A Case Study in How Covid Affected Grades for Different Student Demographics

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Most people use a course grade as a rough indicator of learning achieved in a course. This investigation looked at the effect of Covid on mean course grades by teaching method, student demographics, and college. It showed that there is a clear pattern of mean course grade increase in Spring 20 for different modalities, demographics, and colleges, with a slow decline thereafter to above pre-Covid levels. This pattern holds except in the Honors college which had the opposite pattern. The results also show that hybrid courses clearly maintain the highest mean grade level throughout the timeframe. Since the patterns were consistent across modalities, demographics, and colleges, these metrics don't affect mean grade patterns. These results may provide a clue that average grades and GPA are not good indicators of student learning. Although GPA is often the only indicator one has, this study discusses the use of course grades as a measure of learning and how effective it is.

Keywords: Covid, grades, hybrid, online, teaching methods

INTRODUCTION

Many authors have written on the effect of the Covid shutdown on student learning whether it is increased grades due to ease of cheating and lack of instructor awareness on mitigating the ability to cheat (Hosseini et. al 2021) or a decrease in grades due to the stress of the pandemic (Adedoyin & Soykan 2020). Most have reported increased problems with student learning. Son et al. (2020) indicated that 71% of students surveyed for their study faced increased stress levels due to COVID-19, and 82% experienced higher than normal academic performance concerns. Since the common measurement of student learning is course grade or student GPA, the authors wished to ascertain the effect of the Covid shutdown and following recovery on student grades.

Previously, there had been extensive studies (Moodie 2022) of what factors affected student grades from 2015 to 2019 at Kennesaw State University (KSU). This study used the previous results as a baseline. They then compared the average course grades for each term from Spring 2020 to Fall 2021 with the baseline, for various student demographics at KSU. The 2015-2019 study showed that teaching modality and student demographics affected average course grades. The study wanted to discover if these effects continued during the Covid period.

We start with definitions, followed by the research questions, literature review, and history of executive actions at KSU. We report the data analysis for different modalities, demographics, and colleges.

Definitions

Face-to-face (F2F) is a course taught completely in person. Hybrid in this paper is the traditional hybrid or flipped class where some of the class is in person and the rest is taught online asynchronously. The percentage of the hybrid course that is taught in person varies (e.g., at KSU, we have 33%, 50%, and 66% hybrid classes). For example, a three-credit course meets for 1 ½ hours a week for discussions and covers everything else online, including lectures and assignments. One can view the concept of hybrid education as a compromise between F2F and online teaching or alternately as taking the best parts of both.

Asynchronous online is a course taught totally (or at KSU more than 95%, as some courses have in person exams) online. That is the course does not require students to log on at certain times. Unless otherwise stated, all online classes used in this study are asynchronous online classes.

Synchronous online courses are those where students must log on together at the same scheduled times for joint classes. Transitioning to synchronous online from in person course is easier than to an asynchronous course.

Flex courses are where the instructor teaches some students in person and some online synchronously at the same time. This is probably the most difficult form of teaching.

Research Questions

The research questions that the research examines are:

1. Did average course grades vary across the Covid shutdown and Covid recovery terms?
2. Were students from different demographics, different methods. and in different university colleges have different student final grade outcomes from 2020 to 2021?

LITERATURE REVIEW

Covid Effects

Grades

El Said (2021) examined the effect of the sudden move from F2F to online because of Covid in Egypt. He found no significant difference in students' grades. However, students with low GPAs fared worse than those with high GPAs with this change. This may be due to less instructor and mentor support. Gnaur et al. (2020) looked in Denmark.at the changes due to Covid and said there was little change in exam grades. However, there was a greater spread in exam results. They concluded that students differ in how they benefit from changes to class modality. Hosseini (2021) in Canada found there was little differences in grades once technical problems were fixed. Karim (2021) reported that converting from hybrid to fully synchronously online for his course did not change the grades. The students preferred a take-home exam to an online one with a lock-down browser.

Englehardt et al. (2023) reported no major change in GPAs for business students because of Covid. However, freshmen and first-generation students did worse. They noticed significant grade inflation. This may be due to students becoming accustomed to the more flexible policies on grading that occurred during Covid. Karadag (2021) in Turkey showed an increase in grade inflation during Covid when classes switched from F2F to online. He thought this was caused by instructors compensating during Covid. Opstad (2022) in Norway reported that during the change due to Covid from school-based exams to take-home exams, resulted in better grades. Rodriguez-Planas (2022) noted that lower-income lower-performing students had a lower GPA during Covid than before, while upper-performing low-income students did not. However, this result may be due to allowing students to take classes pass-fail. Supriya et al. (2021) reported a small increase in grades during the Covid transition from in-person to online courses. However, students reported negative impacts on their learning. This was especially true for women. Vargos-Ramos et al. (2022) in Mexico showed that most students had improved grades during Covid. Interestingly, he showed that alcohol consumption hurt grades. Woman did the best.

Carper and Freidal (2021) explored hybrid education and found out hybrid design was critical. How the interaction of faculty, students, and technology occurred had a crucial role in student learning.

Takacs et al. (2023) in Hungary reported no change in dropout rates; less able students doing better; but lower grades overall during the Covid switch from F2F to online classes. This may be because instructors had little support during the change.

Student Attitudes

Andrews et al. (2022) looked at student attitudes post-Covid and found that Hybrid courses were far more popular over F2F and online. Fang et al. (2023) examined student learning experience during Covid in Australia. They reported a general student preference for blended learning. However, they reported problems with group projects when students lived in different time zones. Thamrin et al. (2022) in Indonesia showed that student learning was higher in hybrid classes during Covid. However, internet limitations caused some students problems.

Stearns (2023) reported that transfer students preferred their online classes, which were introduced during Covid, to large F2F classes.

Other Effects

Aucejo et al. (2020) showed that many students, especially lower-income students, have delayed graduation due to Covid. Carper and Freidal (2021) explored hybrid education during Covid and found out hybrid design was critical. How faculty, students, and technology interacted had a crucial role in student learning.

Hybrid

Many studies [from Stern (2004) to Amparo et al. (2018)] looked at the outcomes of pure online teaching compared to all-in-person teaching, often called face-to-face (F2F) in research. This study found far less research that compared hybrid teaching to online and F2F teaching [from Reasons, Valdares, and Slavkin (2005) to Lovern (2010)]. Another problem is a lot of previous research, such as McFarlin (2008), has considered only a single course or instructor. Some research, such as Blau and Drennan (2017), has considered student satisfaction with different methods and academic outcomes.

