. Some students did not turn on their cameras, which contributed to reduced interactions with the Professor.

- a. What aspects of the student-professor interaction impressed you the most to enjoy learning?
  - Students cited prompt replies to their email messages that were open, honest, and caring communications, and timely meaningful feedback on homework assignments as significant contributors to enjoyment/appreciation. They also attributed this to an inclusive teaching style that incorporated student involvement, addressing students by their names, and encouraging participation. Other notable attributions included discussion forum summaries, detailed coverage of course material, and a knowledgeable professor with a sense of humor.
- b. What could have helped you to improve student-professor interactions?
  - In response to this question, students advised faculty to be fair in selecting class participants, and adequate office hours. They recommended fellow students mindfully increase their participation, be proactive in asking more questions, and respond to emails sooner.

#### **4.4. Course Design**

Course design remained unchanged in all modes; thus, no mode was statistically superior in this aspect.

- a. What aspects of the course design impressed you the most to enjoy learning?
  - Students noted that there was a clear correlation between content discussed in class and content tested. They liked discussion forums, citing it as being instrumental in keeping attention in the class, and perceived the transition from in-class to online as smooth. Students perceived expectations to be clear and appreciated the organization of the course. They perceived assignments to be clear, well-thought-out, and sufficiently detailed and believed course content to be relevant to the information age. Students believed screen sharing in Zoom classes to be useful.
- b. What aspects of the course design could have been improved?
  - Suggestions include more presentations in class and more explanations of homework assignments (Excel). Participation on discussion boards should have been mandatory. It is harder to

retain information while learning online, therefore hands-on learning should be reinforced. Repetitive content became helpful due to the retention issues with online learning. Better connectivity and faster internet speeds were needed to accommodate meetings with video and screen-sharing. Some content was repetitive (by design to provide iterative learning).

There were no specific student comments on the following three areas of our research.

#### **4.5. Student Satisfaction**

Familiarity with in-class learning was the single most important reason for more overall satisfaction with this mode. Within online learning, asynchronous class interactions student-to-student as well as instructor-to-student were judged to be more satisfactory than the corresponding interactions in the synchronous mode. As the technology of online platforms improves and as more requirements can be imposed in synchronous learning (like keeping their videos on), we surmise that satisfaction with online learning will keep improving.

Keeping videos on can be a surrogate measure of the level of engagement students have during an online class. According to the recently published study (Szopiński & Bachnik, 2022), the student engagement variable not only determines the current evaluation of online studying, but also the change in frequency of participation since the introduction of online classes, and the preferred mode of study - online or offline.

#### **4.6. Learning Outcomes**

It appears that students' perception of their learning outcomes from in-class mode directly relates to their overall satisfaction with the in-class mode. Even though in-class learning outcomes were consistently perceived as higher than both online modes, the asynchronous mode was perceived as significantly better than the synchronous mode. As assessed by the instructor, participation in the asynchronous mode for learning across peers was much higher than in the synchronous mode. It was most probably due to (a) no intimidation for participation by introverted students, (b) peer pressure prevailed due to clear visibility, and (c) the instructor's overall summary of the student-to-student asynchronous discussion on each theme was much appreciated by the students.

The online synchronous mode resulted in the lowest perception of learning outcomes. Possible attributable reasons are (a) technical glitches during online classes using the Zoom platform, (b) learning curves for both the instructor and students in using the Zoom platform; (c) inability or unwillingness of students to turn their cameras on, despite repeated insistence from the instructor.

#### **4.7. Student Performance**

Actual student performance was assessed using tests, homework assignments, and participation scores. In the context of statistical significance, students performed better on tests in the online mode than in class. However, no difference was found between the modes for HW or participation scores. This could be the result of illicit or legitimate reasons. Illicit reasons include collaboration or answer lookup. Legitimate reasons could be a mix of comfort factors such as fewer distractions and lower anxiety leading to increased focus.

### **5. Conclusion**

Our research was conducted to assess and improve the quality of instruction to be better aligned with the new normal of online education with its variants of blended, hybrid, and the emergence of the Hyflex mode. As discussed, earlier student perceptions of in-class instruction were significant for six of seven perceptions. One paradoxical result is that even though students perceived learning outcomes to be higher in the traditional mode, the actual performance in the tests in the online mode was significantly better. One argument to support this preference is that students prefer autonomy, are happier, and develop favorable perceptions of this mode. However, this presents an opportunity for further exploration.

