A Descriptive Study on the Effects of Modality and Covid-19 on Academic Performance by Demographic Groups

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Abstract: Analysis of student grades and demographic data to understand the effects of modality and Covid-19 on academic performance is important for universities to understand the impact these factors may have on course grades. This study analyzes all the 615,964 complete undergraduate student-course records from Kennesaw State University (KSU) spanning from 2015 to 2024 to examine the impact of course modality and the Covid-19 pandemic on academic performance. The population dataset includes student demographics (e.g., sex, age, ethnicity), prior GPA, and course characteristics (e.g., department, modality). Descriptive statistics and trend analyses were employed to evaluate grade outcomes across in-person, online, and hybrid modalities over the 9-year period. Results indicate a temporary increase in mean course grades during the Covid-19 period, followed by a return to the pre-pandemic upward trend. Hybrid courses consistently exhibited the highest mean grades throughout the study period. However, consistent patterns across modalities, demographics, and academic units suggest that these factors have limited influence on grade outcomes. These findings raise questions about the reliability of GPA and course grades as indicators of learning success across different instructional contexts and student populations.

Keywords: *Covid-19, grades, hybrid, online, teaching modalities.*

Introduction

Over the past several decades, average college GPAs have shown a sustained upward trajectory, justifying an examination of the potential academic and or sociocultural factors driving this trend (Barton, 2002; see Figure 1). The Covid-19 pandemic introduced an unprecedented disruption to higher education, forcing a rapid shift in instructional modalities and prompting renewed interest in how such changes affect student academic performance. During the pandemic, universities around the world reported a further drastic increase in grades. While much attention has been given to the immediate impacts of the pandemic, less is known about how these effects have evolved over time and how they intersect with broader trends in teaching modalities and student demographics.

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Figure 1. Grade Inflation Before the COVD-19 Pandemic

With this increase and extensive research conducted on the effects of modalities and demographics on higher education grades (Nortvig et al., 2018), the question arises on how the Covid-19 shutdown affected grades overall and how changing teaching modalities affected grades before, during, and after the pandemic. This study investigates the impact of the Covid-19 shutdown on student grades, with a particular focus on how different instructional modalities (face-to-face, online, and hybrid) have influenced academic performance before, during, and after the pandemic. By analyzing course grade data from Kennesaw State University (KSU) across three distinct timeframes (2015–2019, 2020–2021, and 2022–2024), this research aims to provide a comprehensive, longitudinal perspective on the relationship between modality, student demographics, and academic outcomes.

Building on prior institutional studies conducted at KSU, this research seeks to clarify conflicting findings in the literature and address gaps related to the hybrid modality and long-term grade trends. The goal is to contribute to a more nuanced understanding of how instructional delivery and demographic factors shape students' success in a post-pandemic academic landscape.

Literature Review

Covid-19 and Academic Performance: A Mixed Picture

Published literature on the academic impact of Covid-19 reveals a complex and often contradictory landscape. Some studies report grade inflation during the pandemic (Karadag, 2021; Tillinghast et al., 2023), attributing it to lenient grading policies and emergency adaptations. Others, such as Di Pietro (2023), emphasize learning loss, particularly among vulnerable student populations. These studies provide very timely insights into academic trends during the pandemic using institutional data to support claims. However, many of these studies are limited in scope and focus on short-term effects, specific disciplines, or non-U.S. contexts (e.g., El Refae et al., 2021; Gnaur et al., 2020). Moreover, few incorporate longitudinal data or control for variables such as prior GPA, course level, course difficulty, or student demographics. This limits the generalizability and comparability of their findings.

In Karadag and Dortyol's (2024) study, the overall GPA trend upwards accelerated during Covid while Karadag (2021) in Turkey showed an increase in grade inflation during Covid when classes switched from F2F to online; Tillinghast et al. (2023) also showed that there was an increase in college grades during Covid; Supriya et al. (2021) reported a small increase in grades during the Covid transition from in person to online courses with students reporting negative impacts on their learning overall and especially women. On the other hand, Gnaur et al. (2020) examined the changes due to Covid in Denmark and found little change in exam grades. However, there was a greater variation in exam results. They concluded that students differ in how they benefit from changes to class modality. Engelhardt et al. (2022) offer a different interpretation by distinguishing between GPA stability and grade inflation, in which the study reported no major change in GPAs for business students because of Covid-19 but noticed significant grade inflation overall. This may be due to students becoming accustomed to the more flexible policies on grading that occurred during Covid and was caused by instructors compensating during Covid. As the multitude of studies clearly show, there is an immense variance among the results from each study.

Modality Comparisons: Inconclusive and Underdeveloped

Research comparing face-to-face (F2F), online, and hybrid modalities has yielded inconsistent results. While some meta-analyses suggest that online learning can be as effective as F2F (Sun & Chen, 2016), others highlight selection bias

and methodological weaknesses, such as lack of random assignment or control for prior academic performance (Cavanaugh & Jacquemin, 2015; Nguyen, 2015).

Specifically, Nguyen (2015) summarized 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 and the limitation here is that hybrid was not included. Cavanaugh and Jacquemin (2015) also did not explore the hybrid model in their large study with a sample size of 5,000 courses. They found no significant differences overall between online and F2F classes. They reported that students with a good pre-course GPA did better. This effect was higher in online courses. They also found that students taking online courses had a higher mean pre-course GPA (3.41) than F2F (3.02). Xing and Saghaian (2022) in China and the US reported that online classes had lower grades than F2F or hybrid, however, Fidalgo-Blanco et al. (2020) reported on using hybrid classes in Spain demonstrating increased student learning.

Biel and Brams (2016) compared student performance in F2F courses to online courses. Some analysis showed that F2F courses were better and some online courses. Sun and Chen (2016) did a review of 47 papers comparing online and F2F teaching methods. They concluded that properly done online teaching works as well as or better than in person teaching. That is a course that has well-designed content, motivated interaction, and well prepared and supported instructors. 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; however, hybrid sections had higher completion rates than online sections. Carper and Friedel (2021) also explored hybrid education and found out that hybrid design was critical to improved academic performance and determined that the interaction of faculty, students, and technology used had a crucial role in student learning.

When comparing modalities during Covid-19, studies such as Darkwa and Antwi (2021), El Refae et al. (2021), El Said (2021), and Verde and Valero (2021) specifically looked at modality effectiveness on academic performance during the sudden move from F2F to online during the Covid-19 shutdown but did not consider the hybrid modality. El Refae et al. found that students at El Ain University demonstrated better academic performance in online or distance learning than in F2F courses and that demographics did significantly impact student performance. They concluded that students differ in how they benefit from changes to class modality.

Notably, the hybrid modality remains underexplored. Studies that do include it (e.g., Carper & Friedel, 2021; Fidalgo-Blanco et al., 2020) often rely on small samples or single-institution case studies, limiting external validity. Furthermore, few studies examine how modality effects evolve over time or interact with demographic variables.

Student Attitudes as a Means for Understanding Modality Outcomes

While much of the literature focuses on academic outcomes across modalities, student attitudes toward these modalities offer valuable context for interpreting performance trends. Several studies suggest that student preferences align with observed performance advantages, particularly in hybrid learning environments.

For instance, Blau and Drennan (2017) found that modality choice significantly influenced both satisfaction and academic outcomes, suggesting that students may perform better when learning in their preferred format. This is echoed by Stearns (2023), who reported that transfer students favored online classes introduced during Covid-19 over large face-to-face (F2F) lectures, citing benefits such as personalized pacing and reduced social anxiety.

Hybrid learning has garnered positive student feedback. Thamrin et al. (2022) and Andrews et al. (2022) both observed that students preferred hybrid formats for their flexibility and balance between structure and autonomy. These preferences may help explain the consistently higher mean grades observed in hybrid courses in this study. However, challenges such as internet connectivity (Thamrin et al., 2022) and coordination in group work across time zones (Fang et al., 2023) highlight the importance of robust infrastructure and instructional design.