Publications That Did Not Include Student Demographics

Fidalgo-Blanco (2020) reported on using hybrid classes in Spain. Their small sample showed that hybrid classes increased student learning. Irani-Kermani et al. (2021) found that high GPA and female students reported higher grades in their hybrid classes over F2F classes in Canada. Kanetaki et al. (2022) in France and Greece modelled hybrid courses grade predictions. They generally showed lower predictions than actual results. In China and the US, Xing and Saghain (2022) reported that online classes had lower grades that F2F or hybrid. Xu and Jaggers (2013) hinted that student demographics can be different for different methods. Brau et al (2010) reported on completion and success results in a course transitioning from F2F to hybrid and online methods. They found that completion rates increased significantly as did success rates. They did not think this was due to better students entering online and hybrid sections. Hybrid sections had higher completion rates than online sections. Irani-Kermani et al. (2021) found that high GPA and female students reported higher grades in their hybrid classes over F2F classes in Canada.

Publications That Included Student Demographics

Cavanaugh and Jacuemin (2013) used a large sample size (5,000 courses) in one institution. They found no significant differences overall between online and F2F classes. They found that students with good pre-course GPA did better than those without. Online courses increased the effect of higher pre-course GPA. They also found that better students tended to do online courses, as the mean pre-course GPA was 3.41 for online students, while only 3.02 for F2F students.

Xu and Jaggers (2014) researched a very large data set of online and F2F courses (500,000 student-course sets). They did allow for differences in pre-course GPAs. They found that males, younger students,

black students, and those with lower pre-course GPAs did worse in online courses, while females and Asians had no significant differences. Older students did better in online courses. They also examined subject matter and reported that computer science, communication, and health had no significant differences. All others had F2F, giving better results than online courses. The social sciences, business, law, and nursing showed the biggest differences. The teaching method affected starting students more adversely than continuing students.

Nguyen (2015) summarizes research comparing F2F and online teaching methods. He found that generally research considers online learning as better but that there were problems with much of this research due to selection bias and a lack of rigorous methodology. Amro et al. (2015) showed that F2F students got higher grades for their algebra courses than those studying online. Although they looked at age and gender factors, they did not look at pre-course GPAs to see if the students had similar ability.

Bief and Brams (2016) compared student performance in online and F2F courses. They encountered mixed results; some studies showed the F2F courses were better and some the online courses. Sun and Chen (2016) reviewed 47 papers comparing online and F2F teaching methods. They concluded that online teaching works as well as or better than F2F if done properly. That is a course that has well-designed content, motivated interaction, and well-prepared and supported instructors.

Most studies did not look at the effect of demographic factors. Price et al. (2016) looked at the effect of different factors on student performance and satisfaction across methods. They looked at age, sex, interaction, clarity, control, and motivation. They found little correlation between age or sex and student outcomes. They found that course design (participant interaction, learner control, and course clarity) did affect student outcomes. method had no significant effect. Kim and Keuegar (2017) compared hybrid and F2F courses. They concluded that using two modalities, F2F and online, in the same course can be challenging to instructors. Baum and McPherson (2019) examined learning in online and hybrid sections, considering entering students' academic weakness. They suggested that students with weak academic backgrounds and other risk factors, including socioeconomic status, struggle in online classes. Hybrid classes do not exhibit these problems.

Moodie, (2021) used only data from KSU's business school courses. The biggest predictor of a student's final grade in a course was their previous university GPA at the start of the course. Generally, female students tend to get higher final grades than male students in all modalities and courses. Alien followed by Asian students tend to get the highest final course grades. Black students tend to get lower grades than other ethnicities. Hybrid gives the highest final course grades for all ethnicities. However, the hybrid advantage is largest for Blacks and least for Hispanics. Overall, hybrid grades were higher than online grades, which were higher than F2F grades. Hybrid courses tend to be junior or senior courses. Only half the business disciplines use hybrid modes. It could be argued that this may affect results. However, in all disciplines with hybrid courses, the hybrid mean course grade is higher than that for online or F2F.

Moodie (2022) examined student outcomes by demographic groups at Kennesaw State University between 2015 and 2019.The biggest predictor for final course grade was previous GPA but many students did not have a previous GPA. This showed that females achieved higher mean course final grades than males for all demographic groups. Blacks achieved lower mean course grades than all other groups. Other demographic and course differences (such as age, course level, etc.) were not as important. Hybrid sections had higher mean final course grades than equivalent F2F and online sections.

HISTORY OF COVID REACTIONS AT KSU

Table One shows the teaching modalities after KSU closed its campus in the middle of Spring 2020 and reopened its campus in Fall 2020. The chancellor, president, and provost decided on these alternatives.

TABLE 1
MODALITIES ALLOWED EACH TERM

Term, Year	Allowed Teaching Modalities
Spring 20	F2F and hybrid sections converted to synchronous online midway through the term.
Summer 20	There were no hybrid sections. With a few F2F sections taught synchronous online.
Fall 20	F2F and hybrid sections were offered synchronously online, some as flex.
Spring 21	Less F2F and hybrid sections offered than pre-COVID.
Summer 21	Mostly asynchronous online with a few Flex, F2F, and hybrid sections taught.
Fall 21	Back to normal with F2F, hybrid, and asynchronous sections. No flex.

ANALYSIS

This research uses data from the whole university to investigate the demographic effects on student outcomes. This study is not an analysis of an experiment but an analysis of an existing population data set which existed before the study began.

The Data Set

Kennesaw State University (KSU) provided every student-course record in KSU's Banner system from 2020 to 2021 for all KSU undergraduate courses.

Each student-course record set originally consisted of the following:

1) An arbitrary random number instead of a student name. The researcher deleted this column from the working database as not useful.
2) Final course grade in letters. This was converted to numbers; A = 4, B = 3, C = 2, D = 1, F = 0.
3) Previous overall university GPA of student at the start of course. This was missing for some students who were just entering KSU. Previous GPA varied from zero to four. Starting transfer and freshmen students would have no previous GPA. The analysis only deleted the students with no previous GPA when examining the effect of previous GPA analysis only.
4) Age. This varied from 14 to 75. The study removed all those under 18, a small number, for IRB reasons.
5) The analysis converted teaching mode [online (OL), hybrid (Hy), or all-in-person (F2P)] to zero-one variables. That is online is [1, 0, 0], hybrid is [0, 1, 0], and F2F is [0, 0, 1] for columns online, hybrid, and AIP.
6) Term – Fall, Spring, or Summer. Some analysis used one for summer and zero for Fall or Spring. This is because the summer term is a different length (2, 4, 6, or 8 weeks, rather than 15 weeks).
7) Calendar year.
8) Course Name - consisting of discipline and number.
9) College
10) Academic department home of the course. I deleted extraneous courses offered through non-KSU only entities.
11) Course Number. The first digit of course number gave the course level (1 = freshman, 2 = sophomore, 3 = junior, or 4 = senior)
12) Sex of student. This research converted this to male = 1, and female = 0.

