

Comparing the Outcomes of the Different Teaching Modes for Different Student Demographics in a Business School using Hybrid Teaching Instructors Only

Douglas Rome Moodie

School of Management, Entrepreneurship, and Hospitality, Kennesaw State University

Abstract— This study was to explore whether certain demographics of students were drawn to certain formats and whether certain demographics did better in certain teaching formats.

This study used data from five years of courses that were taught in the Coles College of Business at Kennesaw State University (KSU) from 2015 to 2019. This data set with individual student and course outcomes, included full student demographics including previous university grade point average (GPA). Previous results showed that for all demographics, hybrid course sections gave better final mean course grades than online sections, which in turn gave better mean final grades than F2F sections. However, instructors who taught hybrid sections also gave higher mean course grades for F2F and online sections than those who did not teach hybrid. Thus, the study only looked at those instructors who taught hybrid sections.

The results showed that student demographics do change with teaching format and that online and hybrid sections had higher mean course grades for hybrid teaching instructors.

This study supports promoting the hybrid method of teaching.

Keywords—component; formatting; style; styling; insert (key words)

I. INTRODUCTION

Hybrid (also called flipped) mode education is becoming more common. This study found far less research comparing hybrid format teaching to online and face-to-face (F2F) teaching formats. Nearly all this research assumes that there is no difference in the students entering different format sections of a course. Many studies from [1] to [2] have looked at the outcomes of pure online teaching compared to face-to-face (F2F) teaching. This study found far less research, from [3] to [4], comparing hybrid teaching to online and F2F teaching. A possible gap in these comparisons is that nearly all the researchers assume that there is no

difference in the characteristics of the students entering F2F, hybrid, or online sections of a course. Most comparison research, such as [5], has considered a single course or instructor. Some research, such as [6] has considered student satisfaction with different teaching modes, as well as the academic outcome or grades.

The concept of hybrid education is to use the best of F2F and online teaching. At Kennesaw State University (KSU) during Covid because of social distancing, nearly all in person classes were converted to online or later, hybrid courses. Until Covid, KSU only offered traditional hybrid and asynchronous online teaching. During Covid, KSU has also offered synchronous online and rotational hybrid modes. Also, KSU forced many traditional F2F only instructors to use rotational hybrids or online formats with little or no training or experience. Thus, this research uses no data after Fall 2019, to avoid any tainting due to unwilling or untrained instructors. KSU also instructed instructors to grade leniently during Covid, which may also taint such information.

The research gap identified is that there may be a difference in demographics between students who opt for one mode over the others, and that certain student demographic groups may do better proportionally in certain teaching formats. This research uses the entering characteristics of students, a large sample of many instructors, and the final mean course grade achieved for a large university over several years, to see if the benefits (including negative benefits) of hybrid and online over F2F modes depends on the characteristics of the entering student. [7] and [8] hinted that student demographics can be different for different modes. This analysis used data from instructors who taught hybrid sections, as [9] had found that hybrid teaching instructors gave higher than average final mean course grades in their F2F and online sections, compared to non-hybrid teaching faculty. Thus, in using only instructors that taught some hybrid sections, the research negates the effect of these higher instructor-based grades.

II. RESEARCH QUESTIONS

Thus, the research questions that the research examines are:

1) Is there a difference (both demographic and previous academic achievement) in students doing the different modes? The hypothesis is that there are such differences.

2) How do different demographics affect student outcomes in different modes? That is the difference in mean course final grades between different groups. The outcomes here are the final course grade for the section. the hypothesis is that some teaching formats benefit some demographic categories more than others.

III. LITERATURE REVIEW

The literature will report on how previous research has examined the difference in the type of students taking different modes or whether the research assumed that students taking different were the same on average. We first examine the larger research output that does not include hybrid courses, then the smaller research that includes hybrid courses.

A. *Online to F2F Comparisons with No Examination of Student Type*

[1] examined online and F2F instruction for one course and concluded that online mode works as well as F2F if online instructors have enough time to do a thorough job. [10] compared grades for online and F2F writing courses. They showed that more students thrived (defined as A or A-) in F2F courses than online courses (32% to 52%). [11] examined grades for online versus F2F for a statistics course. They found no significant output difference between modes of teaching. [12] reported that she could find no significant difference between student grades for online and F2F modes. She did not look at the effect of different entering GPAs. [13] found no differences between online and F2F sections of a graduate human development and an undergraduate psychology course. [14] found that there were no significant differences in outcome between online and F2F classes. [2] used a very large sample (96,000 students) across two institutions to compare online and F2F results. They found that F2F students outperformed online students in course final GPA. [6] used student's perceptions to compare different

teaching formats and suggested that universities find ways to increase perceived favorability of online and hybrid courses for those that prefer F2F.

None of these studies examined pre-course university grade point average (GPA) self-selection, that is do more academically able students prefer a particular type of instruction? In conclusion, most previous research, which compared online and F2F sections of courses, did not examine differences in pre-course GPAs or any demographics of students. Nearly all found no significant difference in final course grades or that online courses achieved worse final course grades than F2F ones.

B. *Online to F2F Comparisons Including Student Demographics*

Most studies did not look at the effect of demographic factors. However, [8] found that better students tended to choose online courses. [7] showed that the difference between online and F2F depends on race, gender, previous GPA, and age. In fact, they showed that older students did slightly better in online courses. These two studies hinted that demographics and pre-course GPA might affect course outcomes. [7] 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, and older students did better in online courses. They also looked at subject matter and reported that computer science, communication, and health had no significant differences. All others had F2F doing better than online courses. The social sciences, business, law, and nursing showed the biggest differences. Teaching mode affected starting students more adversely than continuing students. They showed that the difference between online and F2F depends on race, gender, previous GPA, and age. In fact, they showed that older students did slightly better in online courses. These studies hinted that demographics and pre-course GPA might affect course outcomes.

[15] summarizes research comparing F2F and online teaching modes. He found that generally research considers online learning to be better but that there were problems with much of this research. [16] showed that for their algebra courses, F2F students got higher grades than students studying online did. Although they looked at age and gender factors, they did not look at pre-course GPAs

to see if the students were similar in academic ability.

[17] compared student performance in online and F2F courses. They encountered mixed results; some studies showed the F2F course was better than some of the online courses. [18] did a review of 47 papers comparing online and F2F teaching modes. They concluded that online teaching works as well as or better than F2F if done properly. That is well-designed content, motivated interaction, and well prepared and supported instructors.

[2] used a very large sample (96,000 students) across two institutions to compare online and F2F results. They found that F2F students outperformed online students in course final GPA. However, they did not compare entering overall GPA to test whether entering students were of similar ability.

In conclusion, most previous research compared online and F2F sections of courses and did not allow for differences in any pre-course GPAs or demographics of students. They nearly all found no significant difference in GPA or that online courses achieved worse final grades than F2F. Most studies did not look at the effect of demographic factors. However, [8] found that better students tended to choose online courses. [7] showed that the difference between online and F2F depends on race, gender, previous GPA, and age. In fact, they showed that older students did slightly better in online courses. These two studies hinted that demographics and pre-course GPA may affect course outcomes.

C. Hybrid Comparisons that did not Examine Student Demographics

Several studies looked at comparing hybrid to either or both F2F and online modes. [3] examined the three teaching formats and concluded that online was better in achieving a higher final course grade than hybrid or F2F. [5] examined grade results for hybrid and online sections. He found that student learning, as represented by grades, increased in hybrid and online sections compared to F2F sections. [4] found no significant difference in outcomes between online, hybrid, and F2F sections of the same course. They did not examine pre-course GPA self-selection. [19] looked at a lab class that they offered in the three formats. They concluded that grades were highest in a hybrid mode, and lowest in a pure online format.

Several studies looked at comparing hybrid to either or both F2F and online modes. [20] looked at students' experiences rather than outcomes in online and hybrid classes. They found that students preferred hybrid classes, but some students preferred online courses.

This maybe reflected the student's learning style.

[21] reported on student perceptions of the three modes for one course. He concluded that students felt that hybrid sections were more difficult for this technology heavy course. [5] examined grade results for hybrid and online sections. He found that student learning, as represented by grades, increased in hybrid and online sections compared to F2F sections.

D. Hybrid Studies that Looked at Student Experiences

[22] looked at hybrid sections, as well as online and F2F. Unfortunately, they used student perceptions of learning effectiveness not actual learning achieved as a variable. They did not look at whether students self-select types of course by their pre-course GPA. They showed that students preferred hybrid to online and online to F2F. Others compared the three modes' outcomes based on the training that the instructors had had. He found that online learners were older and had better computer competency.

[4] found no significant difference in outcomes between online, hybrid, and F2F sections of the same course. They did not examine pre-course GPA self-selection. [23] reported on completion and success results in a course transitioning from F2F to hybrid and online modes. 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 had higher completion rates than online sections.

[24] looked at student preferences and outcomes between F2F and online activities. They found no difference in learning outcomes but found students preferred online for written assignments and F2F for discussions. [25] looked at the effect of factors on student performance and satisfaction across modes. 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. Mode had no significant effect.

[26] compared hybrid and F2F courses. They concluded that using two modes, F2F and online, in the same course can be challenging to instructors. [27] examined the three modes of training for one US Air Force course. She found no difference in customer satisfaction between the three modes [28] assessed student performance in hybrid and online

classes. They found no difference in student grades, but higher student evaluations in online courses. [29] examined online and hybrid learning taking account of the academic weakness of entering students. They suggested that students with weak academic backgrounds and other risk factors, including socioeconomic status, struggle in online classes. Hybrid classes in their study did not exhibit these problems. The research that includes student demographic differences showed it sometimes affected student outcomes. In these studies, hybrid formats often achieved better outcomes to either online or F2F formats.