By integrating student attitudes into the analysis of modality effects, this study acknowledges that academic performance is shaped not only by instructional delivery but also by student engagement and perceived fit of learning to the student. These insights support the interpretation of hybrid modality as not only pedagogically effective but also well-aligned with student needs and preferences particularly post-Covid-19 pandemic.

Demographic Effects on Academic Performance

Quite a few studies have looked at the effect of various modalities and demographic factors on academic performance indicating that demographic disparities in academic performance are well-documented. 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 and found little correlation between age or sex and student outcomes, but did find that course design (participant interaction, learner control, and course clarity) affected student outcomes. Xu and Jaggars (2014), using a very large dataset of 500,000, found that younger, male, and Black students tend to perform worse in online settings, while older students and females often fare better enhancing the reliability of their findings. Irani-

Kermani et al. (2021) found in Canada that female students reported higher grades in their hybrid classes over F2F classes. Baum and McPherson (2019) 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 do not exhibit these problems. Butt et al. (2023) looking at subnets in Pakistan, showed that learning characteristics of a student affected results. Acheampong (2023) showed through interviews with Ghanian students that demographic characteristic affected performance. One of these characteristics was the level of technology available at home, however, this study relied more on qualitative data limiting the robustness of its methods. Xu and Jaggars (2014) analyzed a very large data set of online and in person courses (500,000 student-course sets). They had pre-course GPA as a variable. They found that younger students, males, black students, and those with lower pre-course GPAs did worse in online courses. Whilst females and Asians had no significant differences. Older students in online courses did better than F2F courses. They also looked at subject matter and reported that computer science, communication, and health had no significant differences. All others had F2F giving better results than online courses. Business, law, social sciences, and nursing were the majors that showed the biggest differences. Teaching modality affected new college students more adversely than continuing students.

Moodie (2021) used data from KSU's business school courses only. 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 mean course grade for hybrid sections is higher than that for online or F2F.

Moodie (2022) analyzed student outcomes by demographic groups at KSU 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.

Unfortunately, many studies fail to disaggregate results by modality or control for prior GPA, making it difficult to isolate the effects of demographic variables. Moreover, the intersectionality of factors such as race, gender, and socioeconomic status is rarely addressed in depth. For example, while Bowen and Bok (1998) and Massey and Probasco (2010) highlight systemic inequities, few studies examine how these play out across different instructional formats or during periods of crisis like the pandemic. Specific demographic research studies are outlined below to show effects on academic performance which will be observed in this study to show the impact that demographics have on student results based on modality.

Previous GPA Effects

Alwarthan et al. (2022) utilized data mining techniques to analyze previous research and found that cumulative grade point average (CGPA) is the most significant predictor of course grades. This finding underscores the importance of consistent academic performance over time, as it reflects a student's ability to grasp and retain knowledge across various subjects.

Subject Area Effects

Baklavas and Krassas (2024) examined the impact of Covid across different academic subject areas. Their study revealed that the pandemic's effects varied significantly between subjects. For instance, practical and laboratory-based courses faced more disruptions compared to theoretical subjects, highlighting the need for tailored strategies to mitigate Covid's impact on different disciplines.

Sex Effects

Thiele et al. (2014) reported that males were less likely to achieve a good degree in UK universities. This finding suggests potential underlying factors such as differences in study habits, engagement levels, or external responsibilities that may disproportionately affect male students' academic performance.

Sex and Ethnicity Effects

Massey and Probasco (2010) concluded that black males were the demographic group most adversely affected in college, exacerbated by their lower representation compared to black females. This highlights the intersectionality of sex and ethnicity in academic performance, suggesting that targeted support and interventions are necessary to address these disparities. Bowen and Bok (1998) and Bowen et al. (2009) found that Asians generally performed as well or better than whites in terms of grades and graduation rates, while African Americans and Hispanics lagged

significantly behind. These performance differentials are partly attributed to longstanding socioeconomic disparities, which correspond to differences in access to various forms of capital; human, financial, social, and cultural (Massey et al., 2003). This emphasizes the need to address broader socioeconomic issues to improve educational outcomes for underrepresented groups.

Age Effects

Cannady (2010) reported that non-traditional students performed slightly better than traditional students in her small study. In contrast, Brändle and Lengfeld (2017) found that non-traditional students performed worse than their peers with general university entrance qualifications. These mixed findings suggest that while non-traditional students may bring valuable life experiences and motivation, they may also face unique challenges that can impact their academic performance.

Summary

The literature review points to a research gap on the effect of Covid on grade inflation. Thus, the literature review supports the aim of this study.

Methodology

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

Definitions

Face-to-face (F2F) is a course taught completely in person. HyFlex 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. Hybrid, in this study, is the traditional hybrid or flipped class where one teaches some of the class in person and the rest online asynchronously. It is not the HyFlex model where some students are present in person, and some join the class remotely at the same time. The HyFlex model is new in Kennesaw, and limited data is available to include in this study. The percentage of a 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.

Online learning (sometimes referred to as distance learning) refers to learning environments that utilize technology to acquire knowledge and attend classes in remote locations (Sandars et al., 2020) and can be categorized into asynchronous and synchronous. Asynchronous online is a course taught totally (or at KSU, one that is more than 95% online, 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. The Covid period refers to the years 2020 and 2021.

History of Covid Reactions at KSU

Table 1 shows the teaching modalities used 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

Tem, Year	Allowed Teaching Modalities
Spring 20	F2F and hybrid sections converted to synchronous online midway
Summer 20	There were no hybrid sections. 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 were offered than pre-Covid.
Summer 21	Mostly asynchronous online with a few HyFlex, F2F, and hybrid sections.
Fall 21	Back to normal with F2F, hybrid, and asynchronous sections. No HyFlex.

Research Question

The research questions that are examined are:

1) Did average course grades vary before, during, and after the Covid shutdown?

2) Did students from different demographics, different teaching modalities, and in different colleges of the university have different student final grade outcomes before, during, and after Covid?

3) Do course grades of students with different demographics vary amongst the different modalities?

Participants

The participants were all undergraduates, and the dataset included all their courses. Thus, this dataset is a complete population, not a sample or a census.

Variables

Kennesaw State University (KSU) provided every student-course record in KSU's Banner system from 1995 to 2024 for all KSU undergraduate courses. This was 699,131 student-records. Each student-course record set originally consisted of the following variables:

1) An arbitrary random number instead of student name. The researcher deleted this column from the working database as not useful.

2) Final course grade in letters. The analysis converted letters to numbers; A to 4, B to 3, C to 2, D to 1, F to 0.

3) The previous university GPA of a student at the start of the 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 initially varied from 14 to 75. IRB rules insisted on the removal of all those students under 18, which was a small number.

5) Teaching modality was represented numerically using zero-one variables as follows: online is [1, 0, 0], hybrid is [0, 1, 0], and F2F is [0, 0, 1] for columns online, hybrid, and F2F.

6) Term – Fall, Spring, or Summer. Some analyses 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 the course number gave the course level (1 = freshman, 2 = sophomore, 3 = junior, or 4 = senior)

12) Reported 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 that have been taken.

17) Previous number of online courses taken.

These values for variable other than GPS relied on student self-reporting. There is no attempt to check if students used the correct values in the raw data. The research 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 removed 83, 167 records, 12% of the original number. This left 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, for some analysis the number of records used was smaller. The basic characteristics of the dataset are in table 2.

Table 2. Mean and Standard Deviation or Percentage of Total Dataset for the Variables.

