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Dorina
Tila

Shifting to blended online learning and its impact on student performance: A case study for students enrolled in economic courses prior to COVID-19 emergency remote instruction

Abstract

This study explores whether student academic performance differs between the face-to-face and online hybrid sections in an undergraduate introductory macroeconomic course offered at a US community college. The data was collected from 414 students enrolled in various sections of the course during five semesters from spring 2016 to fall 2018. The findings show no statistical difference in student performance between face-to-face and online hybrid courses and contribute to the literature specific to the discipline of economics, which unlike other disciplines, has shown discord in findings. The usefulness of such results may extend to US higher education institutions to help them make data-informed decisions about their future investments in online teaching modalities and course design in the discipline of economics.

Keywords: blended learning, hybrid learning, distance learning, online learning, students' performance

Introduction

Technology has affected various industries provoking a variety of feelings, including euphoria of achieving things unthinkable before, satisfaction of being more efficient, frustration of not knowing the new, as well as excitement of learning the new. Education is not excluded from such an experience. While the impact of technology on education includes a spring of topics, this particular study investigates whether student performance is impacted by the use of online instruction, facilitated through technology. This topic is even more vital at the time that COVID-19 pandemic has affected over four thousand US colleges and over 25 million students enrolled in those colleges (Entangled Solutions, 2020) and about 1.3 billion students worldwide (McCarthy, 2020). When face-to-face teaching is replaced with online, the fear is whether student performance may suffer. For example, Allen and Seaman (2006) reported that only 29% of surveyed faculty considered that online courses were able to fulfill learning outcomes the same or better compared to face-to-face courses. In deciding about future investments in online instruction, it is important to make data-informed decisions. This study provides discipline-specific data and pandemic-free data since it was collected in economics courses offered at a US community college during five semesters between spring 2016 to fall 2018. The importance of pandemic-free data is supported also by Hodges et al. (2020), who provides the distinct differences between online instruction and emergency remote instruction that was implemented during spring 2020. The emergency remote instruction was not planned and designed to be performed in an online delivery and, it is not a true representation of a well-designed and well-planned online instruction. While the main purpose of the study is to compare student academic performance in face-to-face and online blended instruction, the usefulness of this contribution extends to the literature in the discipline of economics and to educators' decisions regarding these teaching modalities.

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The traditional modality of content delivery has been face-to-face instruction, but with the advancement of technology and emerging student needs to balance work, family, and school, alternative modes of delivery have been adopted. Depending on the extent of technology use, online activities, and in-person interaction, courses can be distinguished by several categories. Face-to-face courses use in-person instruction with minimal use of technology. However, when instruction is delivered through a combination of in-person and online delivery, it is considered hybrid or blended. The terms “blended” and “hybrid” will be used interchangeably for the purpose of this paper. Specifically, Allen et al. (2007) define it as having “between 30 percent to 79 percent of the course content delivered online” (p. 5). Fortin et al. (2019) supplement this definition by clarifying that online hybrid courses do not simply mean replacement of delivery mode and provision of the same material in an online environment, but also including learning activities dispensed online. This is an important distinction because, as will be shown in the literature review, most older studies dispense content and material online without adding any online activities, such as the online discussions that were implemented in this study. This is another important reason why this study contributes to the literature by using an updated definition of online instruction. Other distinctions are made between synchronous and asynchronous instructions of complete online delivery, which are out-of-scope for the purpose of this paper exploring partial online delivery in hybrid sections.