13) Reported Ethnicity. This converted an ethnicity of Alien, Asian, Black, Hispanic, Multiethnic, and White to zero or one variables. For example, Alien was [1, 0, 0, 0, 0, 0] for columns Alien, Asian, Black, Hispanic, Multiethnic, and White. Other ethnicities, such as American Indian, Hawaiian, Pacific Islander, or none given were grouped under the together and would be [0, 0, 0, 0, 0] for Alien, Asian, Black, Hispanic, Multiethnic, and White columns.
14) This analysis did not use Instructor ID, which was an assigned random number.
15) Previous number of F2F courses taken.
16) Previous number of hybrid courses taken.
17) Previous number of online courses taken.

This gave 699,131 student-course data records for the analysis. The researcher removed from the dataset all the student-course record sets that had no grade awarded, or had a grade of I (incomplete), S (satisfactory), or U (unsatisfactory), as these grades did not give a full indication of student learning. This gave 615,964 records.

However, there was missing data under some demographics or circumstances, such as the course being the first that the student did at KSU with no previous GPA attached. As a result, the number of records used for some analysis was smaller.

Basic Characteristics of the Dataset

Table Two shows the basic properties of each variable in the data set.

TABLE 2
PROPERTIES OF ALL VARIABLES WITH MEAN AND STANDARD DEVIATION OR PERCENTAGE OF TOTAL DATASET

Variable	Mean or %	Standard Deviation
Student Grade	3.120	1.135
Previous GPA	3.188	0.61
Course Level	2.114	1.089
Student Age	21.515	4.955
Previous F2F	14.255	12
Previous Online	5.311	5.074
Previous Hybrid	0.937	1.349
Male	49.8%	
White	49.9%	
Black	23.3%	
Asian	5.6%	
Hispanic	12.6%	
Alien	1.7%	
Multi-racial	4.9%	
Summer Sections	12.1%	
Previous # Sections F2F	49.3	
Previous # Sections Hybrid	3.8	
Previous # Sections Online	46.9	

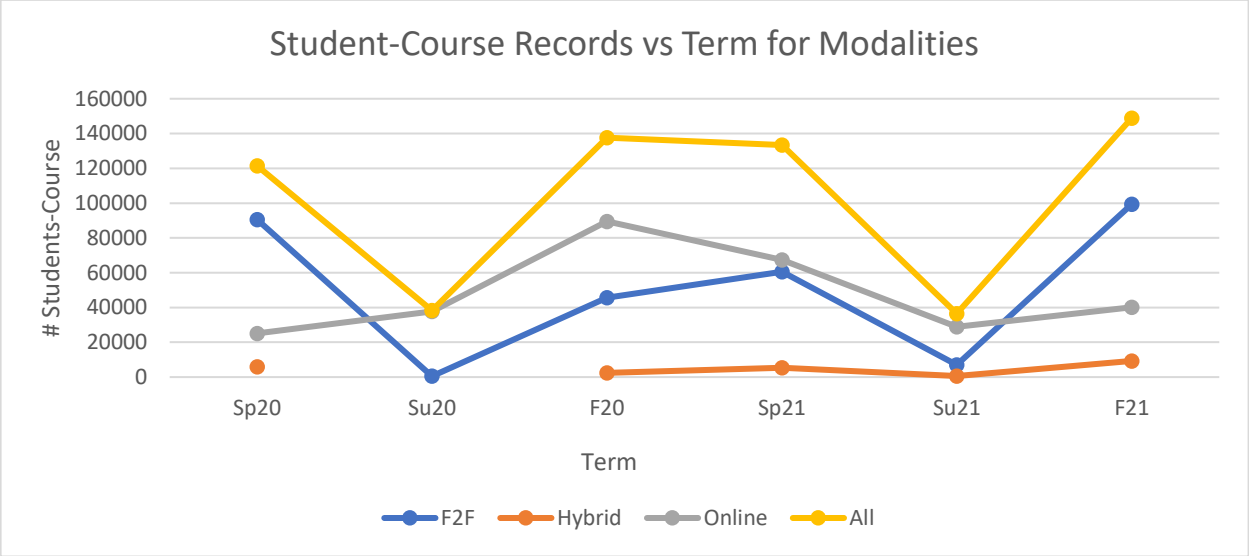
RESULTS

The results are in graphical form and present the findings of demographics, modalities, and colleges within the university on mean grades. Figure One gives the background with a number of student courses

for each modality by term. Most charts show data for each 2020 to 2021 term, with an average presented for the 2015 to 2019 term as a comparison to the COVID time frame.