Students' comments revealed that a shift from in-class to online instruction requires a few accommodations that may not be apparent at first. Online instruction requires increased flexibility to accommodate various learning styles. Flexibility is needed to accommodate limitations that could vary for each student, such as internet bandwidth or a supportive working environment. Unlike in-class instruction in which an instructor can control student attention, online instruction must creatively enable student engagement. An online instructor must also be willing to personalize support and be more responsive than they need to be for in-class instruction.

In light of the 2020-22 pandemic, experts have been making predictions like (a) organizations including educational institutions will explore and experiment to find an effective balance between in-class and remote interaction, enabled by web conferencing platforms;(b) stakeholders, including students and instructors, will start preferring IT enabled to in-class services; (c) an organization's digital presence will increasingly become the primary element of its customer (including student) engagement strategy; (d) where efficient supply chain of physical products (does not affect e-education) matters, current global economy will give rise to self-reliance within national borders; and (e) expanded high-speed internet connectivity and availability will become a top national priority for all countries; (f) online proctoring through video monitoring or through satellite examination centers; (g) requiring students to keep their cameras on during synchronous classes would also encourage class participation.

Our research on the efficacy of online education confirms the predictions of many experts that the online mode of education has become the new norm. University campuses will have less relevance except for sports and in-person lab work. Most universities, including the largest university system in the USA (California), conducted all classes during the academic year 2020-21 online, and are proceeding cautiously with a combination of fully online, flipped, blended, and in-class courses. Most institutions are using a combination of these modes to optimize the benefits for all stakeholders primarily students and professors. We predict that the Hyflex mode will become the norm for teaching and learning in tertiary educational institutions. This Hyflex mode is already being successfully deployed at Northeastern University not only for students but also for conducting professional seminars. Several other higher education universities are also embracing this mode. Hyflex mode represents customization to meet individual student needs and constraints versus traditional education mode which represents conformance in terms of requiring all students to commute to a predetermined physical classroom at pre-scheduled times. We envision customization leading to a menu of courses from different educational institutions worldwide to fulfill customized undergraduate and graduate degrees.

## References

- Alavi, M., & Leidner, D. E. (2001). Research commentary: Technology-mediated learning—A call for greater depth and breadth of research. *Information systems research*, 12(1), 1-10. <https://pubsonline.informs.org/doi/abs/10.1287/isre.12.1.1.9720>
- Al-Zahrani, A. M. (2015). From Passive to Active: The Impact of the Flipped Classroom through Social Learning Platforms on Higher Education Students' Creative Thinking. *British Journal of Educational Technology*, 46(6), 1133-1148. <https://berajournals.onlinelibrary.wiley.com/doi/abs/10.1111/bjet.12353>
- Arbaugh, J. B., Godfrey, M. R., Johnson, M., Pollack, B. L., Niendorf, B., & Wresch, W. (2009). Research in online and blended learning in the business disciplines: Key findings and possible future directions. *The Internet and Higher Education*, 12(2), 71-87. <https://www.sciencedirect.com/science/article/pii/S1096751609000268>
- Baber, H. (2020). Determinants of students' perceived learning outcome and satisfaction in online learning during the pandemic of COVID-19. *Journal of Education and E-learning Research*, 7(3), 285-292. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3679489](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3679489)