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	

Data Analysis

For each variable, the study sorted the dataset by different values of the variable. For some variables this was easy. For example, sex has two discrete values. For continuous variables like age, the study arbitrarily divided the continuous variable into bands. Then, the analysis plotted the mean course grade for these different values or bands. As the study compared populations, not samples, which were so large, all differences, even unimportant differences, were significant.

Results

The results are in graphical form and present the findings of demographics, modalities, and colleges within the university on mean grades. Figure 2 gives the background with number of student-courses for each modality by term for the entire time-period covered in this study. Most charts show data for each 2020 to 2021 term during the Covid-19 shutdown as well as show the average by year for the 2015 to 2019 term and 2022 to 2024 term as comparison to the Covid time frame.
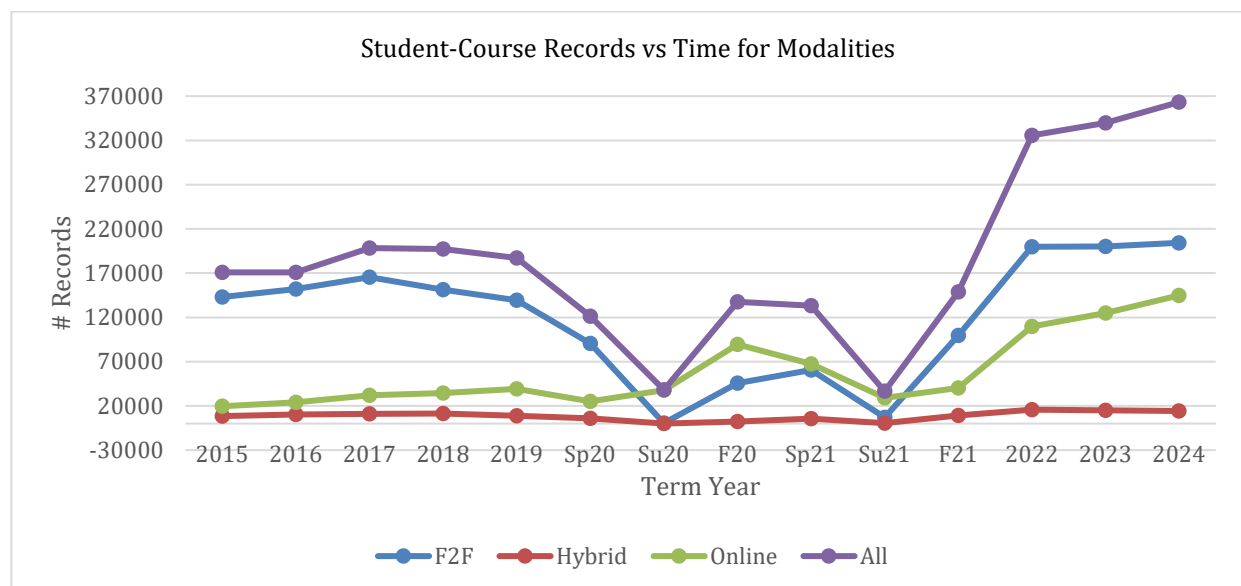

Figure 2. Number of Student-Courses in Each Modality Over Time

Note that Figure 1 shows that hybrid sections are a small percentage of the total. KSU defines synchronous online as F2F, and online as purely asynchronous online. The totals for all increased due to increased student enrollment with time. Note the increase in online sections since Covid.
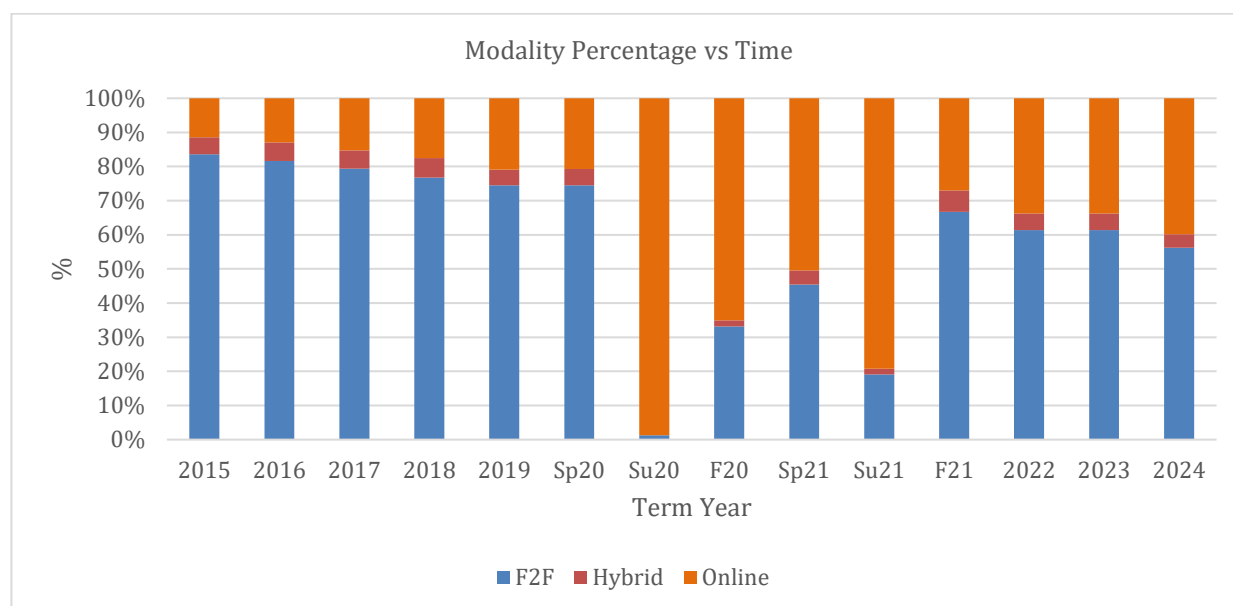
Figure 3. Percentage of Student-Courses for Each Modality Over Time.

As figure 3 shows, the percentage of online and hybrid student-courses has increased between fall 2019 and fall 2021, however, other than the Covid summer 2020 period and the summer 2021 period, F2F still remains the highest percentage of student courses taken.

Effect on Average Course Grades

The study compared the mean grade results from 2015 to 2024. Figure 4 shows the period designated spring 2020 through fall 2021 period during the height of the Covid pandemic data is shown by term and year, as the greatest change took place then. Note that in summer 2020, F2F sections were all taught synchronously online due to the shutdown of the university.
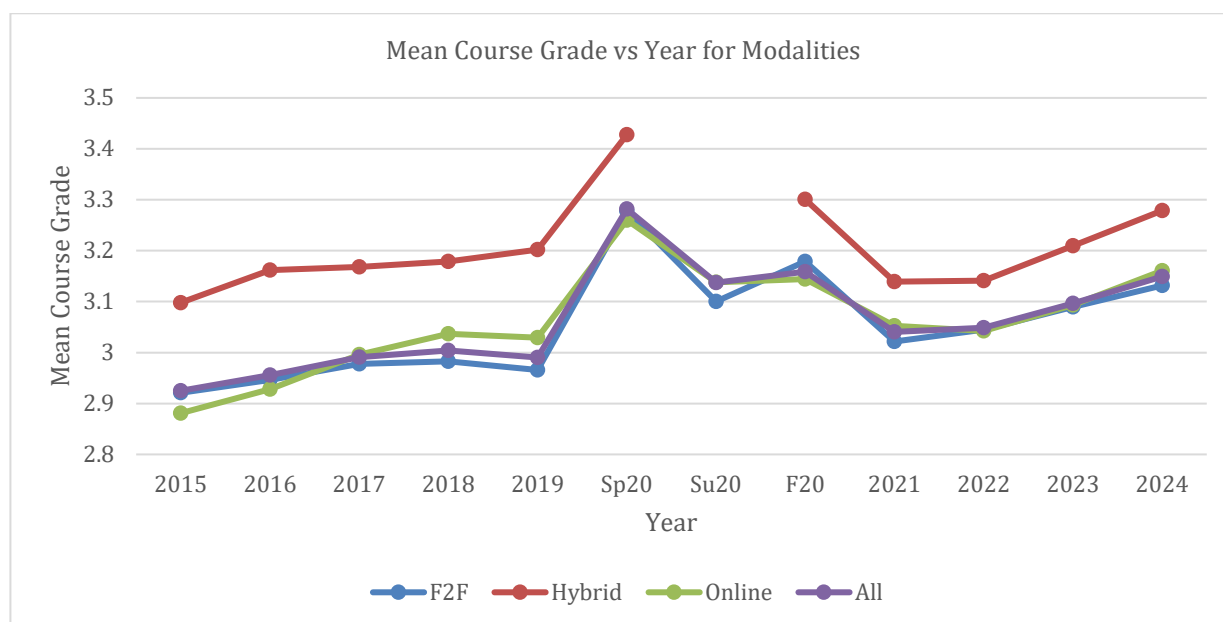