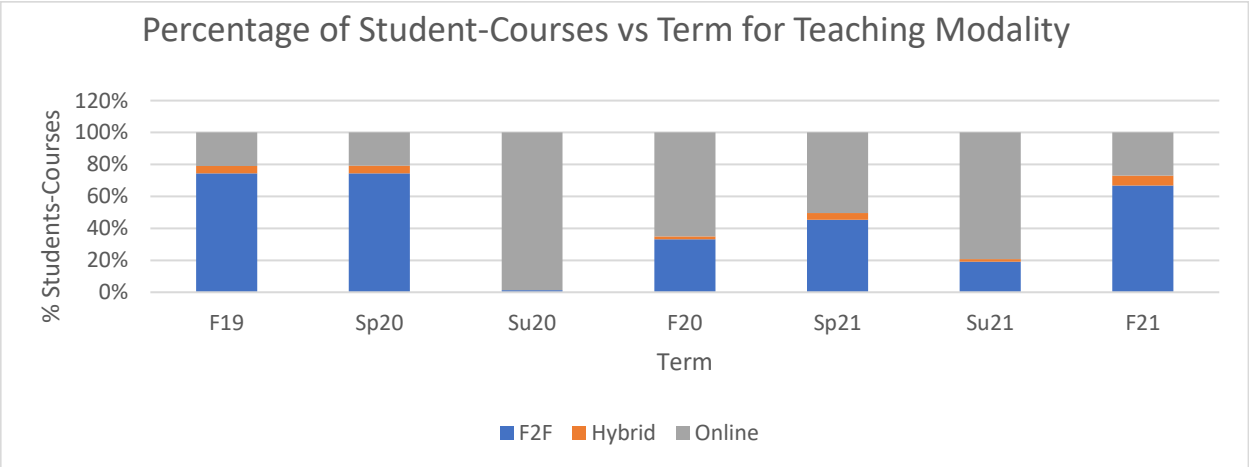
Background Results

FIGURE 1
NUMBER OF STUDENT-COURSES IN EACH MODALITY BY TERM



Note that Figure One shows that hybrid sections are a small percentage of the total. KSU labeled synchronous online or Flex as F2F, and online is purely asynchronous online. The totals for all increased due to increased student enrollment with time.

FIGURE 2
PERCENTAGE OF STUDENT-COURSES IN EACH TEACHING MODALITY BY TERM

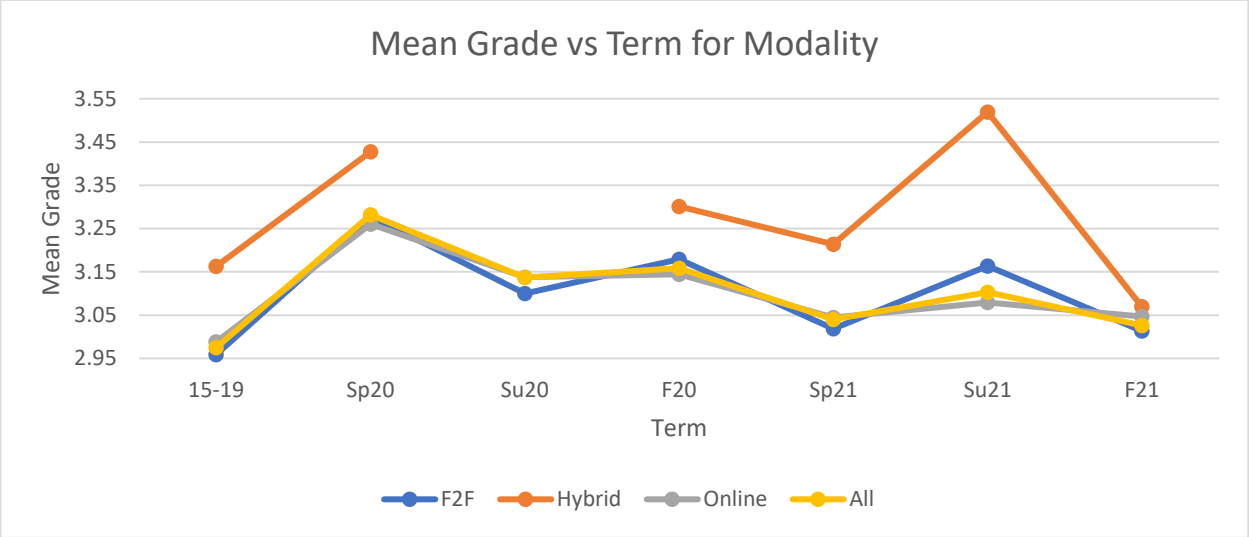


As Table Two shows, the percentage of online and hybrid student courses has increased between fall 19 and fall 2021; however, other than the COVID summer 2020 period and the summer 2021 period, F2F remains the highest percentage of student courses taken.

Effect on Average Course Grades

The study compared the mean grade results from the 2015-2019 previous research period designated as '15-19' to the spring 2020 through fall 2021 period during the height of the COVID pandemic. Note that in the summer of 2020, F2F sections were taught synchronously online.

FIGURE 3
AVERAGE GRADE FOR SECTION MODALITY BY TERM



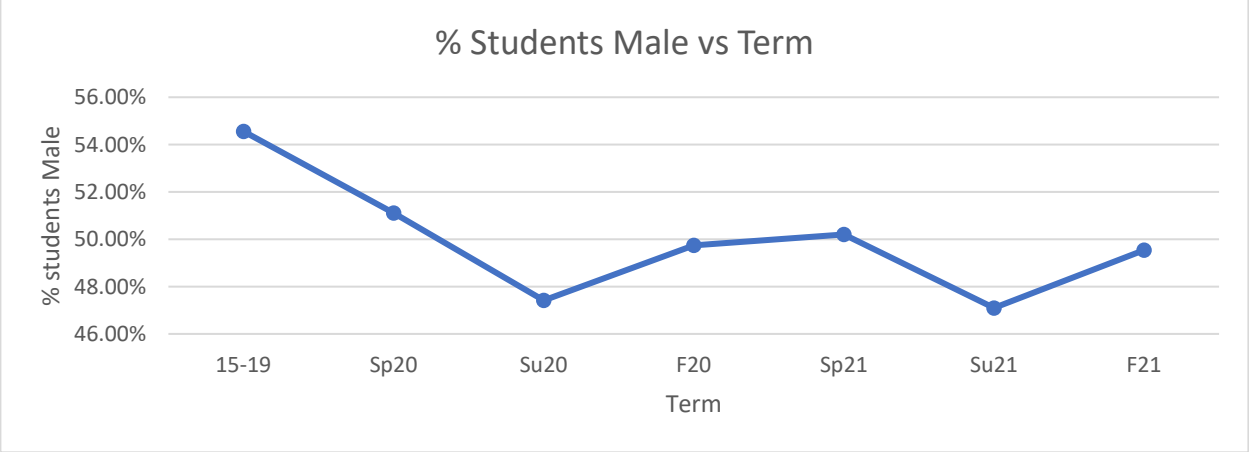
In Spring 20, the President of KSU asked faculty to be generous in grading. As a result, mean grades for all modes shot up. The general grade trend was then down from increased grades awarded when Covid hit mid-Spring 2020. After that, dropped back slowly towards but not back to pre-Covid levels.

Even though it appears as though mean grade levels increased for the hybrid modality in summer 2021, the number of hybrid courses is so small that the hybrid grade spike probably means nothing.