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E. Hybrid Comparisons that Looked at Student Demographics

[30] reported on completion and success results in a course transitioning from F2F to hybrid and online modes. 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. They examined learning in online and hybrid sections, taking account of the academic weakness of entering students. They suggested that students with weak academic backgrounds and other risk factors, including socioeconomic status, struggle in online classes. Hybrid classes in their study did not exhibit these problems. The research that included student demographic differences showed it sometimes affected student outcomes. In these studies, hybrids often achieved better outcomes to either online or F2F formats.

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In conclusion, most previous research compared online and F2F sections of courses and did not allow for differences in any pre-course GPAs or demographics of students. They nearly all found no significant differences in previous GPA or that online courses achieved worse final grades than F2F. Most studies did not look at the effect of demographic factors.

IV. METHODOLOGY

The study used an existing dataset, which was not from a survey, but was all the records of all the students in all the sections for all of the courses for the years covered offered by KSU. The study used a subset of this data set based on only records of student-courses that has had an instructor who had taught a hybrid section. Thus, there is no survey or applied research design. The research analyzed this smaller data set using basics statistics and by manipulating the dataset in an Excel spreadsheet. However, this was not a sample analysis but a complete population analysis.

A. The Data Set

KSU provided every student-course record in KSU's Banner system from Fall 2015 to Fall 2019 for all KSU undergraduate courses. The analysis did not use later data available because of Covid-19. When Covid arrived, all F2F and hybrid sections went completely online within 4 days. Many of our instructors had never taught online before. In addition, the administration told instructors to give the students benefit in grading for the stresses of lockdown, etc. KSU has offered since Covid, synchronous online, plus rotating hybrids, as well as standard hybrid. Many instructors had to teach online for the first time with little or no training. Thus, the course grade they awarded during Covid were skewed upwards and not useful for determining a comparison of teaching modes. The study considers any data after Fall 2019 as tainted.

The research removed from the data set all student-record data that had no grade awarded, or had a grade of I (incomplete), S (satisfactory), or U (unsatisfactory), as these grades did not give an indication of student learning.

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

- 1) An arbitrary random number instead of student name. The researcher deleted this column from the working database as not useful.
- 2) **Course grade** in letters 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. Student's previous GPA varied from zero to 4. Starting transfer and freshmen students would have no previous GPA.

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 the **Teaching Mode**, online (OL), hybrid (Hy), or face-to-face (F2F), to zero-one variables. That is online is [1, 0, 0], hybrid is [0, 1, 0] and F2F [0, 0, 1] for columns online, hybrid, and F2F.

6) **Term** – Fall, Spring, or Summer. Some analysis used 1 for summer and 0 for Fall or Spring. This is because the summer term is a different length (8 weeks rather than 15 weeks) and a different set of students.

7) **Calendar Year.**

8) **Course Discipline** - either accounting [ACCT], economics [ECON], entrepreneurship [ENTR], information systems [IS], information security assurance [ISA], management [MGT], or sales and marketing [MKTG].

9) **Course Number** - the study used the first digit for the course level; 1nnn - freshman, 2nnn - sophomore, 3nnn - junior, or 4nnn - senior.

10) **Sex** of student. This converted this to Male = 1, and Female = 0.

11) **Ethnicity.** This converted an ethnicity of Alien, Asian, Black, Hispanic, Pacific, and White to zero or one variables.

For example, Alien was [1, 0, 0, 0, 0, 0, 0] for columns Alien, Asian, Black, Hispanic, Multiethnic, Pacific, and White. Other ethnicities, such as Pacific Islander, unknown, or missing, would be [0, 0, 0, 0, 0] for Alien, Asian, Black, Hispanic, Multiethnic, and White columns.

12) This analysis used **Instructor ID** to identify who are the hybrid teaching instructors. There were 232 instructors, of whom 16 (6.9%) taught hybrid sections. The study grouped by instructor ID and removed all the instructors who did not teach any hybrid sections.

The original data set had usable 118280 student-course records for analysis. The analysis removed all those data sets that were not taught by instructors who did not teach hybrid sections, leaving 9883 (8.4% of original) student-course records.

B. Hybrid Teaching Instructors are Different

Figure 1 comes from analysis of the complete data set and shows why this study separated the data from the instructors who teach hybrid sections from the data from all instructors who taught any business course. They study defined hybrid types as instructors who teach hybrid sections, as well as F2F and/or online sections.

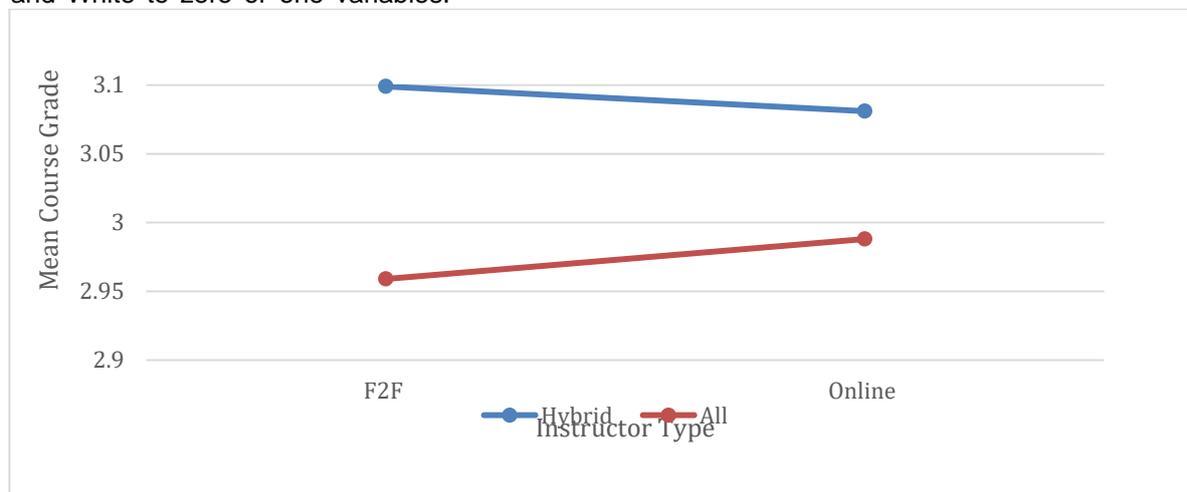


Fig. 1. Mean course grades for different instructor types for different modes.

Generally, instructors who taught at least one hybrid section award higher grades in all modes than those that do not, as shown in Table 1 below. With these hybrid teaching instructors, there is little difference between online and hybrid results are better than F2F results. This may be because the instructors just award better grades, and/or that the students learn more. It may be because the sort of instructor that teaches hybrid may just either grade higher and/or be a more effective teacher.

Table I: Mean Course Grade Differences for All Students by Instructor Type and Mode

Mode	Instructor Type		Difference
	Hybrid	All	
F2F	3.099	2.959	0.139
Online	3.081	2.988	0.093
All Modes	3.106	2.975	0.132

As shown above in Figure 1 and Table I, the mean grade from hybrid teaching faculty is higher than from all the faculty for F2F and online modes. Thus, the reason for this paper is to avoid this hybrid type instructor bias towards high grades. By only looking at grades for those faculty who also teach hybrid sections, one can compare results across modes without this instructor type distortion. Thus, this paper only looks at data from those instructors who teach hybrid sections.

V. STATISTICAL ANALYSIS

The first part of the analysis looked at the data set for hybrid teaching instructors only. The analysis compared final course grades for hybrid teachers by teaching mode, using ANOVA in Table II and t-test mode comparisons in Table III.

A. ANOVA

Table II: ANOVA Results for Hybrid Teaching Instructors

Modes	Count	Sum	Average	Variance
F2F	4154	13544	3.260	0.866
Hybrid	2601	8959	3.444	0.625
Online	3078	10728	3.485	0.704

Source of Variation	SS	df	MS	F	P-value	F crit.
Between Modes	104.3	2	52.165	69.395	0	2.99
Within Modes	7389.2	9830	0.752			
Total	7493.5	9832				

Table II shows that there are significant differences in the data.

Table III: 'T -test of the Final Course Grade by Mode

Modes Compared	t test	Difference in Means
Online - Hybrid	1.89	.041
Hybrid – F2F	8.68	.184
Online – F2F	10.76	.225

Table III. shows that both hybrid and online have a significant positive difference in mean final course grade over F2F sections, when taught by hybrid teaching instructors. There is a lot smaller difference between the mean final course grade of online and hybrid sections with hybrid teaching instructors, unlike the previous analysis of all instructors. Table IV shows the variable correlations for the smaller dataset.