- Bowers, J., & Kumar, P. (2015). Students' perceptions of teaching and social presence: A comparative analysis of face-to-face and online learning environments. *International Journal of Web-Based Learning and Teaching Technologies (IJWLTT)*, 10(1), 27-44. <https://www.igi-global.com/article/students-perceptions-of-teaching-and-social-presence/123160>
- Buzzetto-More, N. (2008). Student Perceptions of Various e-Learning Components. *Interdisciplinary Journal of E-learning and Learning Objects*, 4(1), 113-135. Retrieved from <https://www.learntechlib.org/p/44851/>
- Callister, R. R., & Love, M. S. (2016). A comparison of learning outcomes in skills-based courses: Online versus face-to-face formats. *Decision Sciences Journal of Innovative Education*, 14(2), 243-256. <https://onlinelibrary.wiley.com/doi/abs/10.1111/dsji.12093>
- Cox, D., & Prestridge, S. (2020). Understanding fully online teaching in vocational education. *Research and Practice in Technology Enhanced Learning*, 15(1), 1-22. <https://telrp.springeropen.com/articles/10.1186/s41039-020-00138-4>
- DiRienzo, C., & Lilly, G. (2014). Online versus face-to-face: Does delivery method matter for undergraduate business school learning? *Business Education & Accreditation*, 6(1), 1-11. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2330975](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2330975)
- Driscoll, A., Jicha, K., Hunt, A. N., Tichavsky, L., & Thompson, G. (2012). Can online courses deliver in-class results? A comparison of student performance and satisfaction in an online versus a face-to-face introductory sociology course. *Teaching Sociology*, 40(4), 312-331. <https://journals.sagepub.com/doi/abs/10.1177/0092055x12446624>
- Eom, S. B., & Ashill, N. (2016). The determinants of students' perceived learning outcomes and satisfaction in university online education: An update. *Decision Sciences Journal of Innovative Education*, 14(2), 185-215. <https://onlinelibrary.wiley.com/doi/abs/10.1111/dsji.12097>
- Evans, N. S. (2013). *A cross-sectional descriptive study of graduate students' perceptions of learning effectiveness in face-to-face and online courses*. Wilmington University (Delaware). <https://search.proquest.com/openview/e5fef6c3e676154b279d937326eb4512/1?pq-origsite=gscholar&cbl=18750>
- Fadol, Y., Aldamen, H., & Saadullah, S. (2018). A comparative analysis of flipped, online and traditional teaching: A case of female Middle Eastern management students. *The International Journal of Management Education*, 16(2), 266-280. <https://www.sciencedirect.com/science/article/pii/S1472811717303877>
- Fairlie, R., & Loyalka, P. (2020). Schooling and COVID-19: lessons from recent research on EdTech. *npj Science of Learning*, 5(1), 13. <https://www.nature.com/articles/s41539-020-00072-6>
- Fish, L. A., & Snodgrass, C. R. (2015). Business Student Perceptions of Online versus Face-to-Face Education: Student Characteristics. *Business Education Innovation Journal*, 7(2), 83-96. Retrieved from [http://www.beijournal.com/images/V7N2\\_final.pdf#page=83](http://www.beijournal.com/images/V7N2_final.pdf#page=83)
- Flanagan, J. (2012). Online versus Face-to-Face Instruction: Analysis of Gender and Course Format in Undergraduate Business Statistics Courses. *Academy of Business Research*, 2, 93-101. Retrieved from <https://ssrn.com/abstract=2627101>
- Garrison, D. (2007). Community of Inquiry in Online Learning: Social, Teaching and Online Presence. *Journal of Asynchronous Learning Networks*, 11, 61-72. Retrieved from <https://files.eric.ed.gov/fulltext/EJ842688.pdf>
- Garrison, D. R. (2016). *E-learning in the 21st century: A community of inquiry framework for research and practice*. Taylor & Francis.
- Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The internet and higher education*, 7(2), 95-105. <https://www.sciencedirect.com/science/article/pii/S1096751604000156>
- Harasim, L. (2012). *Learning theory and online technologies*. New York, NY: Routledge/Taylor & Francis Group.
- Hart, C., Alonso, E., Xu, D., & Hill, M. (2021). COVID-19 and community college instructional responses. *Online Learning*, 25(1), 41-69. <https://eric.ed.gov/?id=EJ1287109>