Effect of Sex on Grades

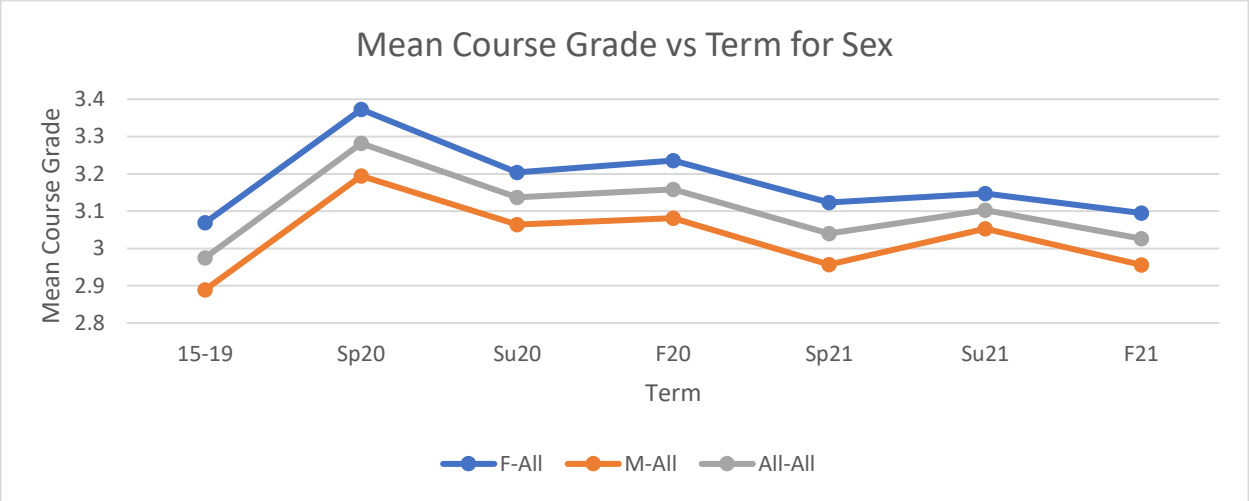
The study looked at whether this grade effect was affected by sex.

FIGURE 4
PERCENTAGE OF STUDENTS-COURSES THAT ARE MALE BY TERM



If one ignores the summer terms, the percentage of males dropped in spring 2020 from the 2015-2019 period and levelled off afterwards.

FIGURE 5
THE AVERAGE GRADE FOR EACH TERM FOR EACH SEX



Comparing the mean course grade for the designated sexes, female students, as in the previous study (15-19), do better in all terms. For all sexes, the mean grade went up in Sp20 (as per the President's instructions of grade generosity, then fell back down towards the previous mean with a constant difference between male and female. However, the trends of the same for both sexes.

Next the analysis looked at splitting this Sex effect by teaching modality.

FIGURE 6
MEAN COURSE GRADE FOR SEX AND METHOD OVER TERMS

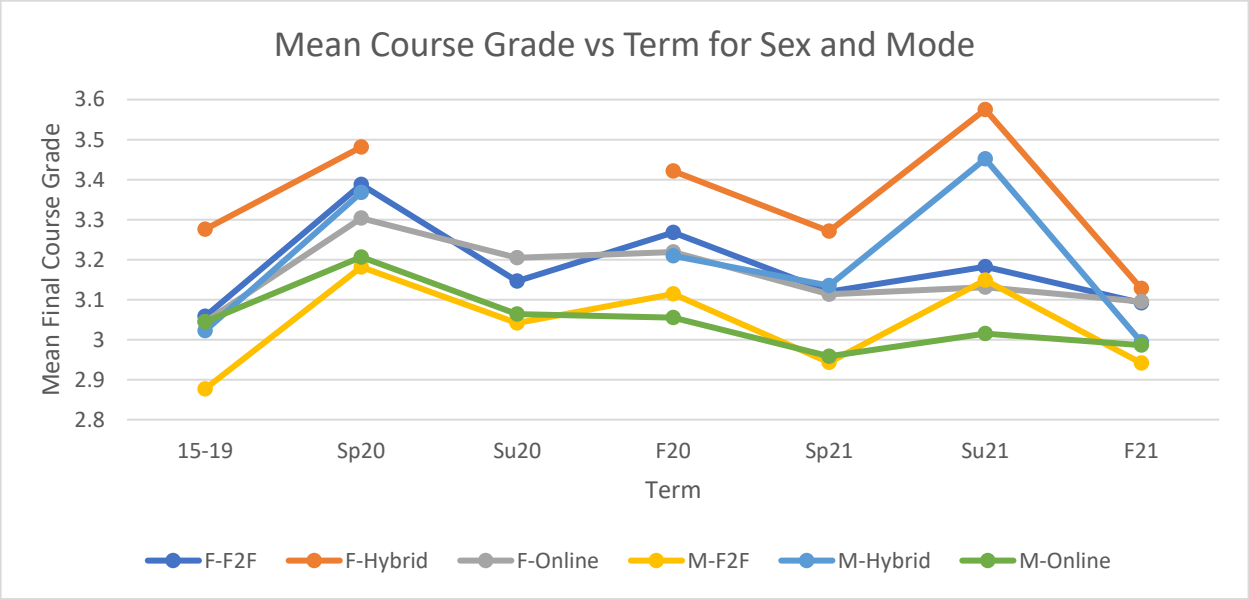
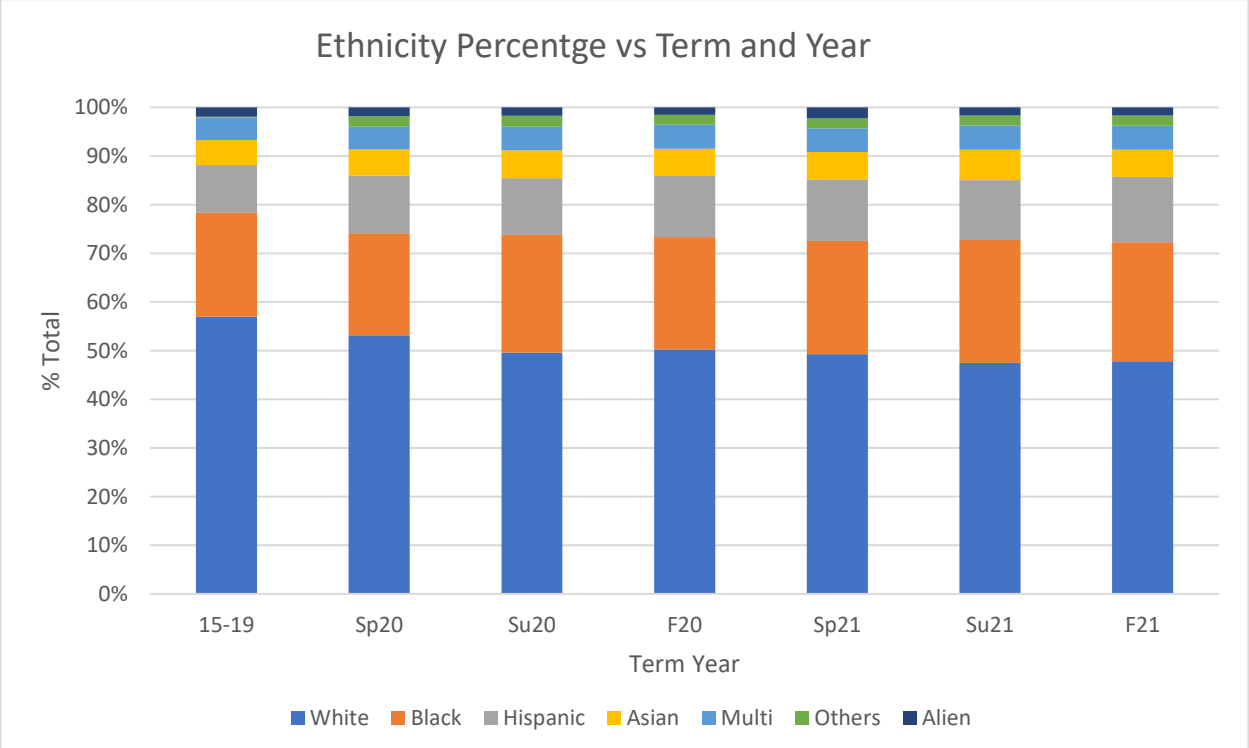