The demand for these other alternative teaching modalities was increasing prior to the COVID-19 pandemic. Seaman et al. (2018) reported continuous growth in annual distance learning enrolments in US higher education from 2012 to 2016, with a 2016 annual growth rate of 5.6%, while overall student enrolment was declining. The demand for online and hybrid courses experienced growth also in the community college where this study was performed. For example, the “2016 Student Experience Survey” provides a glimpse of students’ preference for an increase in the supply of online and hybrid sections in the CUNY system, which is the largest urban public university system in the US with an enrolment of 275,000 students as of 2017. About 45 percent of the respondents reported that they would like their institution to offer more hybrid courses, which is an indication of demand being higher than supply. This scarcity in hybrid courses leads US educational institutions to ponder whether they should increase the supply of such alternative teaching modalities and whether they provide similar value compared to traditional face-to-face instruction. According to Pew Research’s surveys conducted on 1,055 US higher education institutions during spring 2011, 51% of the participating presidents considered that online courses are just as valuable as face-to-face courses compared to 29% of the general public (Parker et al., 2011). Allen and Seaman (2006) reported a similar discrepancy in

opinions whereby 71% of the participating administrators compared to 29% of the participating faculty considered that learning outcomes were fulfilled the same or better in online courses compared to face-to-face. While this shows a discord in opinions between administration and faculty regarding the quality of online instruction and its equivalence to traditional in-person instruction, scholars have been analyzing this question for several decades. Studies comparing the success of different learning modes are not scarce as expected by the growing effect of technology on our lives. However, these studies differ in context and discipline, definition and implementation of learning mode, limitations of analyses including biases as well as small sample sizes. More importantly, as shown in the literature review, scholars have not reached a converging conclusion on whether online instruction affects students’ learning and academic success in the specific discipline of economics.

This study aims to assess the efficacy of online blended instruction compared to face-to-face instruction in the discipline of economics, for which there is no convergence in scholarly opinion and empirical studies’ findings. Furthermore, the investigation of this question becomes useful during the time of a pandemic that has led educational institutions to invest more in online instruction and may help them make data-informed decisions in the long-term regarding online instruction in the discipline of economics.

Literature review

Levy (2017) explains some benefits of online learning, specifically for community college students, such as fostering digital readiness, nurturing professionalism, and encouraging the independent learning which are the right ingredients to succeed in a digitally driven workplace. Crawley (2015) explains several benefits associated with hybrid courses, such as building community, helping diverse learners and preparing students for the workforce. Other benefits listed are schedule flexibility and balancing work, family, and school (Gould, 2003; Jackson & Helms, 2008). The benefits derived from the blend of both online and in-class instruction may explain why hybrid courses are the preferred choice among students. Marquis and Ghosh (2017) found that over 50 percent of the students surveyed in their study preferred the hybrid course compared to only 20 percent preferring a face-to-face course. Nollenberger (2017) found similar results from the survey completed by students enrolled in its Master in Public Administration program at Midwestern University. Students valued the benefits of online learning while still preferring traditional in-class teaching, thus making the hybrid teaching mode the one to offer the greatest promise.

While demand and preference for hybrid courses had an increasing trend prior to the pandemic, as shown in US enrolment data reported by Seaman et al. (2018), several studies have investigated the question of whether the delivery format leads to differences in

student performance. Some studies show that hybrid courses may improve performance, which might be due to the offering of flexibility and more options of communication that allows different types of students to showcase their abilities (Dziuban & Moskal, 2001; Gould, 2003; Martyn, 2003; Tseng & Walsh, 2016; Vaughan, 2007). But the majority of studies have shown no significant difference in students' performance between online hybrid courses and traditional face-to-face instruction (Cosgrove & Olitsky, 2015; Gerlich & Sollosy, 2011; Keller et al., 2009; Utts et al., 2003; Ward, 2004). Such "no-significance" findings are strongly evidenced by several meta-analysis studies, such as Means et al. (2010) looking at empirical studies between 1996 and 2008; Bernard et al. (2004) looking at studies between 1985 and 2002; and Vo et al. (2017) looking at studies between 2001 and 2015 covering a range of disciplines such as health and medicine, English literature, psychology, environmental studies, law, etc.