Figure 4. Mean Course Grade for Teaching Modalities Over Time

In Spring 2020, the President of KSU requested faculty to adopt a more lenient grading approach due to the unprecedented challenges posed by the Covid-19 pandemic. Consequently, the mean grades across all teaching modalities experienced a significant increase. This initial surge in grades was a direct response to the sudden transition to fully online learning and the associated difficulties faced by students. Following this period, the general trend in grades began to decline from the elevated levels observed during the onset of Covid-19 in mid-Spring 2020. Over time,

grades gradually decreased, approaching but not fully returning to pre-Covid levels. This suggests a partial reversion to the original grading standards as the immediate impact of the pandemic lessened.

Interestingly, there was a noticeable increase in mean grades for hybrid courses during the summer of 2021. However, the number of hybrid courses offered was relatively small, indicating that this spike in grades may not be statistically significant. The limited sample size of hybrid courses makes it difficult to draw definitive conclusions about the overall impact of this modality on grade trends for that specific period. Overall, while the initial increase in grades was a temporary response to the pandemic, the subsequent trends reflect a gradual normalization of grading practices.

The Effect of Previous GPA on Course Grades

The analysis revealed that the primary predictor of an individual student's course grade is their previous cumulative GPA (CGPA). To explore this relationship further, we examined the mean course grades across different GPA bands. Figure 4 illustrates this analysis, categorizing students into four GPA bands:

1. *3.5 to 4.0:* Representing strong students.
2. *3.0 to 3.5:* Representing average students.
3. *2.5 to 3.0:* Representing weak students.
4. *0.01 to 2.5:* Representing struggling students.
5. *0:* representing having no previous GPA at KSU.

The results indicated a clear correlation for students between the previous GPA and current course grades. Strong students (3.5 to 4.0 GPA) consistently achieved higher mean course grades, reflecting their ability to maintain high academic performance. Average students (3.0 to 3.5 GPA) also performed well, though their mean grades were slightly lower than those of strong students.

Weak students (2.5 to 3.0 GPA) showed a noticeable decline in mean course grades, suggesting that they may face challenges in maintaining consistent academic performance. Struggling students (0 to 2.5 GPA) had the lowest mean course grades, highlighting the need for additional support and resources to help them improve.

Students with no previous GPA at KSU presented a unique case. Their mean course grades varied widely, indicating that this group may include a diverse range of academic abilities and backgrounds. This variability suggests that factors other than previous GPA, such as prior educational experiences or personal circumstances, may play a significant role in their academic performance.

Overall, this analysis draws attention to the importance of previous academic performance as a predictor of future success. It also highlights the need for targeted interventions to support students in lower GPA bands, ensuring they have the resources and guidance necessary to improve their academic outcomes.
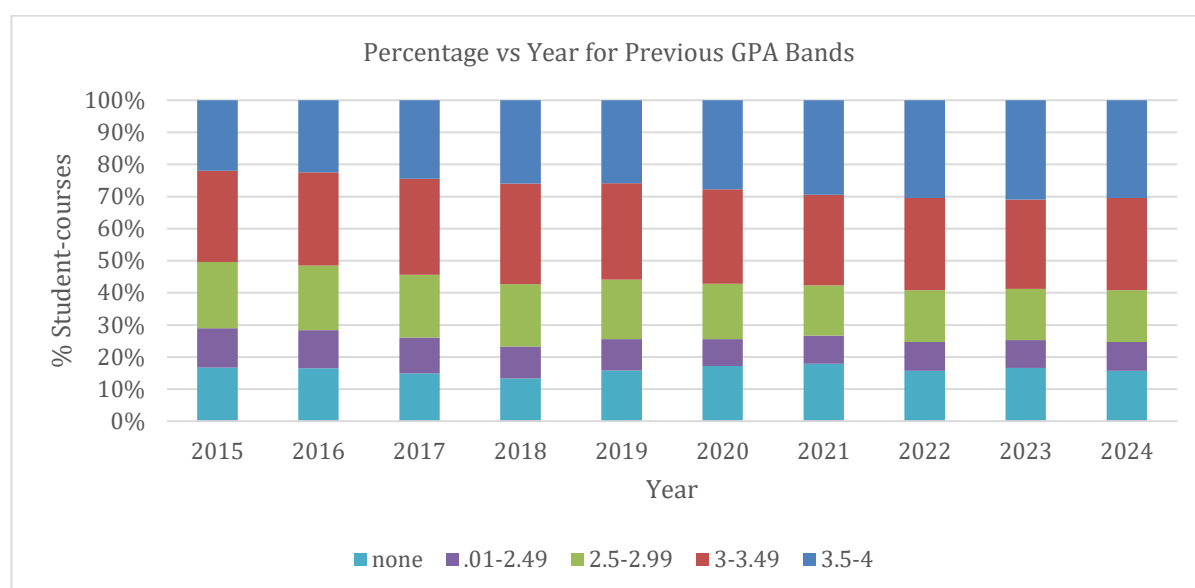

Figure 5. Previous GPA Bands' Shares of Student-Courses Over Time

Figure 5 shows that there has been an increase in the percentage GPAs over 3, a decrease in GPAs between 2.5 and 3 and between 0 and 2.5. The zero percentage represents those students that have no previous GPA, which has remained relatively constant. Note how the highest previous GPA band has increased steadily.
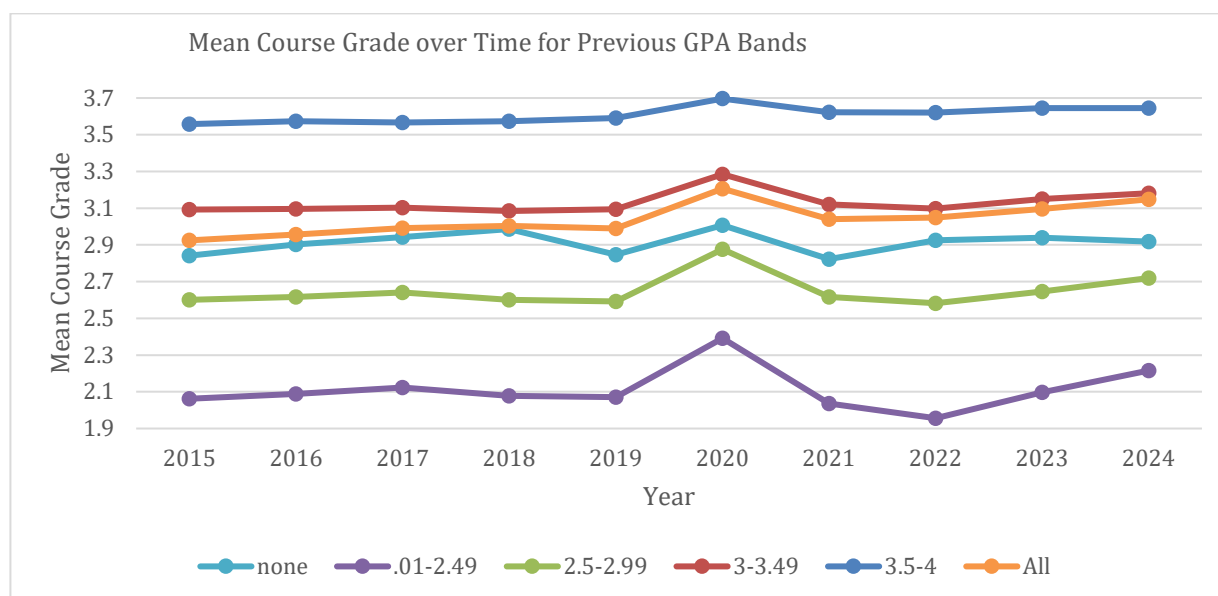
Figure 6. Mean Grades for Previous GPA Bands Over Time