Figure Six follows the same pattern as Figure 3 and a similar pattern to Figure 5. There is a rise in the average grade during Covid, followed by a slow decline. Note there are very few summer hybrid sections. However, this analysis shows that although the pattern is the same between modalities and sexes, there is no clear distinction between the online and F2F mean grade levels even when accounting for sex. The hybrid modality does clearly have the highest mean grade level.

Layering on another demographic to see if there was a change in grade pattern or trend, the analysis looked at the effect of self-reported ethnicity. The other ethnicities include American Native, Pacific Islander, unknown, refuse to state, and missing.

Effect of Ethnicity on Grades

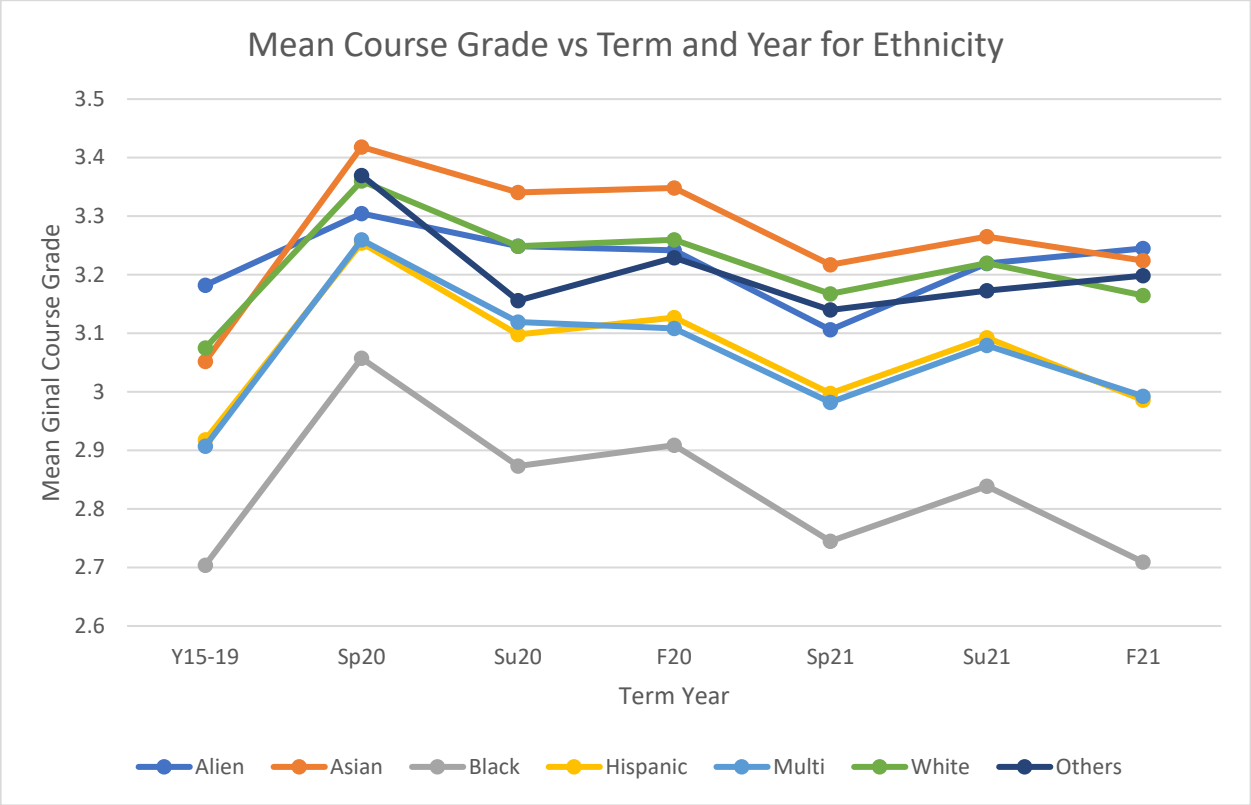
FIGURE 7
COMPOSITION OF STUDENT-COURSES BY ETHNICITY OVER TIME



Note that there has been a steady decline in the percentage of White and an increase in those of Hispanic and Multi-ethnic groups. These ethnicities were self-reported. Others included students who refused to state ethnicity, Pacific Islanders and original natives.

All groups show a major rise in mean grade in Spring 20 when Covid struck, followed by the same decline to previous grade level over time as reported in the other figures. Blacks are the only group to have reverted completely to pre-Covid Grade levels. Multi-ethnic and Others show a rise since Spring 21. This indicates that the mean grade trends remain the same between modality, sex, or ethnicity and there is no change in the established patterns.