- Hrastinski, S. (2008). Asynchronous and Synchronous e-Learning. *Educause Quarterly*, 31(4), 51-55. Retrieved from <https://er.educause.edu/articles/2008/11/asynchronous-and-synchronous-elearning>
- Jones, J. E., Jones, L. L., Calvert, M. J., Damery, S. L., & Mathers, J. M. (2022). A Literature Review of Studies that Have Compared the Use of Face-To-Face and Online Focus Groups. *International Journal of Qualitative Methods*, 21. <https://doi.org/10.1177/16094069221142406>
- Kumar, A., Kumar, P., Palvia, S. C. J., & Verma, S. (2017). Online education worldwide: Current status and emerging trends. *Journal of Information Technology Case and Application Research*, 19(1), 3-9. <https://www.tandfonline.com/doi/abs/10.1080/15228053.2017.1294867>
- Kumar, P., Kumar, A., Palvia, S., & Verma, S. (2019). Online business education research: Systematic analysis and a conceptual model. *The International Journal of Management Education*, 17(1), 26-35. <https://www.sciencedirect.com/science/article/pii/S1472811718302854>
- Lewohl, J. M. (2023). Exploring student perceptions and use of face-to-face classes, technology-enhanced active learning, and online resources. *International Journal of Educational Technology in Higher Education*, 20(1), 48. <https://link.springer.com/article/10.1186/s41239-023-00416-3>
- Lo, N. P. K. (2023). Digital learning and the ESL online classroom in higher education: teachers' perspectives. *Asian-Pacific Journal of Second and Foreign Language Education*, 8(1), 24. <https://link.springer.com/article/10.1186/s40862-023-00198-1>
- Marino, M. J. (2018). Statistical analysis in preclinical biomedical research. In *Research in the biomedical sciences* (pp. 107-144). Academic Press. <https://www.sciencedirect.com/science/article/pii/B9780128047255000033>
- McCutcheon, K., Lohan, M., Traynor, M., & Martin, D. (2015). A systematic review evaluating the impact of online or blended learning vs. face-to-face learning of clinical skills in undergraduate nurse education. *Journal of Advanced Nursing*, 71(2), 255-270. <https://onlinelibrary.wiley.com/doi/abs/10.1111/jan.12509>
- Nguyen, T. (2015). The effectiveness of online learning: Beyond no significant difference and future horizons. *MERLOT Journal of online learning and teaching*, 11(2), 309-319. <https://tinyurl.com/mr4ae4uj>
- Piccoli, G., Ahmad, R., & Ives, B. (2001). Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skills training. *MIS Quarterly*, 401-426. <https://www.jstor.org/stable/3250989>
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary educational psychology*, 25(1), 54-67. <https://www.sciencedirect.com/science/article/pii/S0361476X99910202>
- Sanford, D. (2017). Course format and learning: The moderating role of overall academic performance. *The International Journal of Management Education*, 15(3), 490-500. <https://www.sciencedirect.com/science/article/pii/S1472811716301331>
- Seaman, J. E., Allen, I. E., & Seaman, J. (2018). Tracking Distance Education in the United States. Babson, MA: Babson Survey Research Group and Quahog Research Group, LLC. Retrieved from <https://files.eric.ed.gov/fulltext/ED572777.pdf>
- Sebastianelli, R., Swift, C., & Tamimi, N. (2015). Factors affecting perceived learning, satisfaction, and quality in the online MBA: A structural equation modeling approach. *Journal of Education for Business*, 90(6), 296-305. <https://www.tandfonline.com/doi/abs/10.1080/08832323.2015.1038979>
- Segbenya, M., Bervell, B., Minadzi, V. M., & Somuah, B. A. (2022). Modelling the perspectives of distance education students towards online learning during COVID-19 pandemic. *Smart Learning Environments*, 9(1), 13. <https://link.springer.com/article/10.1186/s40561-022-00193-y>

- Matta, V. & Palvia, S. (2023). Comparing student perceptions of in-class, online synchronous, and online asynchronous instruction. *World Journal on Educational Technology: Current Issues*, 15(3), 303-320. <https://doi.org/10.18844/wjet.v15i3.8656>
- Soliman, C., Salman, D., & GamalEldin, G. O. (2022). Students' perceptions of online learning in higher education during COVID-19: an empirical study of MBA and DBA students in Egypt. *Future Business Journal*, 8(1), 45. <https://link.springer.com/article/10.1186/s43093-022-00159-z>
- Szopiński, T., & Bachnik, K. (2022). Student evaluation of online learning during the COVID-19 pandemic. *Technological Forecasting and Social Change*, 174, 121203. <https://www.sciencedirect.com/science/article/pii/S0040162521006363>
- Vygotsky, L. (1980). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.
- Weldy, T. G. (2018). Traditional, Blended, or Online: Business Student Preferences and Experience with Different Course Formats. *E-Journal of Business Education and Scholarship of Teaching*, 12(2), 55-62. Retrieved from <https://files.eric.ed.gov/fulltext/EJ1193431.pdf>
- Yong, D., Levy, R., & Lape, N. (2015). Why no difference? A controlled flipped classroom study for an introductory differential equations course. *Primus*, 25(9-10), 907-921. <https://www.tandfonline.com/doi/abs/10.1080/10511970.2015.1031307>