Figure 6 illustrates that all Previous GPA bands showed an increase in course grade for the Covid period, with weak and struggling students showing the greatest increase.

The Effect of Course Level on Course Grades

We analyzed the changes in mean course grades across different course levels to understand how academic performance varied by student year. The course levels were categorized as follows:

Level 1: Courses numbered 1000, typically first year courses

Level 2: Courses numbered 2000, typically sophomore courses

Level 3: Courses numbered 3000, typically junior courses

Level 4: Courses numbered 4000, typically senior courses

Courses numbered 0000, which are high school makeup courses, were excluded from this analysis.

Our analysis compared mean course grades for the years 2020 and 2021 by term, while other years were aggregated and compared on an annual basis. This approach allowed us to capture the immediate impact of the Covid pandemic on academic performance and observe any subsequent trends.

The results indicated that mean course grades varied across different course levels. Freshman courses (Level 1) showed a noticeable increase in mean grades during the initial terms of 2020, likely due to the lenient grading policies implemented in response to the pandemic. However, as the situation stabilized, mean grades for these courses gradually declined, approaching pre-Covid levels.

Sophomore (Level 2) and junior (Level 3) courses exhibited similar trends, with an initial spike in mean grades followed by a gradual decrease. This pattern suggests that students at these levels also benefited from the temporary grading leniency but faced challenges as academic standards were reinstated.

Senior courses (Level 4) showed a more complex trend. While there was an initial increase in mean grades, the decline was less pronounced compared to lower-level courses. This could be attributed to the greater academic maturity and resilience of senior students, who may have been better equipped to adapt to the changing learning environment.

The differential impact of the pandemic on academic performance across various course levels demonstrates the value of providing targeted support to students at different stages of their academic journey to ensure they can successfully navigate the challenges posed by universities studies, in general, or unprecedented events such as the pandemic.

Figure 7 shows that while the proportion of level 1 courses declined noticeably during Covid, by 2022, the proportions were back to pre-covid numbers.
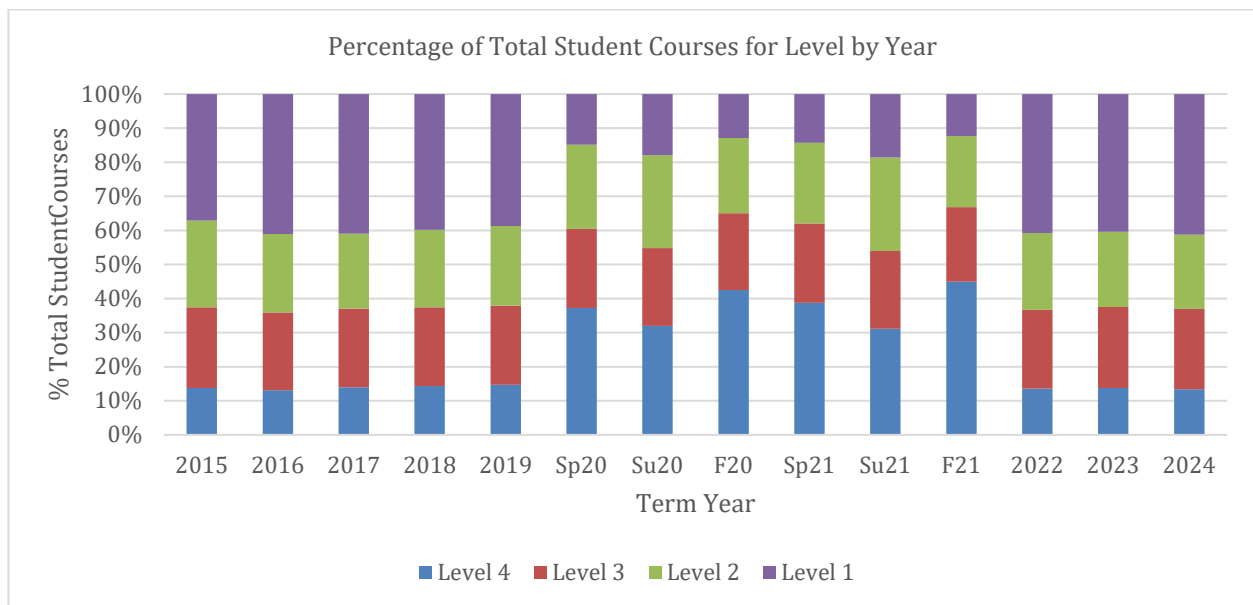
Figure 7. Levels' Shares of Student-Courses Over Time

Note that during Covid**,** the percentage of first year students dropped greatly. There was no equivalent rebound after Covid. This hints that freshmen lost during Covid did not come back later.
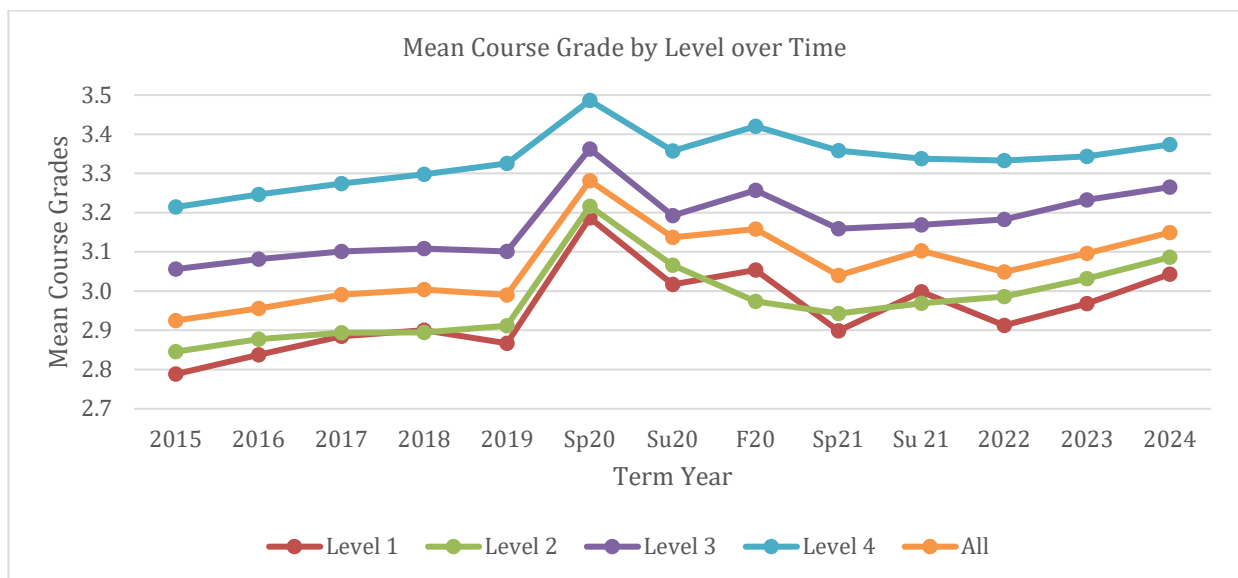

Figure 8. Mean Course Grade for Course Levels Over Time

All the course levels exhibited the Covid spike in mean course grades as Figure 8 illustrates and all course levels except senior courses showed a reversion to the pre-covid rising trend. Interestingly, senior courses did not revert to pre-covid rising trend but have plateaued. As expected, mean course grades increase with course level, however, the gap between junior and senior courses has decreased in the years following the pandemic.