FIGURE 8
MEAN COURSE GRADE FOR ETHNICITY OVER TERMS



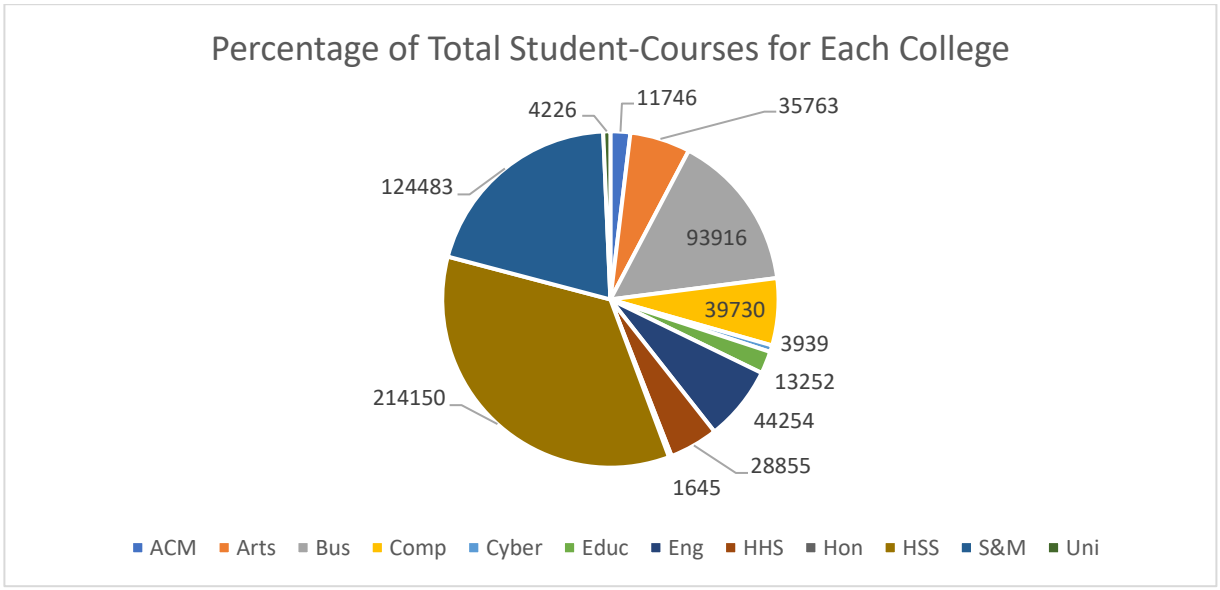
Effect of College on Mean Grades

The report uses the following abbreviations for colleges, which vary widely in size.

TABLE 3
COLLEGE ABBREVIATIONS EXPLAINED

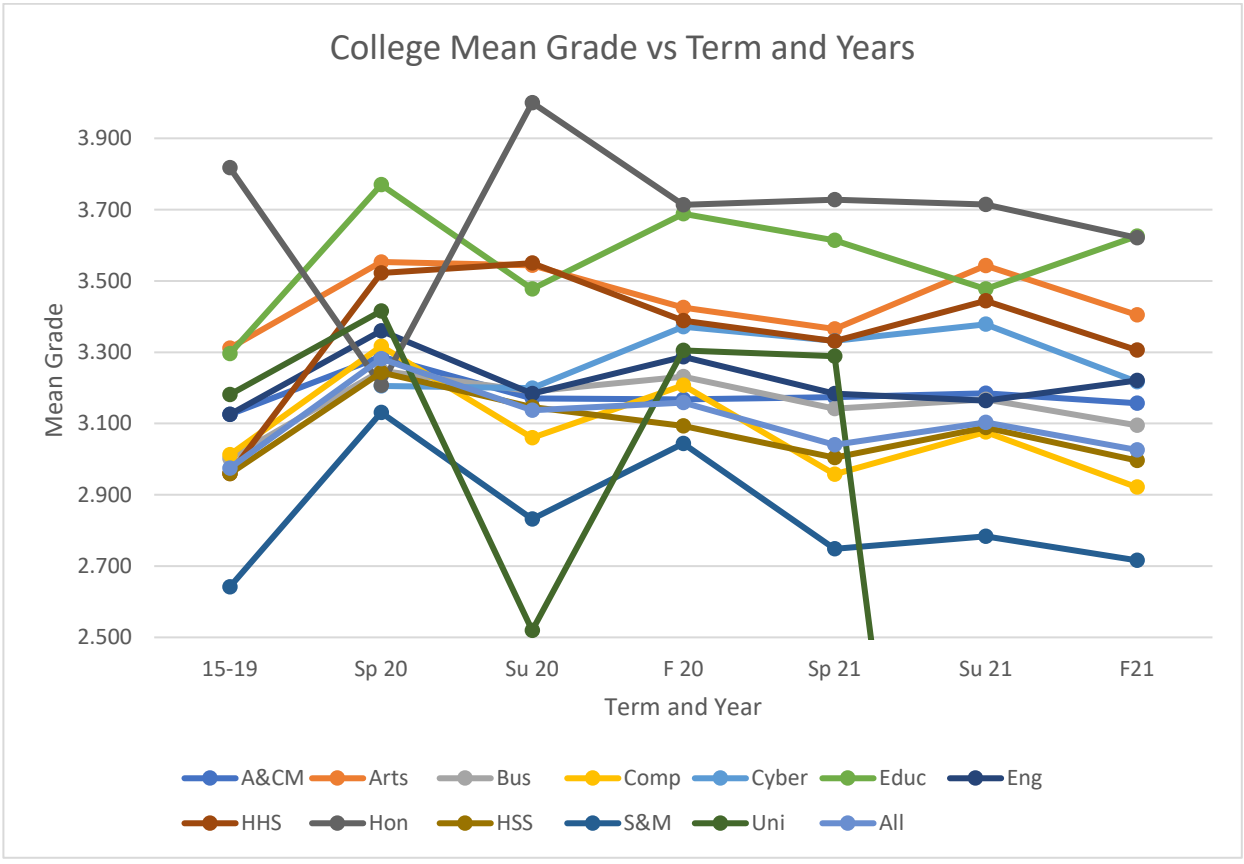
Abbreviation	Full Name of College	# Student-Courses
A&CM	Architecture and Construction Management	11746
Arts	Arts	35763
Bus	Business	93916
Comp	Computing and Software Engineering	39730
Cyber	Institute for Cyber Security	3939
Educ	Education	13252
Eng	Engineering and Engineering Technology	44254
HHS	Health and Human Sciences	28855
Hon	Honors	1645
HSS	Humanities and Social Sciences	214150
S&M	Science and Mathematics	124483
Uni	University	4226