Unlike other disciplines, most studies in economics found a significant difference in favor of face-to-face instruction. The findings from the meta-analysis of Sohn and Romal (2015), reviewing articles published from 2000 to 2012, showed statistically significant higher performances in face-to-face compared to online undergraduate economic courses offered in US higher education. Focusing on specific studies, Brown and Liedholm (2002) analyzed a dataset of 710 students enrolled in the Principles of Microeconomics courses during fall 2000 and found that face-to-face instruction produced better results in terms of exam scores, compared to hybrid and online instruction. Their study did not address instructor bias, as face-to-face and hybrid were taught by different instructors. Also, the hybrid course was supplemented with online materials, such as PowerPoints and practice materials, without offering additional online activities. Coates et al. (2004) compared the scores on the Test of Understanding College Economics (TUCE) of students enrolled in principles of economics courses in three US higher education institutions. The findings showed that students enrolled in face-to-face courses scored higher. The study used a small size sample of less than 100 students, 67 and 59 for face-to-face and online, respectively. Gratton-Lavoie and Stanley (2009) had similar findings in their study of 98 students enrolled in face-to-face courses and 58 students enrolled in online courses of principles of microeconomics at California State University during fall 2001 through fall 2003, again representing a small sample size.

Only a minority of studies to date found no significant difference between face-to-face and online instruction in economics (Bennett et al., 2007; Dendir, 2019; Navarro & Shoemaker, 2000). Navarro and Shoemaker (2000) collected data from 200 students enrolled in a Principles of Macroeconomic course during 1998–1999 and found that students in online modalities outperformed students enrolled in a traditional face-to-face course by using the scores of an identical final exam comprised of a short essay ques-

tion. This old study had some similarities with the current study as it did integrate online discussions, but they were synchronous rather than asynchronous. Bennett et al. (2007) provides some peculiar results using data from 406 students enrolled in face-to-face courses and 92 enrolled in online courses at Jacksonville State University during fall 1999. The face-to-face instruction outperformed the online instruction in microeconomics, while the opposite was true for macroeconomics. The researchers argued that the difference may have resulted from the more quantitative aspect of microeconomics. The study does not show whether there were any differences in the instructional design between the different modalities which makes these findings difficult to interpret.

This study contributes to this literature by encompassing all of the following features that were missing from prior studies: 1) this is a semi-experimental design comparing control and experiment groups that are analyzed for statistical difference by applying parametric and nonparametric tests; 2) the subjects are all enrolled in the same course taught by the same instructor in various semesters, thereby minimizing subject or instructor bias; 3) the sample pool is large, comprised of 414 students enrolled at one of the largest community colleges in New York City; 4) the data covers a long period of five semesters prior to COVID-19; 5) the online hybrid instructional design includes online activities that utilize the online environment; and 6) the data is up-to-date and provides a fresh view of the efficacy of the hybrid teaching modality in the discipline of economics.

The findings of this study support the argument that shifting to online hybrid economic courses does not inhibit student learning while it includes the associated benefits. This provides a good argument to ponder over the possibility of moving forward into fully online teaching in the long term.

Study description and methods

Data was collected from 414 students enrolled in twelve Principles of Macroeconomics sections at City University of New York (CUNY) Kingsborough Community College during five semesters from spring 2016 to fall 2018. Principles of Macroeconomics is a core curriculum course for most of the Department of Business AAS program degrees at CUNY Kingsborough Community College, and an elective for other majors. Data was collected from 150 students enrolled in hybrid sections, known as the experimental group, and 294 students enrolled in traditional face-to-face instructional courses, known as the control group. All sections were taught by the same instructor. Students were able to see the teaching modality prior to enrolling and they could select the section based on their preferences and the availability of seats. At the beginning of the semester, the students were given the syllabus and were informed that they were enrolled in a hybrid or face-to-face section and were able to change class without penalty. Table 1 shows

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the student enrolment in the control and experimental sections for each of the five semesters. Out of 414 students initially enrolled, only 382 students successfully completed the course while 32 withdrew from the course. The difference in attrition rates between the two groups is discussed in the results section.

Table 2 shows the distinction between the control and experimental groups. The traditional face-to-face sections (control group) consisted of 36 1-hour teaching sessions taught three times a week, while each hybrid section (experimental group) consisted of 24 1-hour teaching sessions taught twice a week with an added online component. All teaching sessions consisted of a mix of lectures, class discussions, and organized group work. The learning objectives, the course material and its organization were the same in both types of learning environments. Topics were divided into four modules, and each module contained two assignments. All eight assignments were administered via a Learning Management System (LMS), specifically Blackboard. All quizzes and final exams were administered in class with the use of traditional paper and pencil.