B. Correlations for Students

Variable	Course Grade	Previous GPA	Age	Summer Term	Sex Male
Previous GPA	0.3483	1			
Age	-0.0005	-0.0392	1		
Term Summer	0.0461	-0.0275	0.0389	1	
Sex Male	-0.0807	-0.1120	-0.0472	-0.0180	1
Alien Ethnicity	0.0364	0.0436	-0.0053	-0.0211	-0.0151
Asian Ethnicity	0.0117	0.0033	-0.0199	0.0382	-0.0445

Black Ethnicity	-0.0829	-0.1552	0.0920	0.0215	-0.1017
Hispanic Ethnicity	-0.0031	0.0050	0.0040	-0.0150	-0.0125
White Ethnicity	0.0479	0.0920	-0.0645	-0.0124	0.1088
Online Mode	0.0818	0.0369	0.1505	0.1663	-0.1326
Hybrid Mode	0.0446	0.0030	-0.0253	-0.1475	0.0397
F2F Mode	-0.1167	-0.0373	-0.1187	-0.0244	0.0890

Table IV: Correlation of the Student Variables for Hybrid Teaching

Variable	Course Grade	Previous GPA	Age	Summer Term	Sex Male
Previous GPA	0.3483	1			
Age	-0.0005	-0.0392	1		
Term Summer	0.0461	-0.0275	0.0389	1	
Sex Male	-0.0807	-0.1120	-0.0472	-0.0180	1
Alien Ethnicity	0.0364	0.0436	-0.0053	-0.0211	-0.0151
Asian Ethnicity	0.0117	0.0033	-0.0199	0.0382	-0.0445
Black Ethnicity	-0.0829	-0.1552	0.0920	0.0215	-0.1017
Hispanic Ethnicity	-0.0031	0.0050	0.0040	-0.0150	-0.0125
White Ethnicity	0.0479	0.0920	-0.0645	-0.0124	0.1088
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F2F Mode	-0.1167	-0.0373	-0.1187	-0.0244	0.0890

The highest correlation is between the course grade awarded to a student in the course and the student's previous GPA. There is a negative correlation between male students and black students and course grade. It also shows there is a negative correlation between course grade with F2F mode. There is low correlation between age and online.

C. Correlations for Instructors

The analysis used a regression, with the course grade awarded for the course as the predicted variable and all the other variables as predictor variables. Table V shows the regression analysis results without an intercept.

Table V: Correlation of the Variables for Hybrid Teaching Instructors' Data Set.

Variables	Coefficients	Standard Error	t Stat	P-value
Previous GPA	0.6730	0.0192	34.9867	0.0000
Age	0.0001	0.0015	0.0906	0.9278
Summer Term	0.1386	0.0248	5.5884	0.0000
Sex - Male	-0.0652	0.0171	-3.8232	0.0001
Alien	0.1457	0.0557	2.6175	0.0089
Asian	0.0599	0.0482	1.2428	0.2140
Black	-0.0449	0.0385	-1.1658	0.2437
Hispanic	0.0259	0.0418	0.6208	0.5347
White	0.0439	0.0337	1.3029	0.1926
Online Mode	1.2626	0.0832	15.1818	0.0000
Hybrid Mode	1.2674	0.0824	15.3861	0.0000
F2F Mode	1.0881	0.0813	13.3856	0.0000

The highest correlation in Table V is between the course grade awarded to a student in the course and the student's previous GPA. There is a negative correlation between male students and black students and course grade. It also shows there is a negative correlation between course grade with F2F mode. There is low correlation between age and online.

D. Regression Analysis

The analysis used a regression, with the course grade awarded for the course as the predicted variable and all the other variables as predictor variables. Table VI shows the regression analysis results without an intercept.

Table VI: Results of Regression for Final Course Grade Without Intercept.

Regression Statistics				
Multiple R	0.9727			
R Square	0.9461			
Adjusted R Squared	0.9459			
Standard Error	0.8111			
ANOVA	df	SS	MS	F
Regression	12	113338.1	9444.8	14356.8
Residual	9821	6460.9	0.7	
Total	9833	119799.0		

This regression in Table VI backed up the correlation analysis. The most significant predictor of a student's course final grade was the student's previous GPA. However, the mode was the second biggest predictor, with Alien ethnicity next. Alien ethnicity followed by Asian ethnicity are higher predictors of a high course grade than White, whilst Black is a negative predictor. This shows that Alien and Asian ethnicities tend to get higher course grades than Whites and Hispanics, who in turn get higher grades than Blacks.

VI. DETAILED NON-STATISTICAL ANALYSIS

A. Analysis of Mode Effect

The initial statistical analysis suggested that the choice of teaching mode affected the final course grade. So, the analysis in Table VII looked at teaching mode effects on mean final course grades.

Table VII: Data for All Students by Mode

Mode	F2F	Hybrid	Online	All
N	4154	2601	3078	9833
%	42.20%	26.50%	31.30%	
Course Grade	3.26	3.444	3.525	3.379
Prev. GPA	3.215	3.236	3.276	3.234
Age	22.91	23.45	24.92	23.68
Male	63.90%	62.10%	48.60%	58.80%
Summer Term	12.00%	4.70%	22.50%	13.00%
Alien	3.60%	3.80%	2.20%	3.20%
Asian	5.40%	4.90%	4.80%	5.20%
Black	15.00%	16.00%	14.80%	15.10%
Hispanic	10.30%	9.10%	8.00%	9.30%
White	59.40%	59.50%	63.40%	60.60%

Separating results by teaching mode shows that the hybrid mode leads to higher course grades over the F2F mode (5.66%), as does the online mode over F2F mode (8.13%). However, these results are for all students. Online students tend to be older. Male students prefer F2F, and hybrid compared to female students who prefer online. There are few hybrid sections offered in summer, but far more online sections than in fall or spring.

B. Analysis of Previous GPA

The analysis then looked whether previous university GPA affected the final course grade, as this had had the strongest correlation in the statistical analysis. So, the study calculated the mean

final course grade for ten different previous university GPA bands by mode in Figures 2, 3, and 4. For age bands, n+ means from n to just below the next highest band.

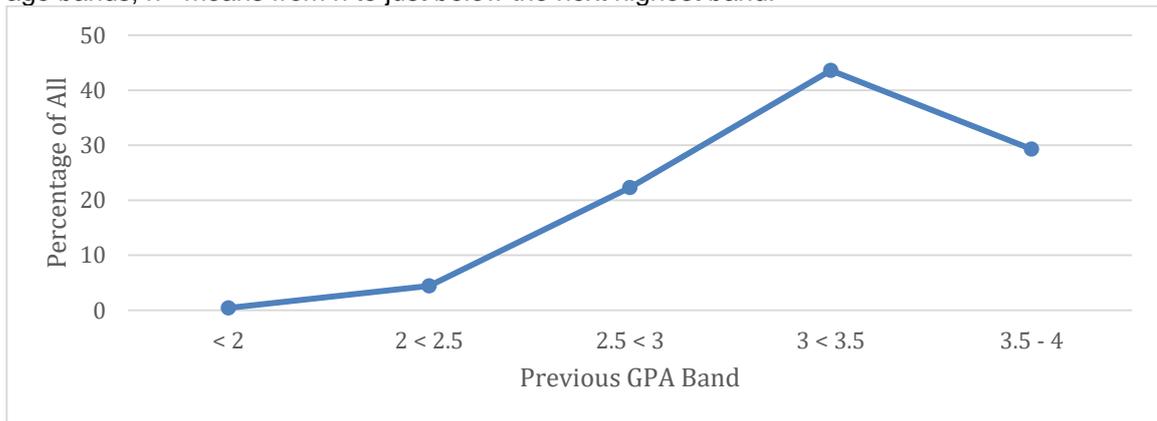


Fig. 2. Percentages of all students in each PGPA band by previous GPA bands

Previous GPA band proportion rises to the previous GPA band of 3 to 3.5 and then declines slowly.

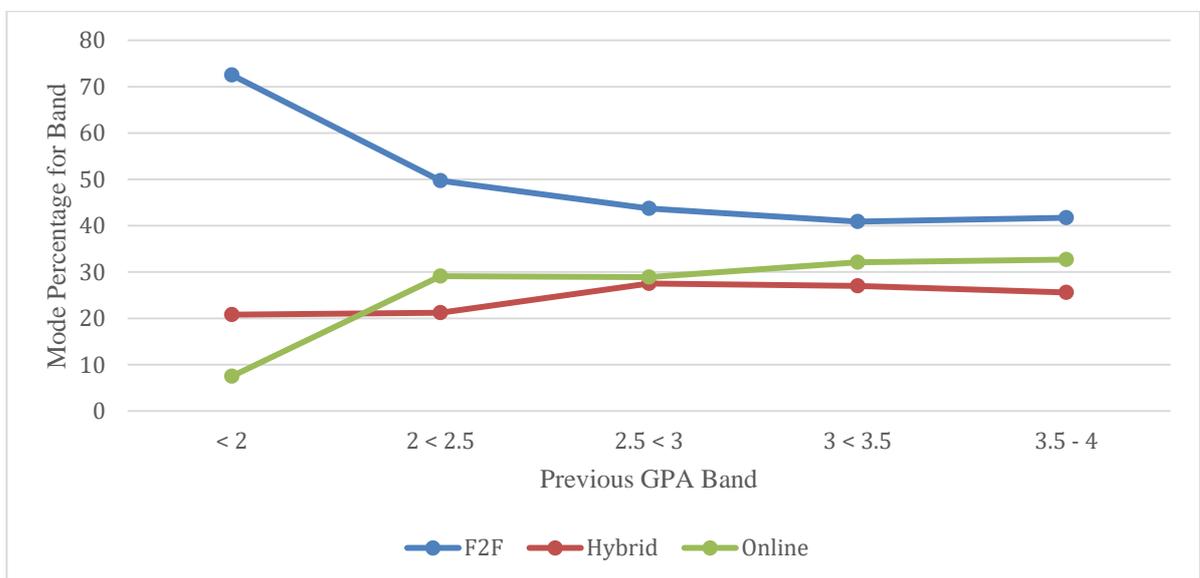


Fig. 3. Mode percentages for all students in a band by previous GPA bands

Other than the very few students with a previous GPA of zero, there is very little difference in student choice breakdown for hybrid between the previous GPA bands. Online preference drops slightly and F2F preference rises slightly with students who have a higher previous GPA.