Effect of Sex on Grades

The study also looked at whether this grade effect was affected by sex. Figure 9 exhibits how the proportion of males at KSU has changed. Note that Sex was self-reported, and students (unlike for Gender) can only answer Male of Female.
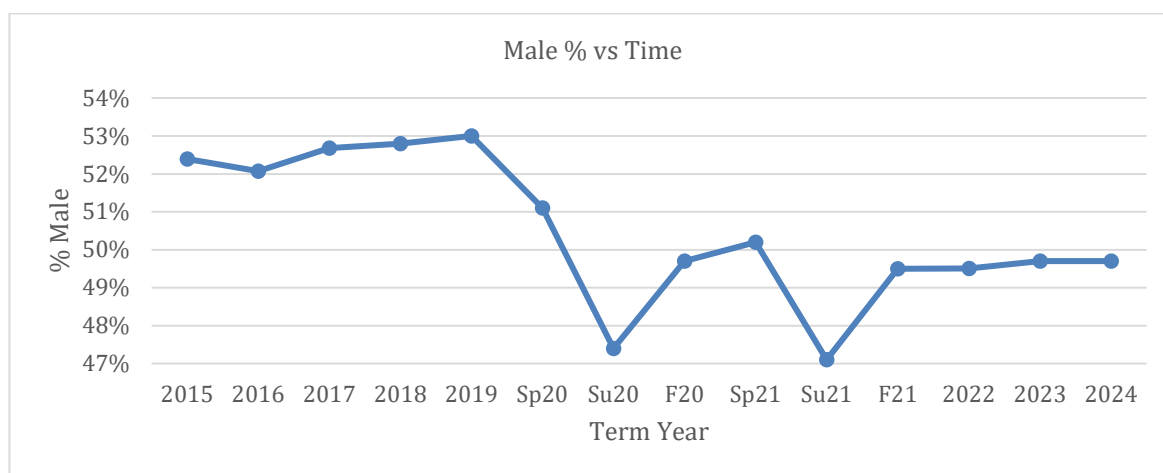
Figure 9. Male's Percentage of Students-Courses Over Time

If one ignores the summer terms, the percentage of males dropped in spring 2020 from the 2015-2019 period and levelled off afterwards. It seems that Covid has had a permanent downward effect on the male proportion. Figure 10 furthers this analysis by then investigating how the mean course grade changes with time.
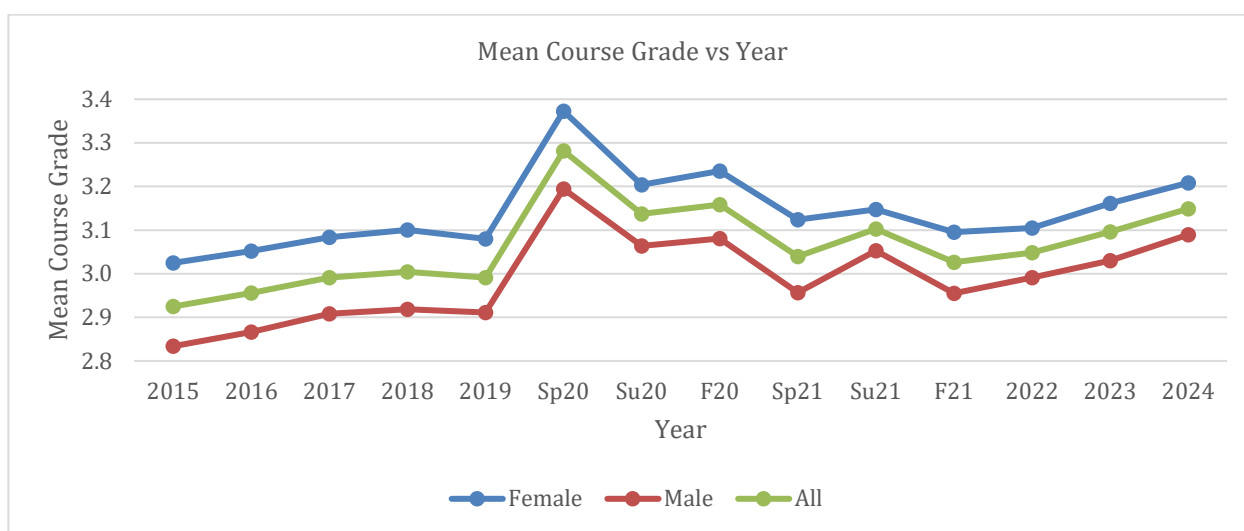

Figure 10. Mean Grade for Each Sex Over Time

When comparing the mean course grades by sex, it was observed that female students consistently outperformed their male counterparts. This trend was evident across all terms and years analyzed. In Spring 2020, following the President's directive for more generous grading due to the Covid-19 pandemic, mean grades for both sexes increased significantly. This temporary grading leniency resulted in a noticeable spike in grades.

However, as the immediate impact of the pandemic lessened and grading standards began to normalize, mean grades for both sexes gradually declined, moving closer to pre-Covid levels. Despite this overall decline, the consistent performance gap between male and female students remained unchanged, with female students continuing to achieve higher mean grades.

The parallel trends observed for both sexes suggest that while the grading leniency affected all students, the relative performance difference between male and female students persisted. This indicates that the underlying factors contributing to the academic performance gap between sexes were not significantly altered by the temporary changes in grading policies.