The hybrid course used Blackboard to host additional course materials and various discussion forums that allowed the students to participate in asynchronous dialogues, which was not provided in face-to-face (F2F). In the hybrid sections, the students were required to respond to bi-monthly discussion questions. The instructor would post a question, such as graph the real GDP of a country and identify

its most recent recession. The student would write their answer to the question and respond to at least one other peer. The instructor participated in the asynchronous discussion throughout the two-week period and provided a grade followed by an extensive and customized feedback. While students' posts and instructor's responses were visible to the whole class, the customized feedback was visible only to the addressee. These online discussions were not available to the students enrolled in F2F and were replaced with in-class quizzes. Hence, the hybrid sections had a fundamental difference in their instructional design. The one hour a week that was shifted from face-to-face meetings to online instruction utilized the online environment not solely by placing material online, but also by adding additional online activities (i.e., online discussions). As shown in Table 2, the hybrid sections replaced the in-class quizzes with online discussion forums, which comprised 30 percent of the course grade.

The hybrid courses had a change in their instructional design as some aspects of face-to-face instruction were replaced with online activities, such as online asynchronous discussions. The instructor considered this particular instructional design based on the academic freedom and the belief that online asynchronous discussions would meet the learning objectives by giving students different modes of expressing economic arguments that may help shy students (Gould, 2003). Other benefits of online discussions have been previously identified. For example,

Table 1
Student participation in traditional face-to-face and hybrid courses

Semester	Control group Traditional face-to-face	Experimental group hybrid	Total
Spring 2016	36	30	66
Spring 2017	39	30	69
Fall 2017	111	28	139
Spring 2018	39	32	71
Fall 2018	39	30	69
Total no. of students	264	150	414

* Note that no data is provided for fall 2016 since the instructor was not teaching during that semester.

Source: author's own work.

Table 2
Settings for face-to-face and hybrid courses

Course settings	Control group face-to-face	Experimental group hybrid
Number of in-class Quizzes (30 percent)	4	0
Number of Online Discussion Forums (30 percent) *	0	6
Number of assignments *	8	8
Weekly 1-hour in-class teaching sessions	3	2

Note: (*) Administered online through LMS.

Source: author's own work.

Hammond's meta-analysis study listed various benefits of asynchronous online discussions identified from studies across different locations and disciplines, such as health and medicine, English literature, psychology, environmental studies, and law. Such benefits included providing opportunities for interaction between learners, increasing of online student engagement and instructor presence, and creating a sense of community (Hammond, 2005). This is also in alignment with a generally accepted online hybrid course as shown by Allen et al. (2007) classification of hybrid as a "substantial proportion of the content is delivered online, typically uses online discussions, and typically has some face-to-face meetings" (p. 6). This provides the reasoning for crafting such instructional design to include online discussions, but it does not serve to evaluate its efficacy. The purpose of this study is not to evaluate the use of online discussions in isolation, but the efficacy of whole hybrid course in comparison to face-to-face, including all of the online learning activities.

The data was collected and analyzed as part of the "Assessing Students' Performance on Multiple Entry Assignments" project which aimed at analyzing students' performance when they were allowed to revise some of their multiple-choice assignments in hybrid and face-to-face courses (Tila & Levy, 2020). During this data analysis, it was found that there was no statistical change in students' performance between hybrid and F2F courses, which was the seed of this paper. Participants received an oral and internet-based consent form regarding student data collection during the first two weeks of classes and online through Blackboard. The consent form described the voluntary participation and the anonymous aspect of the data collected, assured that data collection and analysis would be conducted only after grades were posted, and confirmed the deletion of all students' personal information prior to analysis.

Limitations

This study collected a large sample across various semesters and successfully overcame some limitations, such as instructor bias, by selecting sections taught by the same faculty, and content bias, by selecting different sections of the same course. However, self-selection bias was limited but not eliminated. Students could self-select which section to register based on their preferences and the availability of seat.