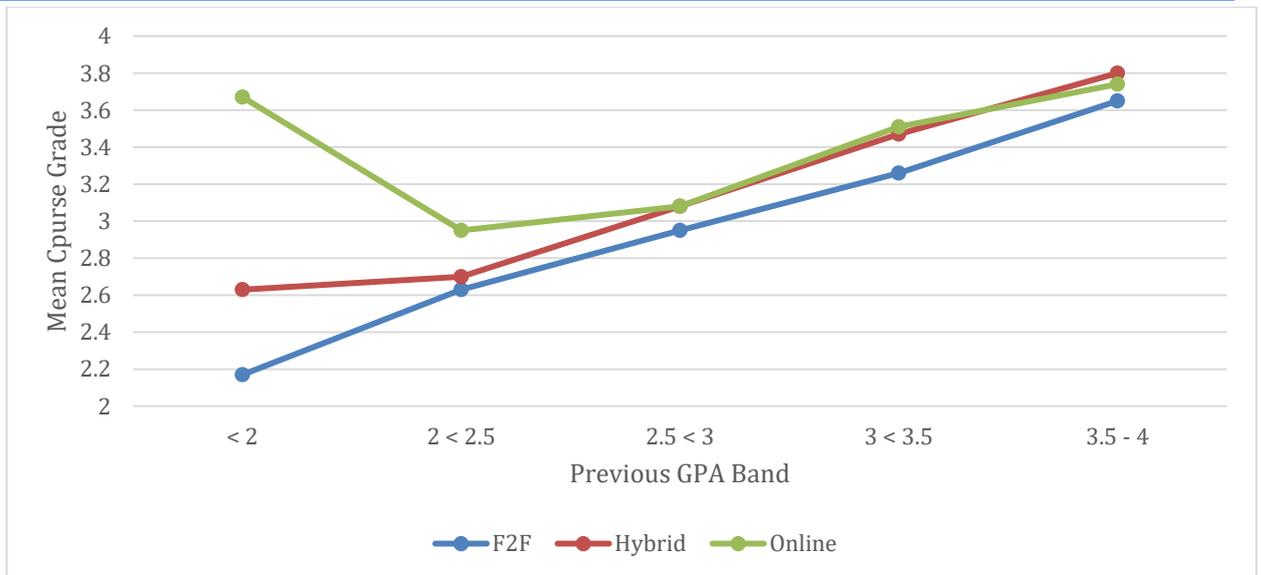


Fig. 4. Mean course grade for all students by previous GPA bands.

This shows that when the previous GPA is better, so is the course grade for all modes. For all bands of previous GPA, both hybrid and online modes are better than F2F. However, online is slightly better than hybrid for all previous GPA bands, except for the highest band where hybrid is slightly better.

C. Analysis of Age

Then the analysis looked at results by various student characteristics, starting with the age of the student. The analysis examined what effect student age had on mean final course grades with four age bands in Figures 5, 6, and 7.

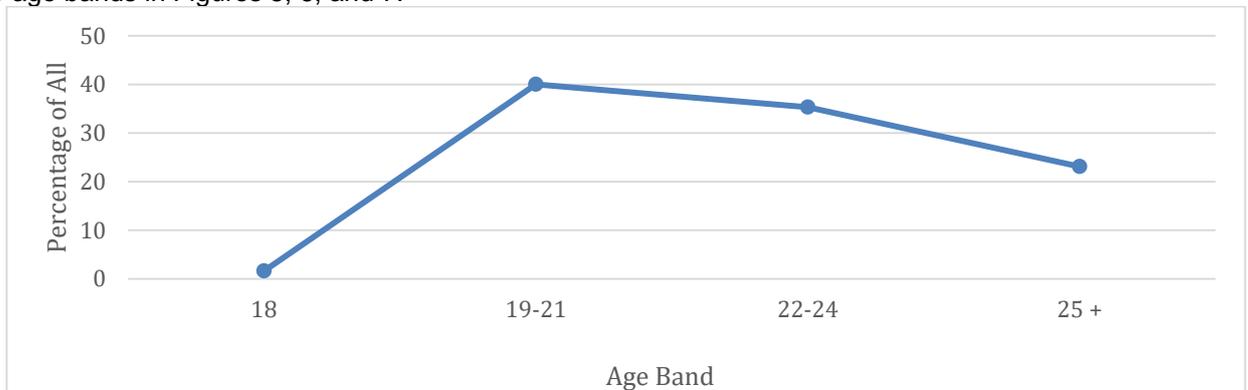


Fig. 5. Band percentage of all students by age band

The analysis discarded 18-year-olds (1.6% of the total dataset) as they were outliers in grade and did so few online or hybrid courses (<2%). Also, the analysis re-split the age bands so that they are roughly the same percentage of the dataset.

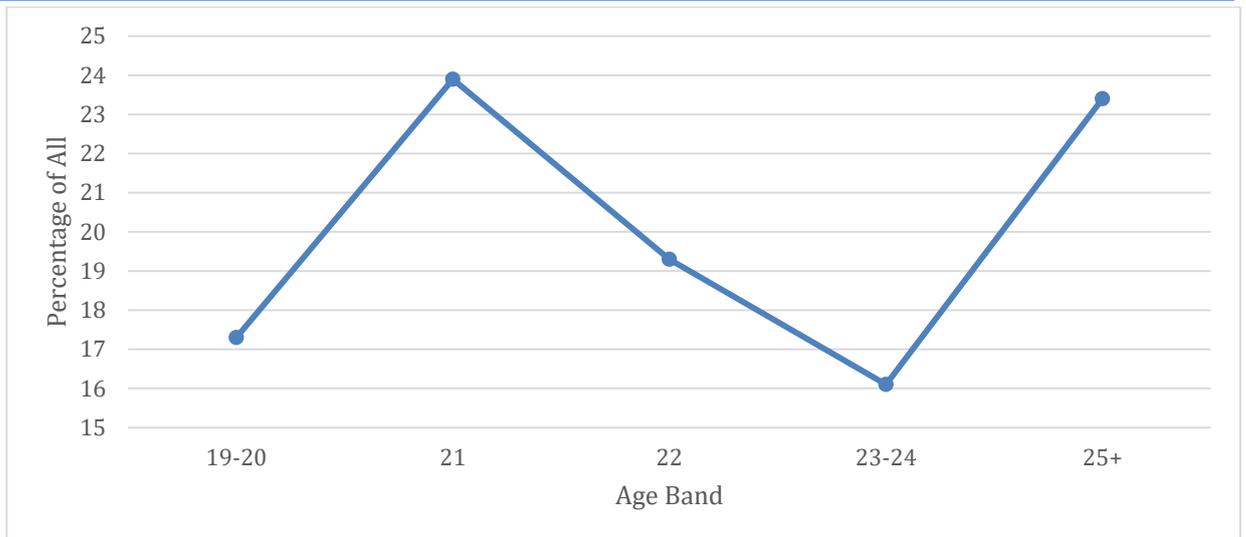


Fig. 6. Band percentage of all students by age band

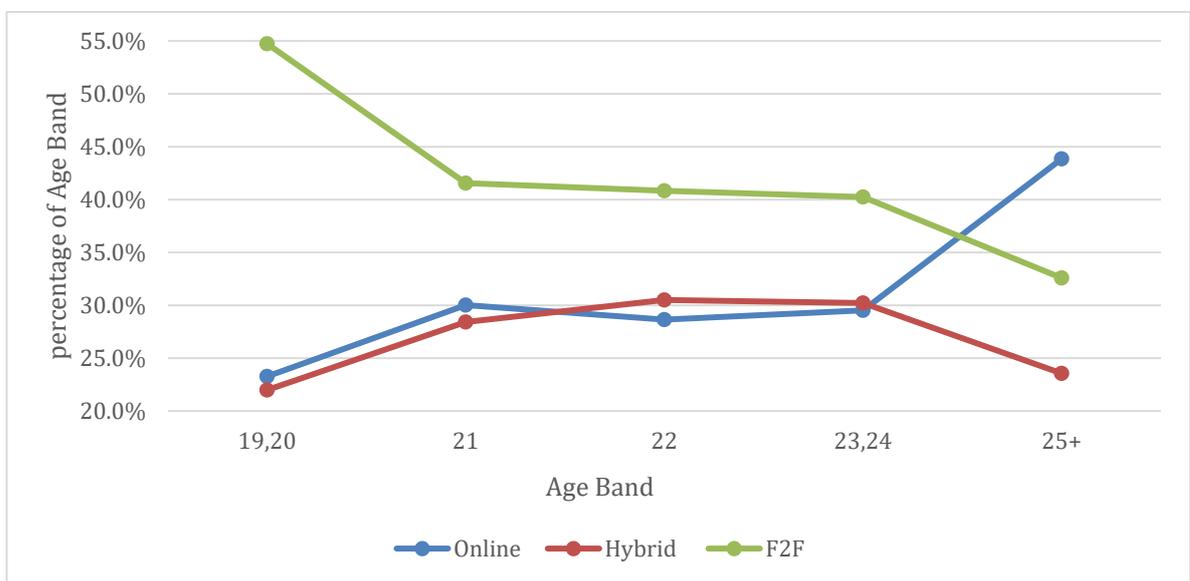


Fig. 7. Mode percentage of band by age band

The proportion preferring F2F sections falls off steadily with increasing age, and those preferring online sections increase. The proportion doing hybrid sections is steady for 21 to 24, and less for 19, 20 and 25 and over.