FIGURE 9
COLLEGE STUDENT-COURSE SHARE, 2020 TO 2021



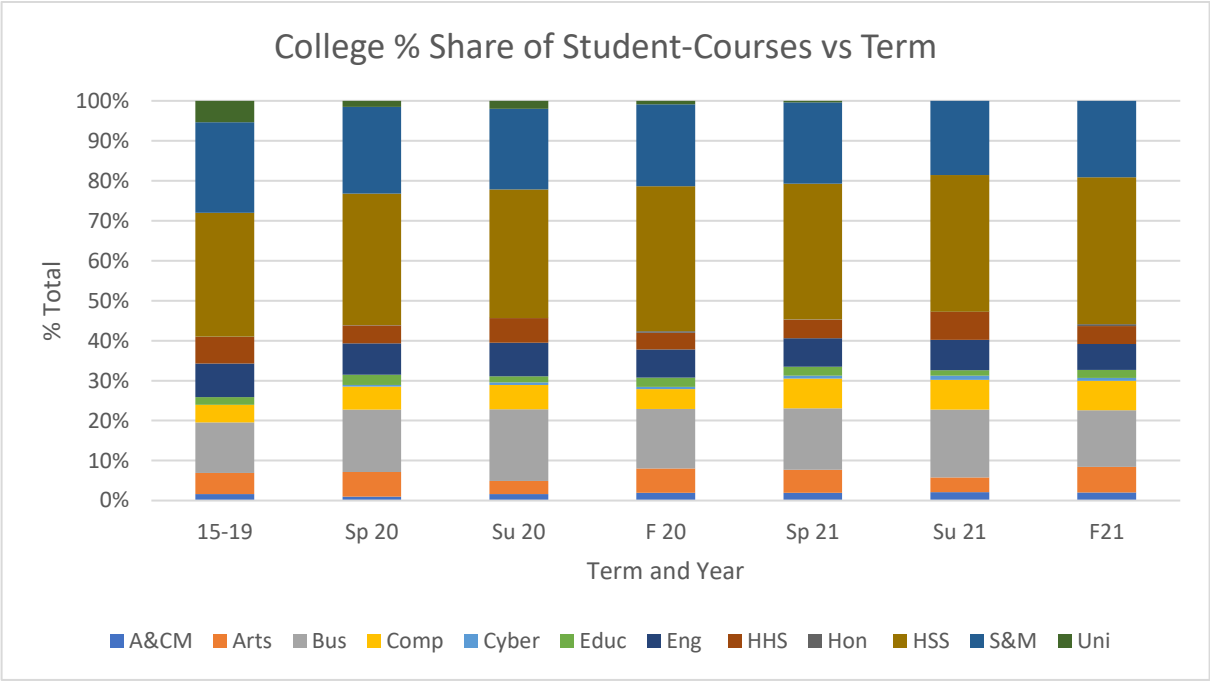
Note that University College was phased out in Summer 2021.

FIGURE 10
MEAN COURSE GRADE FOR EACH COLLEGE OVER TERMS



Note that all colleges, except Honors College, show a bump in mean course grade when Covid arrived. Most show a trend downward later. The patterns for the most part are erratic though the colleges of humanities and social sciences (HSS), business (Bus), engineering (Eng), architecture and construction management (A&CM), and computing and software engineering (Comp) exhibit similar patterns and average mean grades over the time frame presented and exhibit the same similar pattern found in Figures 3, 6, and 8. This shows consistency in mean grades across the university's colleges and that the mean grades of several of the largest colleges on campus maintain similar grade levels irrespective of demographics or modalities. The Honors College reacted opposite to Covid, although the mean grades pattern began to shadow the other colleges' patterns in the summer of 21. The University College was phased out during this period and abolished by Summer 21. Cyber only started in the spring of 2020 and is an all-online stand-alone institute, not a college.

FIGURE 11
COLLEGES' SHARES OF STUDENT-COURSE OVER TERMS



CONCLUSIONS

This study examines the effect of COVID-19 on mean course grades, by teaching method, student demographics, and college as a means of learning achieved in each course. The investigation set out to answer two questions: 1) Did average course grades vary across the Covid shutdown and Covid recovery terms? And 2) Did students from different demographics, methods, and parts of the university have different student final grade outcomes from 2020 to 2021?

For question 1, yes, there was a clear pattern of a big rise in average course grade followed by a slow decline. The results show that there is a clear pattern of mean course grade increase in Spring 20 for different modalities, demographics, and colleges, with a slow decline thereafter to above pre-Covid levels. However, the increase in the mean grade for Spring 2020 seems to be a result of the President's grading generosity versus an increase in student learning. The examination of the data in this case indicates that the increase in mean grades did not result from increased learning, bringing in to question the use of grades as a proof of student learning.

This stated pattern holds for all modalities, demographics, and colleges except in the Honors college which had the opposite pattern. This may indicate that online learning during the pandemic did not result in learning for the honors college students as this is not their preferred modality. As in previous research, hybrid modality or format exceeds in-person and online modalities. Different colleges and demographics do a different proportion of each modality. This confounding may explain the variation. The results did indicate that hybrid courses maintain the highest mean grade level throughout the timeframe.

Since the patterns were consistent across modalities, demographics, and colleges, these metrics don't affect mean grade patterns. These results may prove that average grades and GPA are not good indicators of student learning. Although GPA is often the only indicator one has, this study discusses the use of course grades as a measure of learning and how effective it is.

DISCUSSION AND FUTURE INVESTIGATIONS

Based on the results of this study, some future research questions arise. Since the data only runs through 2021 and this study sees a decrease in the mean course grade from the Spring and Summer 2020 online switch, will this grade inflation due to Covid continue? Or will it continue to decay to pre-Covid levels? The overall increase in mean course grades also then brings into question grades as a measure of learning and how accurate those grades are, based on the increase in grades during Covid, as a means of student learning.

This study also shows a higher mean course grade for the hybrid teaching modality. Whereas much of the research focuses on F2F and online teaching methods, and many universities seem to be adopting more online classes, what will the continued trend be for teaching modalities?

Finally, with a seemingly higher increase in the mean course grade and potentially student learning for the hybrid modality, will higher education institutions adopt more flexible modalities and move away from F-2-F? This is an area where research is lacking and needs further exploration.

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