This may have created differences between samples that might potentially affect the results. Such self-selection bias has been present throughout the prior studies with the exception of a few, which allowed random assignment (Arias et al., 2018). However, as reported by these researchers, such a technique created another layer of selection bias because the students who decide to participate in this random selection do self-select.

Other limitations were addressed, such as student seniority, meaning which year of their undergraduate degree they were completing based on credits accumulated. Table 3 shows that 67% of the students enrolled in face-to-face sections and 65% of the students enrolled in hybrid section were freshmen, meaning in their first year of study. A two-tail t-test shows no statistical differences between the control and experimental groups ($p < 0.62$), suggesting that there was no selection bias based on student seniority. This suggests that any difference in students' performance, or lack thereof, is not attributed to the sample difference in terms of student seniority.

Demographic, gender, race and ethnicity data could have provided some understanding on whether the samples were different due to self-selection bias. The instructor reports to have witnessed no difference between the two sample groups, however, the collection of such data was not available to the researcher. Therefore, the data was analyzed collectively, segregated solely by the online instruction factor in the experimental and control groups.

Results

This study analyzed the impact of teaching modalities on students' performance, specifically traditional face-to-face versus hybrid courses. The data spans a three-year period (five semesters) from 2016 to 2018. The final exam grades and the course grades were collected from 414 students at Kingsborough Community College enrolled in traditional F2F and hybrid sections. The letter grades were translated into a scale ranging from A to F (or a 1 – 5 score), similar to a Likert score, as shown in Table 4. Students who did not complete the course but withdrew, received a "W" letter which is categorized as "W" and distinguished from a failing grade F.

Once the grades were scored between five letters A through W, Figure 2 shows the grade frequency between the two learning environments. The students'

Table 3
Student year of studies / seniority (percentages)

Semester	Control group Traditional face-to-face		Experimental group hybrid	
	Freshmen	Sophomores	Freshmen	Sophomores
Total no. of students	177	87	97	53
Total (percentages)	67%	33%	65%	35%

Source: author's own work.

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Table 4

Grade conversion to Likert scale

Letter grade	Letter grade	Score
A+ A A-	A	5
B+ B B-	B	4
C+ C C-	C	3
D+ D D-	D	2
F	F	1
W	W	0

Source: author's own work.

performance was measured through their final grade in the course but also through their grade in the final exam. Both the control and experimental groups completed a similar final exam. Table 5 and Figure 1 show a withdrawal rate of 12.67 percent in the hybrid courses compared to 4.92 percent in the traditional F2F courses, suggesting that hybrid courses experience a higher attrition rate. However, the reason for such withdrawals is not known. Table 5 provides the course grade distribution for each group: control and experimental. The results show a higher percentage of students (35.86%) in the face-to-face sections obtained an A, compared to the hybrid sections (26.72%).

Figure 1 shows the graphical results of Table 5 and includes the standard deviation error bars. Such standard deviation error bars overlap, which indicates that most likely such differences are not statistically significant. As will be shown in the next section, parametric and nonparametric statistical tests are performed to draw a definite conclusion to this suggestion.

Figure 2 provides the final exam grade distribution for each group: control and experimental. The results show a higher percentage of students (27.09%) in the face-to-face sections obtained an A, compared to the hybrid sections (18.32%). The standard deviation error bars, shown in Figure 2, do not always overlap (e.g.,