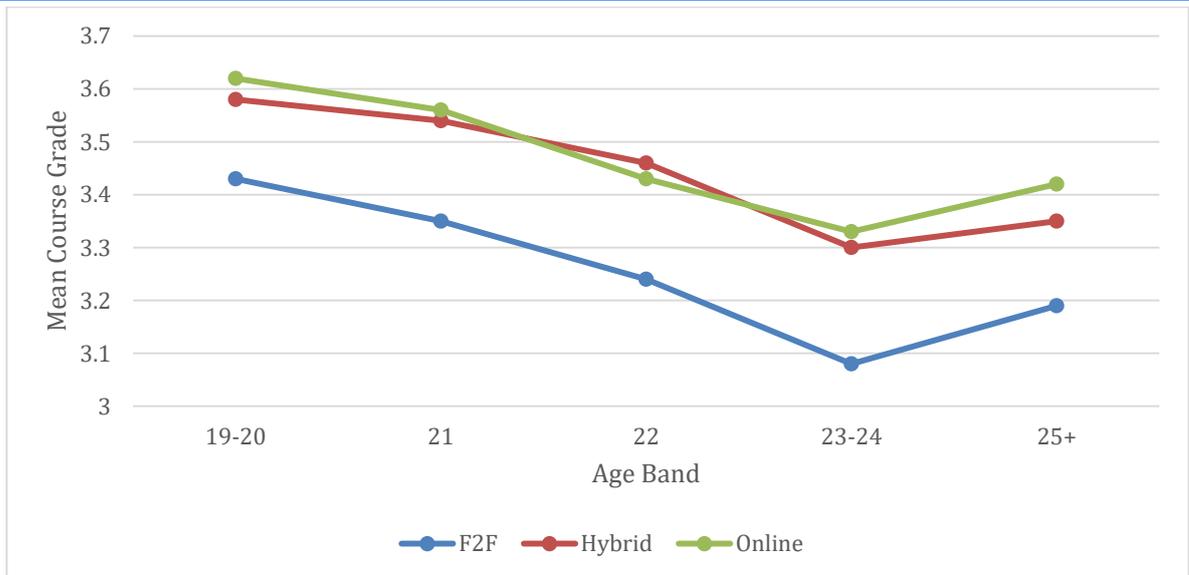


Fig. 8. Mean course grade for all students by age band.

For all modes, the mean final course grades drop with increasing age. For all age bands except 22-year-olds, online is marginally better than hybrid. Hybrid and online are appreciably better than F2F for all bands.

D. Analysis of Sex

The analysis in Figures 9 and 10 looked at the effect of sex of a student on final course grade.

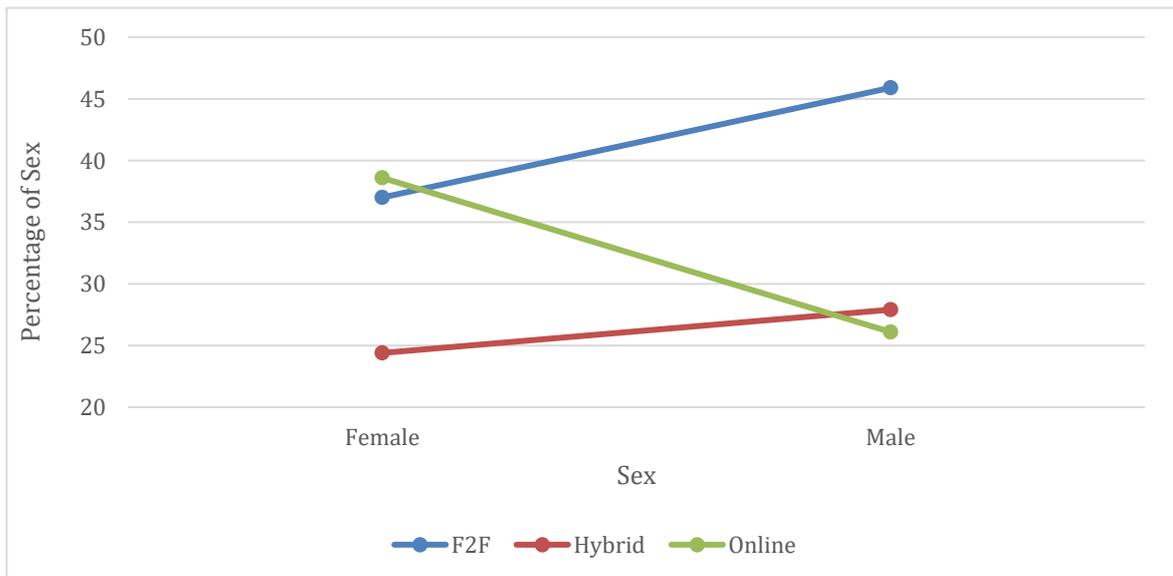


Fig. 9. Percentage of mode for sex

First, notice that the overall sex balance is 58.8% male to 41.5% female. Despite this, proportionally more females (38.6%) do online courses than male students (26.1%). More male students (27.9%) do hybrid courses than females (24.4%). More males choose F2F sections (45.9%) than females (37%) proportionally.

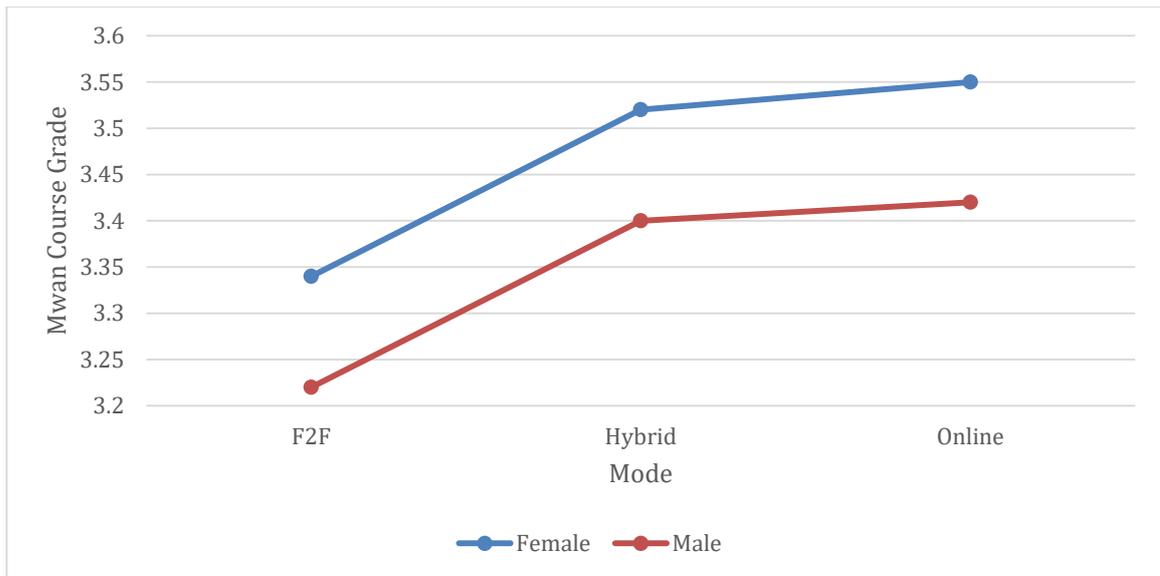


Fig. 10. Mean course final grade for all students by sex and mode.

Figure 10 shows that for all teaching modes, females do better than males. For both sexes, online is marginally better than hybrid, and hybrid and online are significantly better than F2F.

E. Analysis of Course Level

The analysis examined in Figures 10 and 12 whether the course level affected results.

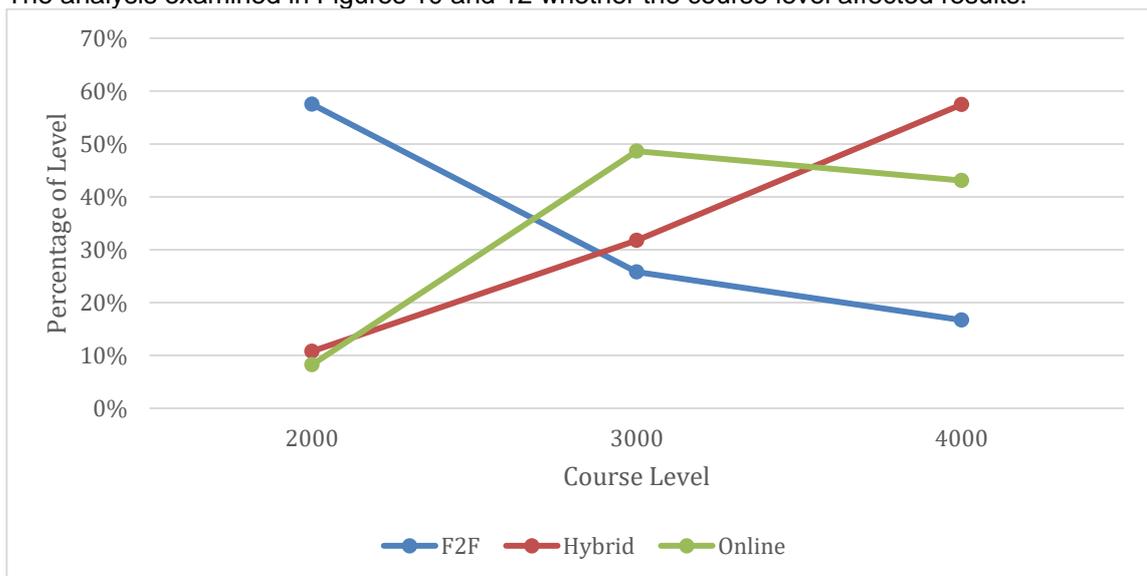


Fig. 11. Percentage of course level by course level for modes

Figure 11 shows that hybrid teaching instructors mainly teach upper division courses. The peak percentage for hybrid is senior (4000) level courses, whilst for online it is junior (3000) level courses. In senior year students, there are more hybrid and online student-courses than F2F. So, hybrid increases with level as a percentage of total student-courses for that level.