The resilience of the performance gap between male and female students, even in the face of significant external disruptions, is clearly present. It underscores the need for further investigation into the factors driving this disparity and the development of targeted interventions to support male students in achieving academic success. Next the analysis looked in Figure 11 at splitting this Sex effect by teaching modality.
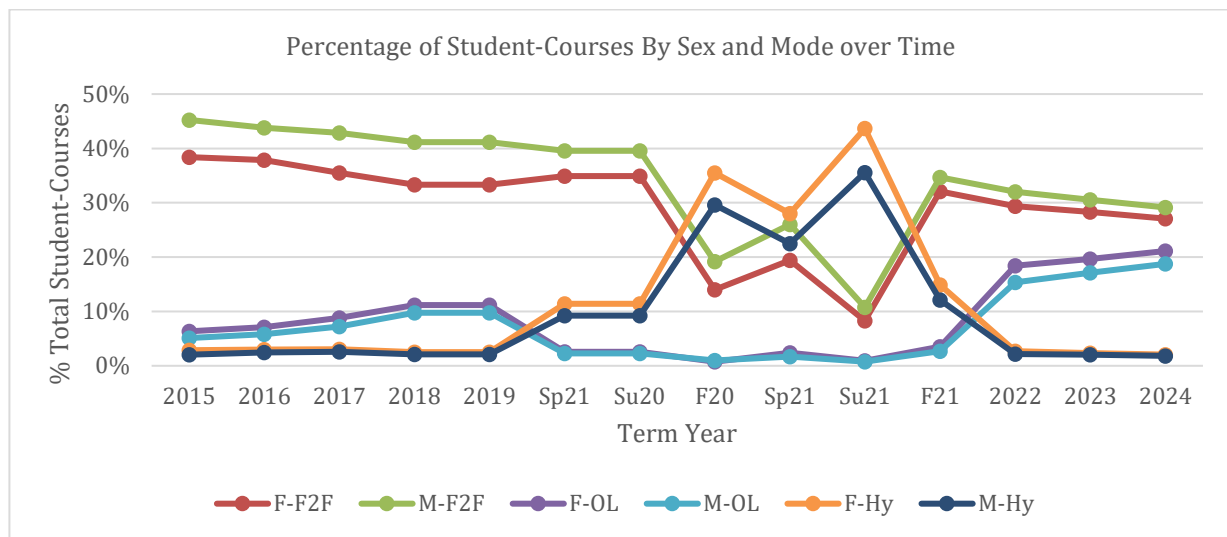
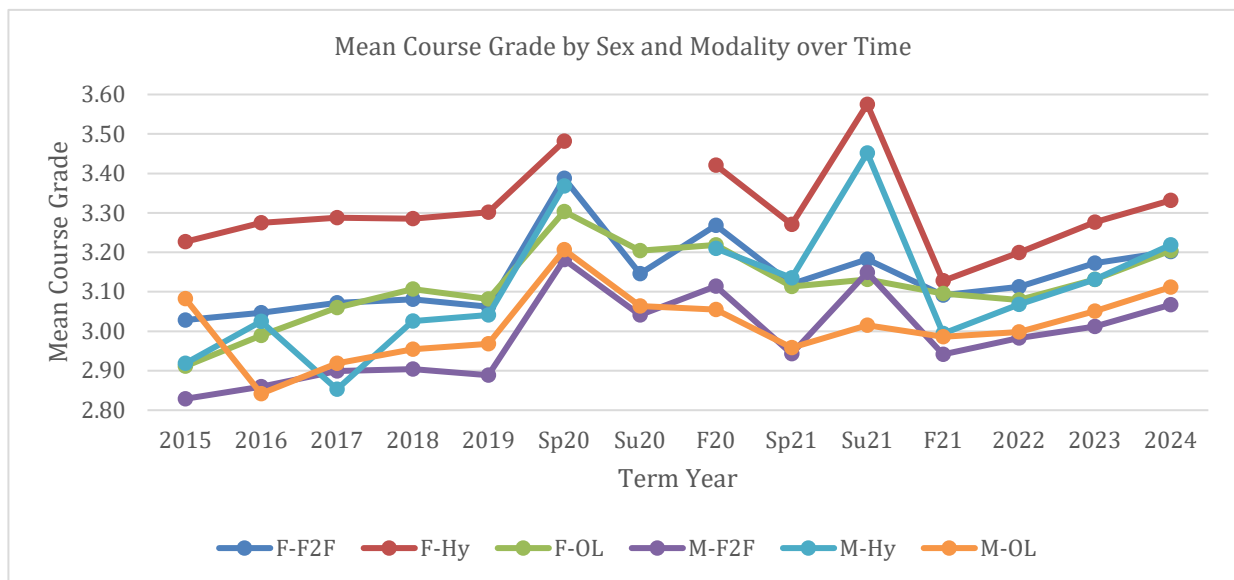*Figure 11. Percentage of Student-Courses for Sex and Modality Over Time.*

Figure 12. Mean Course Grade for Sex and Modality Over Time.

Figure 12 follows the same pattern as previous figures. During the Covid pandemic, there was a noticeable rise in average grades, followed by a gradual reversion to the pre-pandemic rising trend line. It's important to note that there were very few hybrid sections offered during the summer 2021, which may limit the generalizability of findings for that period.

The analysis indicates that while the overall pattern of grade changes was consistent across different teaching modalities (online, face-to-face, and hybrid) and sexes, there was no significant distinction between the mean grade levels of online and face-to-face (F2F) courses, even when accounting for sex. This suggests that the mode of instruction (online vs. F2F) did not have a substantial impact on average grades based on the sex demographic.

However, the hybrid modality stood out with the highest mean grade levels. This could be attributed to the flexibility and blended learning opportunities that hybrid courses offer, potentially enhancing student engagement and performance. The combination of in-person and online elements in hybrid courses may provide a more supportive and adaptable learning environment, contributing to higher academic achievement. Figure 12 clearly indicates the potential benefits of hybrid learning in achieving higher mean grades.

Effect of Ethnicity on Grades

To further investigate potential changes in grade patterns or trends, the analysis incorporated the demographic factor of self-reported ethnicity. This additional layer aimed to identify any variations in academic performance across different ethnic groups. Figure 11 shows the proportion of each ethnicity over time.

The "Others" category in this analysis includes American Native, Pacific Islander, unknown, refuse to state, and missing ethnicities. By examining this diverse group alongside more commonly reported ethnicities, the analysis sought to provide a comprehensive understanding of how ethnicity might influence grade trends.

There has been a steady decline in the percentage of White and an increase in that of Hispanic. These ethnicities were self-reported. Others included students who refused to state ethnicity, as well as pacific islanders and original natives. The results indicated that while there were some variations in mean grades among different ethnic groups, the overall pattern of grade changes remained consistent. This suggests that the impact of the Covid pandemic and subsequent grading policies affected students similarly across various ethnic backgrounds. However, it is important to note that the "Others" category, due to its heterogeneous nature, may not provide a clear picture of specific ethnic group performance. The inclusion of multiple distinct ethnicities within this category could mask more nuanced trends that might be present within individual groups. Additional granular data is needed to better understand the unique challenges and strengths of different ethnic groups in the academic environment.
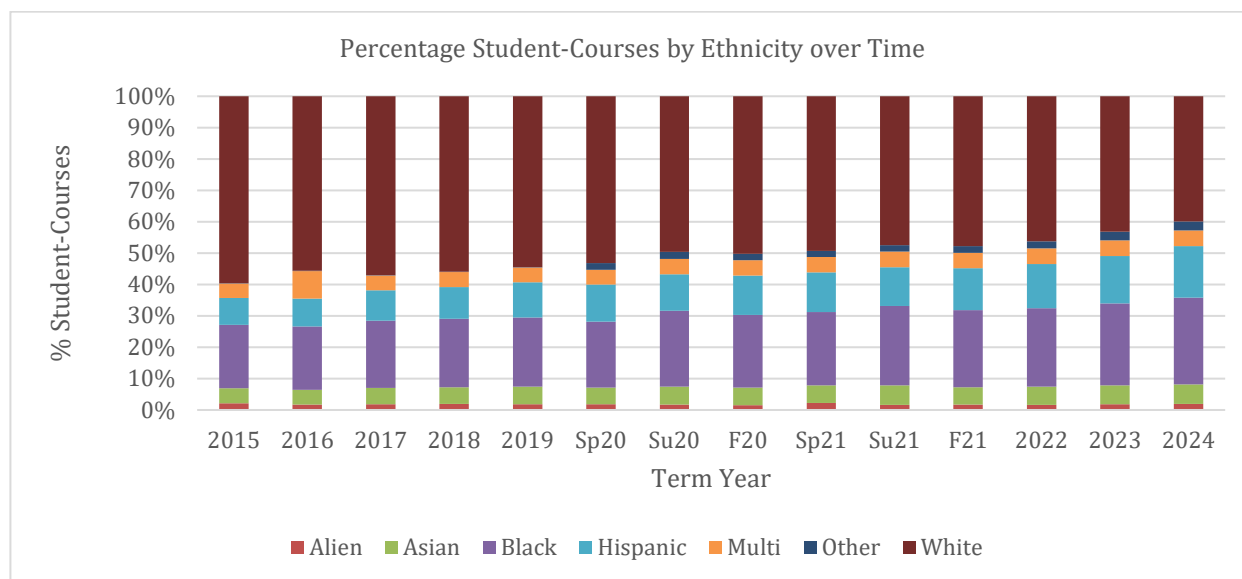