Table 5

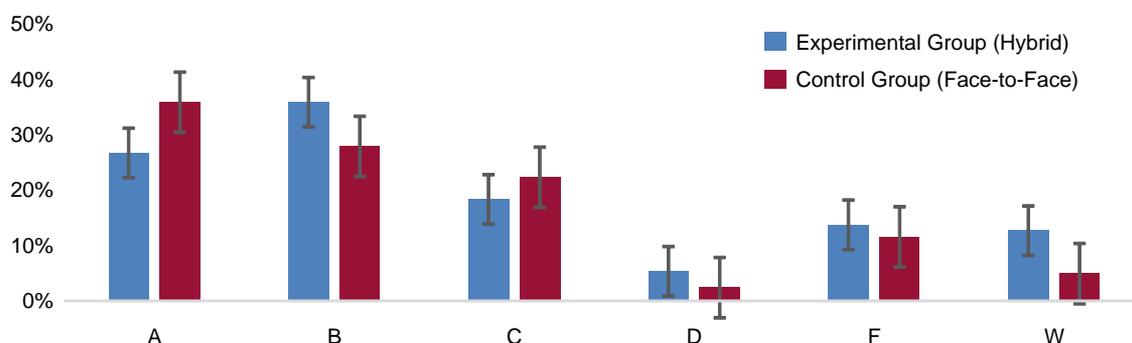
Macroeconomics course grade distribution (percentages)

Course format	Course grade						
	Observations (N)	A (%)	B (%)	C (%)	D (%)	F (%)	W (%)
Control (face-to-face)	264	90 (35.86)	70 (27.89%)	56 (22.31%)	6 (2.39%)	29 (11.55%)	13 (4.92%)
Experimental (hybrid treatment)	150	35 (26.72%)	47 (35.88%)	24 (18.32%)	7 (5.34%)	18 (13.74%)	19 (12.67%)
Total	414	125 (31.65%)	117 (29.62%)	80 (20.25%)	13 (3.29%)	47 (11.90%)	32 (8.10%)

Source: author's own work.

Figure 1

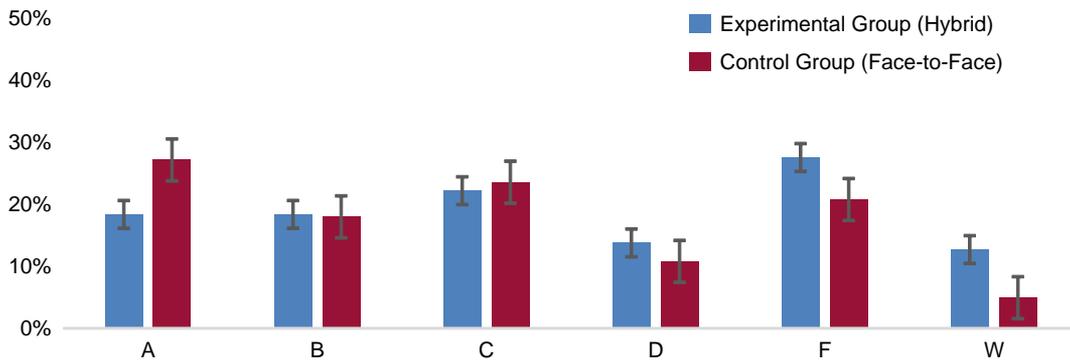
Macroeconomics Course grade distribution (percentages)



Source: author's own work.

Figure 2

Macroeconomics final exam grade distribution (percentages)



Source: author's own work.

grade A). This provides a clue that such a difference might be statistically significant. As will be shown in the next section, parametric and nonparametric statistical tests were performed to draw a definite conclusion to this suggestion.

Even though the data in Figures 1 and 2 show that course and final exam grades are higher in traditional F2F compared to hybrid courses, it does not confirm that such differences are statistically significant. Therefore, a two sample two-tail t-test was run with the null hypothesis being that the sample of grades from the control group (traditional F2F courses) and the sample of grades from the experimental group (hybrid courses) come from the same distribution and their means are the same. Note that demographic, gender, race and ethnicity data was not collected in this study. Their use in segregating the data was not considered necessary as it would not provide actionable data. In other words, in the event that online teaching had a different impact on different genders, for example, such a finding would not have been actionable as gender would not be used in changing or limiting students' enrolment in college courses. The drawbacks of lacking such data to deal with selection bias are noted in the Limitations section. Hence, the results were observed in aggregate assuming it to be a representative sample of the student body.