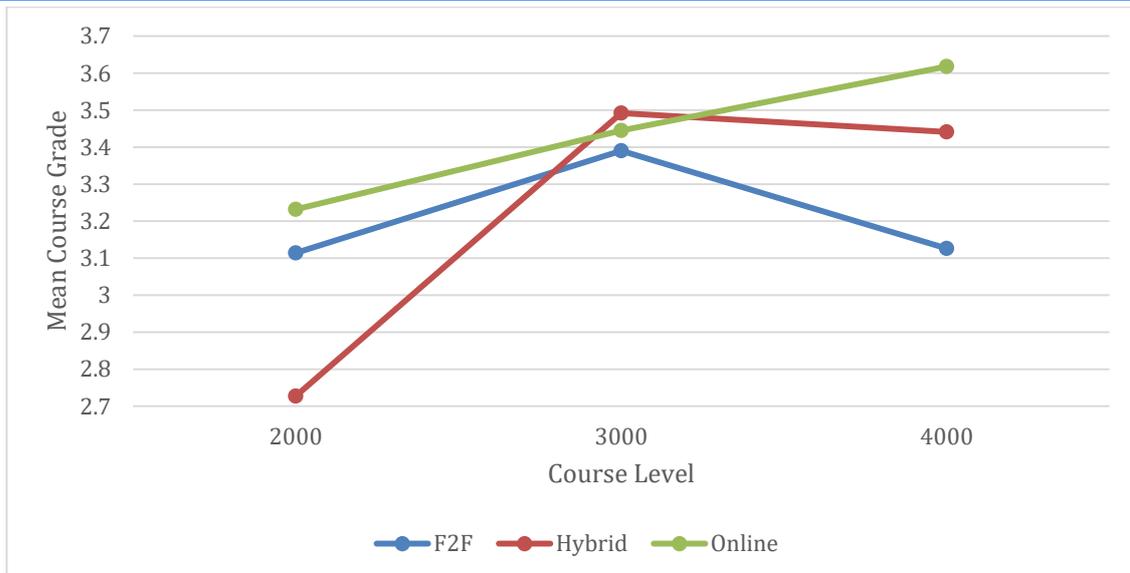


Fig. 12. Mean final course grade of level for all students by course level and mode.

Figure 12 shows for senior and junior year students, hybrid (3.44, 3.49) has similar final mean grades to online (3.62, 3.45), and both have higher mean grades than F2F (3.13, 3.39). With sophomore level courses, hybrid had the lowest mean course grade.

F. Analysis of Summer Term

The next variable the analysis examined is whether the term the course was held in affected the results. Fall and spring terms are 15 weeks long; whilst the summer term is 8 weeks long. Also, many students do not attend summer classes, so there may be a demographic difference in the student body. So, the study compared in Figures 13 and 14 fall and spring results, which showed little differences to the summer term results.

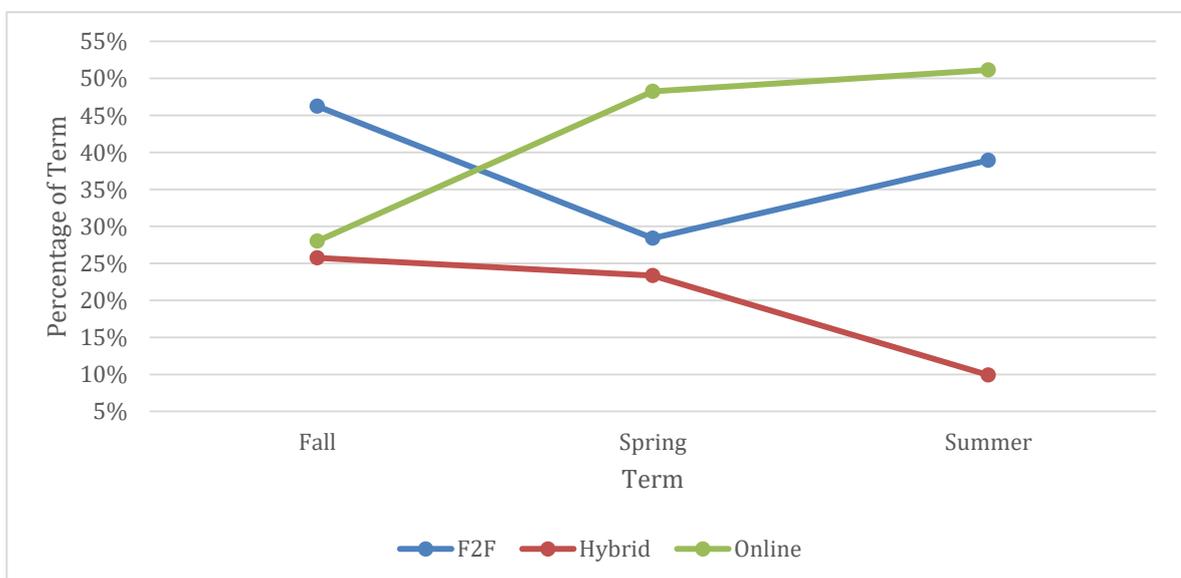


Fig. 13. Percentage of records for all students by term for modes

Figure 13 shows that for F2F, there is a higher mode percentage in fall than spring terms, whilst for hybrid the opposite is true. There are proportionally far fewer hybrid and many more online sections in summer than the other terms.

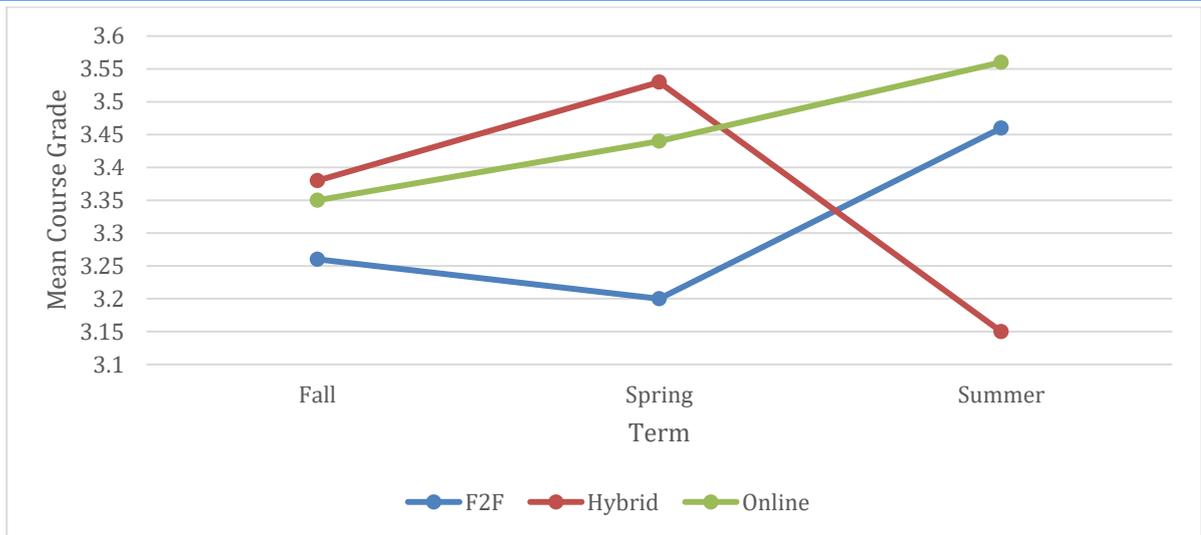


Fig. 14. Mean final course grades for all students by term and mode.

Figure 14 shows that hybrid has lower mean final grades in summer and F2F and online higher than in spring and fall.

G. Analysis by Discipline

Next, the analysis looked at data by college to see if that had an effect.