Table 6 shows the results of the parametric test using the 1 through 5 grading scale as shown in Table 3 and excluding students who withdrew voluntarily. The results show a p-value of 0.21 which fails to reject

the null hypothesis that students perform the same, regardless of the teaching modality: traditional F2F or hybrid. Although the students in traditional F2F performed slightly better than in the hybrid courses as shown by means of 3.74 vs 3.56, respectively, such a difference is not only small as they both translate into the same letter grade (i.e., B), but most importantly not statistically significant.

The t-test is a parametric test that assumes the sample is drawn from a normal distribution. If this assumption is relaxed, then the Mann-Whitney U test is conducted, which is the nonparametric equivalent of the independent t-test (Leech et al., 2014). The two samples, control and experiment groups, could likely be considered randomly drawn from the college student population since this course is an elective. The data are independent because the scores of students do not affect those of other students within and across the treatments. The data is an ordinal scale of measurement fulfilling the conditions for conducting a nonparametric test (Brace et al., 2006). The results are similar to the parametric test: no statistical difference was found on the final grades (p-value of 0.18) while there is a significance difference in the final exam scores (p-value of 0.03*) at 5%, but not at 1%.

Even though the findings suggest that there is no statistical difference between the two teaching modalities, F2F or hybrid, it is important to note that if the performance of particular tasks, such as summative assessments (e.g., final exams), are analyzed, there may be a statistical difference to 5% but not 1% between the

Table 6

Two sample two tail t-test

Course Grades	Observations	Mean	Variance	p-value
Traditional (Control)	251	3.74	1.66	
Hybrid (Experiment)	131	3.56	1.72	< 0.21
Final Exam Grades				
Traditional (Control)	251	3.20	2.17	
Hybrid (Experiment)	131	2.86	2.15	< 0.03*

Source: author's own work.

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two teaching modalities. For example, in the hybrid courses, students are able to perform the same as in F2F courses only through receiving higher grades in formative assessments, such as online discussion forums provided only in the hybrid courses compared to multiple choice quizzes in F2F courses, to make up for the lower grades in the summative assessments, like the final exam. Some teaching modalities may focus more on successful multiple-choice exam completions, like the F2F courses in this study, while others may prepare students for more essay-like questions which are deployed through online discussion forums, like the hybrid courses in this study. The students in this study seemed to react to the incentives and formative assessments that were given by the instructor. For example, when the course grade was affected by online asynchronous discussions, the students shifted focus towards these forums. Hence, the question might shift from the use of teaching modality to the instructional design of the course, regardless of the modality. How we want students to learn, through discussion forums, writing, case studies, or multiple-choice questions is an interesting topic that may need further analysis, and these findings suggest that students are reacting to incentives provided by faculty. It is important to note that most prior studies referred to in the literature had no changes in the instructional design between the various teaching modes. Such prior studies in the discipline of economics showed students' performance to be better in the face-to-face instruction. There is no sufficient data to conclude causation, meaning that the instructional design dictated the difference in the results of this study compared to the prior ones, but it might be an indication worth considering in future research.

Conclusion

This study aims to assess the efficacy of online blended instruction compared to face-to-face instruction in the discipline of economics. While most prior findings in this specific discipline show face-to-face instruction outperforming online instruction, this study shows no significant difference. These findings may help educators and institutions in planning future education and in providing a range of teaching modalities, including blended and online. This study shows that, in addition to the benefits associated with hybrid and online courses laid out by prior scholars, the shift does not negatively impact student performance in the specific discipline of economics as measured by the final grades of the students enrolled in the online blended economic courses at a US community college. The findings are based on data collected before the occurrence of COVID-19. The data during a pandemic may be significantly different due to instructional and student differences. Regarding instructional differences, Hodges et al. (2020) shows that emergency online instruction that was implemented during spring 2020 was not planned and designed to be performed as an online delivery and provides

significant differences to what is considered planned online instruction. Regarding student differences, other variables that affect their performance, such as health, psychological and economic hardship, are skewed to higher levels of alert caused by the health crisis during a pandemic versus an endemic situation. The pandemic-free data analyzed in this study is collected from a semi-experiment performed with students enrolled in twelve sections of Principles of Macroeconomics taught by the same instructor at a US community college during the most recent three-year period prior to the pandemic. The findings show that student performance does not change whether they are taught in a traditional face-to-face or in a hybrid section with online learning. On a general level, this study reinforces prior findings covering various disciplines taught in US higher educational institutions, that using traditional F2F or online teaching through hybrid courses does not affect student performance. On a more specific level, the study offers an important contribution to the discipline of economics, for which there was no convergence in scholarly opinion and findings. While the objective was the comparison of these two teaching modalities, this investigation becomes useful during the COVID-19 pandemic, which forced educational institutions worldwide to shift to emergency remote instruction. These findings may be useful to US educational institutions to make data-informed decisions in their long-term and post-pandemic investments regarding online instruction in the discipline of economics.

This study also paves the way for future research to explore the implementation of various online activities that would improve student performance. Most prior studies referred to in the literature review had no changes in the instructional design between the various teaching modes and showed that students outperformed in face-to-face instruction compared to online hybrid instruction in economics. This study implemented design changes to include online activities, such as asynchronous discussion forums that enables students to utilize the online environment as an instructional environment rather than a storage of content. There is no sufficient data to conclude causation, meaning that the instructional design dictated the difference in these results compared to the prior findings, but it might be an indication worth considering in future research.

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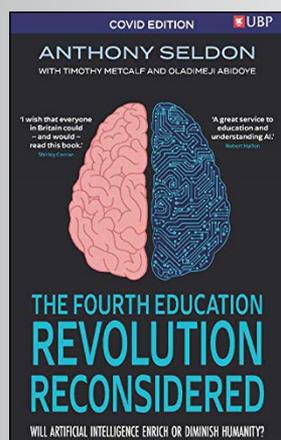
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Dorina Tila, PhD, is a professor at the Department of Business at City University of New York (CUNY) Kingsborough Community College. She is an online peer faculty mentor at the Kingsborough Center for e-Learning (KCeL), a lead Open Educational Resources (OER) adopter, as well as facilitator for *Using Data to Support Teaching and Learning* faculty interest group. In addition to academic teaching and research, she has previously worked at Ernst & Young and Deloitte and has consulted many U.S.- and non-U.S.-based multi-national companies on the economic and tax implications of various intercompany transactions for planning, restructuring, compliance and audit defense purposes. Equipped with corporate and academic experience, she is involved in projects that support student equity, including OER, online and culturally responsive teaching.

WE RECOMMEND

Anthony Seldon with Timothy Metcalf and Oladimeji Abidoye,
The Fourth Education Revolution Reconsidered: Will Artificial Intelligence Enrich or Diminish Humanity?



In this book its author stresses that “there is no more important issue facing education than the fast approaching revolution of Artificial Intelligence (AI) and what we term 4.0, the cluster technologies. (...) The history of education is the history of humanity. We are in the early morning of the fourth education revolution, with misty patches and hazy outlines, some tantalizing glimpses of what may lie ahead, but without a clear path yet defined.” The author points out the great advantages of the collection, analysis and visualization of very large data sets enabled and delivered by the use of AI. But at the same time, he warns that “all educators everywhere should open their eyes to what is coming towards us. If they do so, then our future will have the best chance to be shaped by us in the interests of all.”

Publisher: University of Buckingham Press, The 2020, Covid edition based on the book from 2018, available at <https://www.amazon.com/Fourth-Education-Revolution-Intelligence-Infantilise/dp/1800318243>

Joseph E Aoun, Robot-proof. Higher education in the age of Artificial Intelligence.

How can higher education prepare students for their professional lives when professions themselves are disappearing? In *Robot-Proof*, Northeastern University president Joseph Aoun proposes a way to educate the next generation of college students to invent, to create, and to discover – to fill needs in society that even the most sophisticated artificial intelligence agent cannot.

Aoun lays out the framework for a new discipline, humanics, which builds on our innate strengths and prepares students to compete in a labor market in which smart machines work alongside human professionals.

From the website <http://robot-proof.com/#about>
Publisher: MIT Press, 2018.