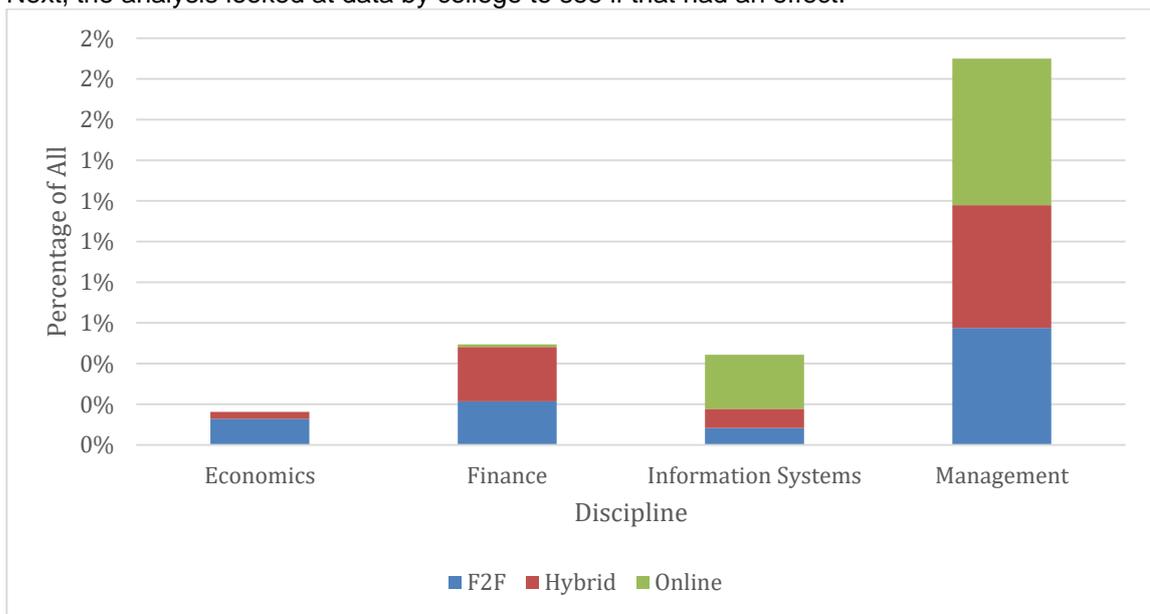


Fig. 15. Percentage of all in each discipline by modes

Figure 15 shows that Finance had the highest proportion of hybrid courses followed by Management. Information Systems had the highest proportion online. This figure shows that each discipline offers a very different breakdown of section mode formats. Economics hybrid teaching instructors did not teach any online courses. The other disciplines not listed above (accounting, entrepreneurship, hospitality, information security, marketing, sales) did not teach hybrid sections.

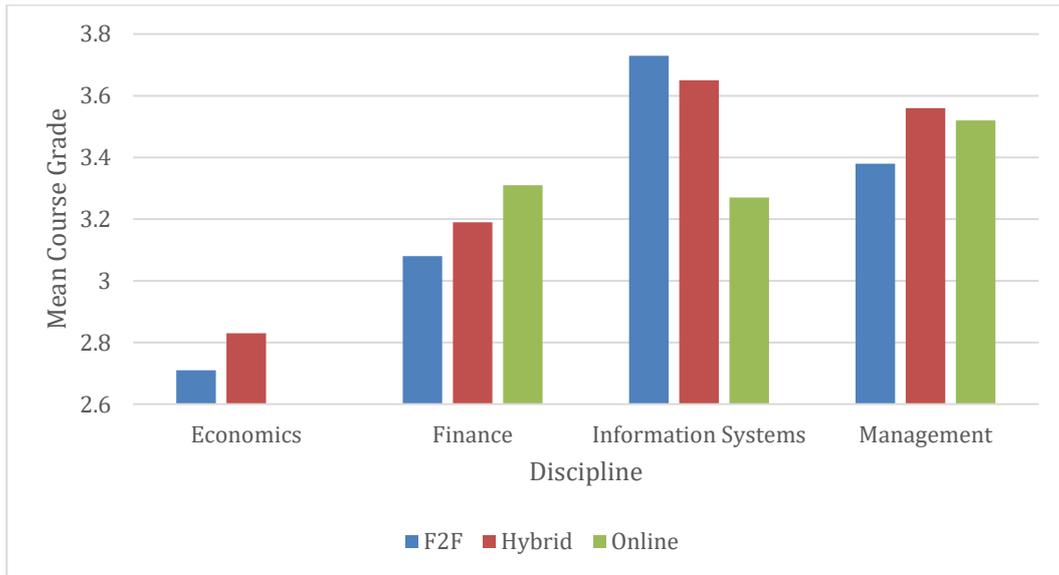


Fig. 16. Mean course grade by mode in each college.

There are major differences in the disciplines, shown in Figure 16 and Table VII. IS and Management have higher grades for hybrid than online than F2F. Finance has the highest grades for online and IS has highest grades for F2F. Economics does best with hybrid.

TABLE VII: NUMBER OF DEPARTMENTS BY BEST MODE AS BEST

Best Mode	Department
F2F	Information Systems
Hybrid	Economics, Management
Online	Finance

H. Analysis of Ethnicity

The analysis next looked at the effect of ethnicity on final course grade by mode. The study deleted any students whose ethnicity record was missing. The resulting total N was 9577 student-course records. The effect of ethnicity is in Figure 17, 18 and 19.

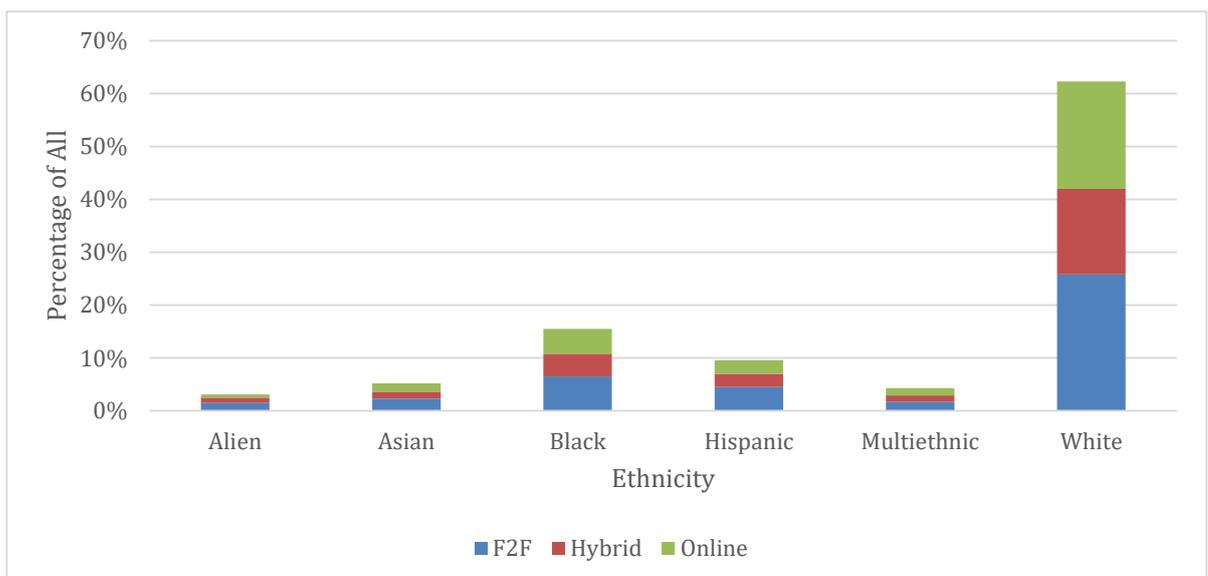


Fig. 17. Percentage of all by ethnicity for modes

The White ethnicity dominates this sample.

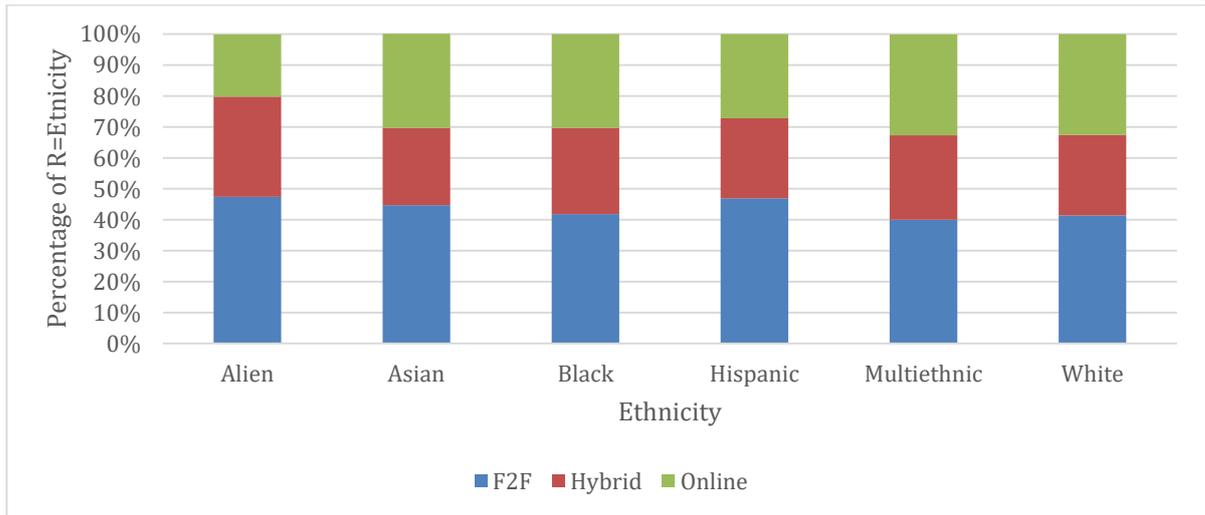


Fig. 18. Percentage of an ethnicity by ethnicity for different modes

Figure 18 shows that all ethnicities except Alien (mainly foreign students) tend to split modes in approximately the same proportions. Aliens do more hybrids and less online sections.

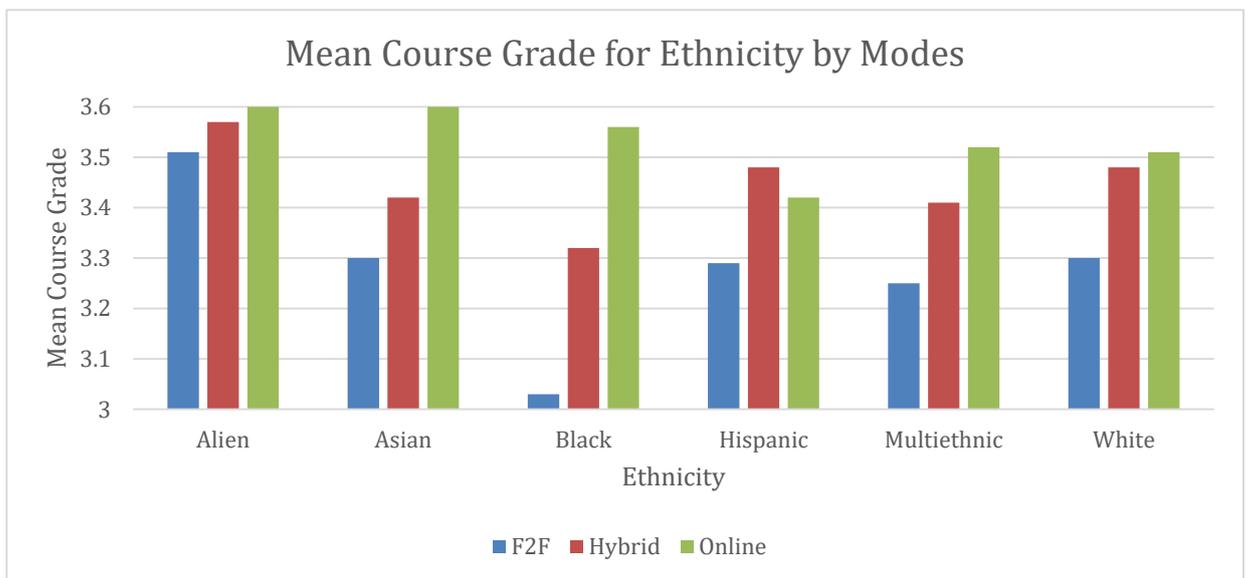


Fig. 19. Mean final course grade for all students by ethnicity and mode.

Figure 19 shows that for all ethnicities, hybrid and online modes produce the highest mean course grade, and for all ethnicities except Hispanics (who do marginally better in hybrid sections), online is slightly better than hybrid. However, the hybrid and online advantage is least for Aliens, but very strong for Blacks. While the White-Black gap is .27 for F2F and .12 for hybrid; it is -.05 for online. That is Blacks do better than Whites in online sections.

VII. DISCUSSION OF RESULTS

The analysis used the mean final course grade as the objective. The analysis was to see what demographic factors and teaching format affected course grade. The study looks at each factor in turn.

Mode - Regression showed hybrid and online modes achieves higher course grades than F2F, even with the same

instructor. Overall, online grades were marginally higher than hybrid grades, which were higher than F2F grades. Hybrid courses tend to be junior or senior courses.

Previous GPA - Correlation and regression analysis showed the biggest predictor of a student's grade in a course was their previous GPA. Both online and hybrid were better than F2F for all previous GPA bands. One would expect a student with high previous GPA to get a high grade on a

course, as people who do well at something tend to carry on doing well. However, it appears that previous GPA differences do not lead to different choice of teaching format.

Age - The fact that final course grades decline with age for all modes is interesting and the study has no suggestion why this occurs.

Sex - Female students got higher grades than male students in all modes. They also prefer online compared to males, who prefer online and hybrid sections. Males may prefer the increased in person interaction in F2F and hybrid modes.

Course Level - Hybrid and online results in sophomore year are too small a percentage to be very significant. For senior and junior year, the result showing F2F worse than the other modes tie in with the other factor results.

Term – The fact that there are few hybrid courses in summer and far more online courses proportionally in summer, probably means that term is not a significant factor in final course grade, other than all grades tend to be higher in summer for online and F2F courses.

Discipline - Only half the disciplines use the hybrid mode. However, in all disciplines with hybrid courses, the format that gives the best mean course grade varies with discipline. It may be that some disciplines are more suited for a particular mode than others.

Ethnicity - Alien followed by Asian students tend to get the highest course grades. Black students tend to get lower grades than other ethnicities except online. Hybrid gives the highest course grades for Hispanics. Why certain ethnicities do better with certain modes is not known.

Thus, this study concludes using this data set that in general, students learn most in hybrid and online mode, and least with the F2F mode. One major problem with looking at what affects the mean final course grade is that some factors probably confound the effect of others.

VIII.LIMITATIONS

1. The use of previous GPA to represent the academic ability of an incoming student is a convenient assumption. However, that is how most students rate their learning.

2. The use of previous grade point average (GPA) to represent the academic ability of a student is a convenient assumption. This assumes that the previous GPA at the start of a course represents how able a student is to do academic work in the course. Previous GPA is the average of all previous final course grades of previously taken courses. The use of final course grade to represent the objective is a common approximation of how much a student has learned. This analysis did not consider other factors like how many online or hybrid courses the student had done before the course, how many online or hybrid courses the student took at the same time, or whether the student was only taking online courses or mixing F2F with online and hybrid courses.

3. The analysis only used data from those faculty who had taught at least one hybrid section, as hybrid teaching faculty gave higher final course grades in their F2F and online sections than the mean of all teaching faculty. This study did not examine the differences between individual instructors. However, many instructors grade harder than others for the same course. Also, this study assumed that Coles College of Business is representative of other business schools, which is a huge assumption that may not be true.

4. Another major limitation for more general conclusions is that the dataset mainly contained junior and senior level courses and very few freshmen level courses. This is mainly because only one freshman course (in Economics) exists at Coles College; the rest are at higher levels. Thus, the conclusions from this data set may not apply to freshman courses. Another limitation is that the teaching hybrid only data set was only 8.4% the size of the original dataset, and that it bases results on 16 (6.9%) instructors rather than the 223 instructors in the original study.

5. The use of course final grade to represent learning from a course is a common approximation of learning.

6. This analysis did not consider other factors like how many online or hybrid courses the student had done before the course, how many online or hybrid courses the student took at the same time, or whether the student was only taking online courses or mixing F2F with online and hybrid courses.

7. The data for this case study comes from one university. Other

universities and colleges may show completely different patterns.

IX. CONCLUSIONS

However, due to the large number of student-course records, I consider this analysis gives useful information. The analysis also showed there was little difference in the type of student who did each mode, except older students tended to do more online courses. This research basically replicates most of the previous studies with larger student populations, but with more information on how student types affect the results. [31] reports assessing student learning is difficult.

If you assume that the objective of choosing a teaching mode is to raise the mean final course grade (as has been done by many studies from [1] on), then this study shows that hybrid or online modes achieve this with instructors who teach hybrid mode sections. In practical terms, students and instructors choose a teaching mode for a host of good and bad reasons, such as perceptions on how hard a section is, [21] noted, fitting in class around other activities like work, personal preferences, quality of their home internet, wish to socialize with other students and faculty, etc. The analysis also showed the only factors that affected final course grades appreciably were previous university GPA, as [8] reported, the discipline of the course, the ethnicity, and the sex of the student, as [7] related.

The importance of the work is that it suggests that more work should be done into why and which types of students should learn best from different teaching formats. Data on this could help student councilors in advising student son what mode to take.

X. IMPLICATIONS

Based on this data, one may consider that administration may want to consider offering more hybrid sections in courses. Alternatively, it may be that the type of instructor who wants to teach in a hybrid mode gives higher mean course grades, and that the results of this study would not apply if instructors who prefer F2F teaching, started to teach hybrids. Another huge implication is that if junior and senior students do better in online and hybrid sections, then a university need not build new classrooms to handle an increased student load. Alternatively, if student numbers are falling or the same then administrators should consider reducing their

number of classrooms by selling off or repurposing their surplus real estate.

XI. FUTURE WORK

As many courses are now, due to Covid, being taught using the rotating hybrid and synchronous modes, then there should be research to examine how these new teaching modes affect results. However, there will be a large confounding effect if one uses results after Fall 2019, as unlike before 2020, new to online and hybrid mode instructors received far less training and often did not choose (but were made to by Covid distancing rules) online and hybrid modes for their courses. Another confounding effect would be that the administration told faculty to go easy on grading during Covid. It would also help if researchers did similar analysis for other universities, to discover whether the conclusions of the effect of demographics from this dataset can be applied in other locations.

While this study showed hybrid teaching had better results than F2F, it did not show why. One line of interesting research would be to find out why hybrid modes do better. One theory could be that hybrid only does the interesting interactive stuff in person, while the less interesting basic learning is done online. Another theory might be that knowledge acquisition is best done using a student's preferred learning times and speed, whilst more advanced learning is best done in an interactive in-person manner.

Another line of research might be the relationship between the instructors who wanted to teach hybrids and why they gave higher course grades in all formats. It could be they are better teachers, or it could be because they are lighter graders, or a combination of both. One would need an outside test to compare the rigor of different instructors to see if higher grades meant students learned more or that higher grades just meant easier grading (marking) by instructors. There is also the possibility that the instructors who give higher grades tend to be those who teach hybrid courses.

It would be interesting to do similar studies with other universities and colleges to see if KSU's patterns are similar or different. If done with several other teaching institutions and one found similar results, then one could make generalized conclusions on the effect of teaching mode on course grades. The next stage should do the analysis for all the colleges at KSU; not just those in the business school to see if these trends are replicated across other

subject matter. It may be these conclusions are unique to business schools. As many courses are now, due to Covid, being taught using the rotating hybrid and synchronous modes, then there should be research to examine how these new teaching modes affect results. However, there will be a large confounding effect if one uses results after Fall 2019, as unlike before 2020, new to online and hybrid mode instructors received far less training and often did not choose (but were made to by Covid distancing rules) online and hybrid modes for their courses. Another confounding effect would be that the administration told faculty to go easy on grading during Covid. It would also help if researchers did similar analysis for other universities, to discover whether the conclusions of the effect of demographics from this dataset can be applied in other locations.

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