Figure 13. Composition of Student-Courses by Reported Ethnicity Over Time

Figure 13 shows the steady drop in White percentage over time and the increase in Black and Hispanic. Figure 14 demonstrated in what way the mean course grade has changed for each ethnicity over time.
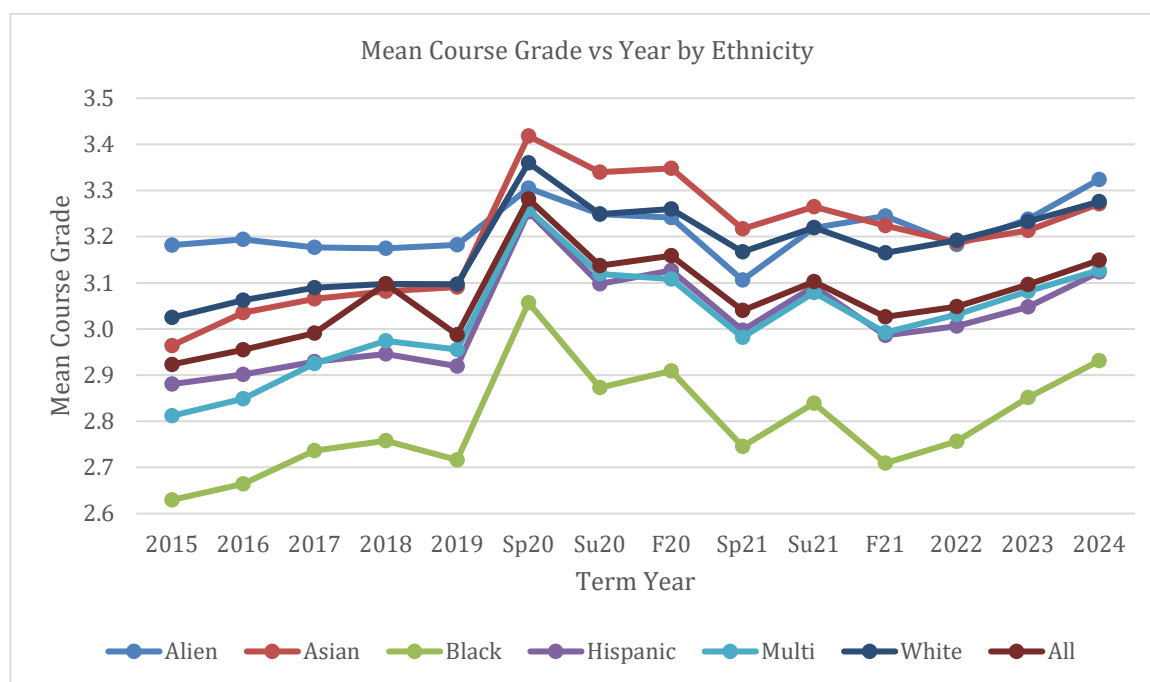

Figure 14. Mean Course Grade for Reported Ethnicity Over Time

Figure 14 shows that all ethnic groups experienced a significant rise in mean grades in Spring 2020 when Covid struck, followed by a gradual decline back to the previous grade trend over time, as observed in other analyses. Despite this overall pattern, Black students continued to have mean grades significantly lower than those of other ethnicities.

Meanwhile, White and Asian students' mean grades caught up with those of international students (referred to as "Aliens" in the original text). This convergence suggests that the temporary grading leniency during the pandemic had a similar impact across these groups, allowing them to achieve comparable academic performance levels.

The consistent trends across different modalities, sexes, and ethnicities indicate that the established patterns of academic performance remained largely unchanged despite the disruptions caused by the pandemic outlining the resilience of these trends but once again, shows the need for greater academic assistance for to address persistent disparities, particularly for Black students.

Effect of Age on Grades

The study examined the effect of student age on mean course grades. Given that most students are young, the following four age bands were selected for analysis:

1. 18-19 years old
2. 20-21 years old
3. 22-28 years old
4. Over 28 years old

KSU's Institutional Review Board (IRB) requested that we exclude results from students under 18, as they are considered minors.

The analysis revealed distinct trends in academic performance across these age groups. Younger students (18-19 years old) generally showed higher mean course grades, reflecting their recent high school preparation and familiarity with academic routines. Students aged 20-21 also performed well, though their mean grades were slightly lower, possibly due to increased academic and personal responsibilities as they progress through their college years.

The 22-28 age group exhibited more variability in mean grades, suggesting a mix of traditional and non-traditional students with diverse backgrounds and experiences. This group may face unique challenges, such as balancing work, family, and academic commitments, which can impact their performance.

Students over 28 years old had the most varied mean grades, reflecting the wide range of life experiences and educational backgrounds within this group. While some older students excelled, others faced significant challenges, highlighting the need for tailored support to address their specific needs.

Figure 15 demonstrates the proportion of total students for each age band over time and Figure 16 illustrates how mean course grades for each age band have changed over time.
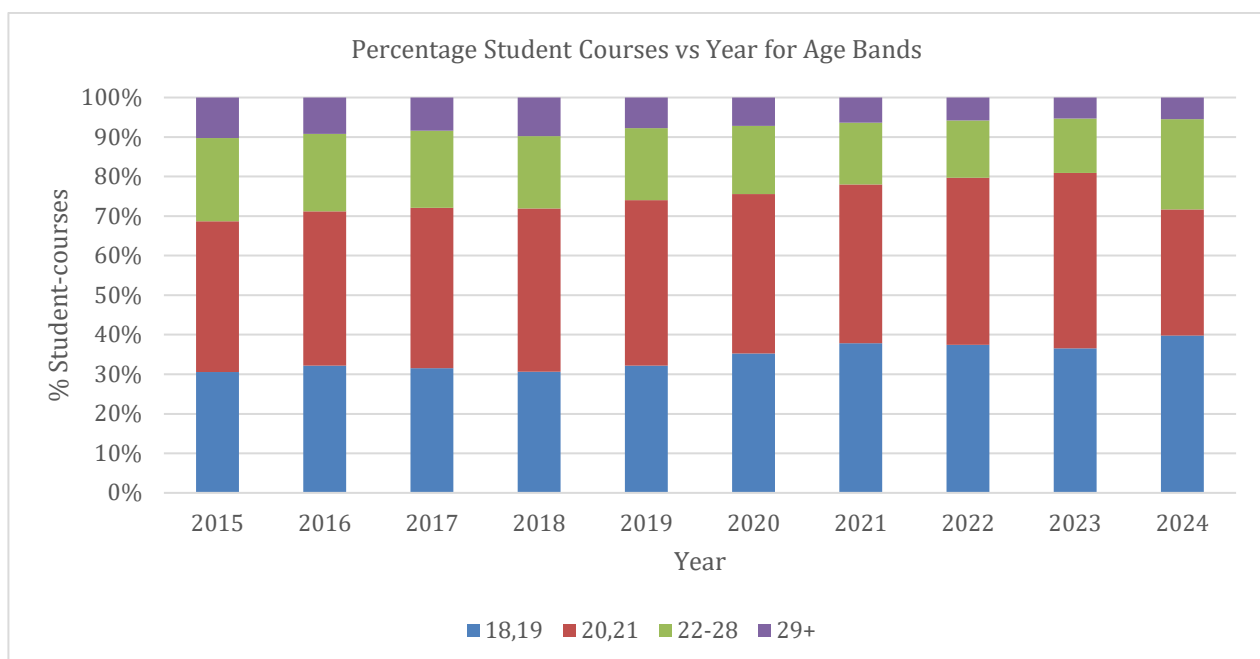

Figure 15. Percentage Student Courses by Age Bands Over Time

There appears to have been an increase in eighteen- and nineteen-year-olds and a decreased proportion of students over the age of 28 since Covid.
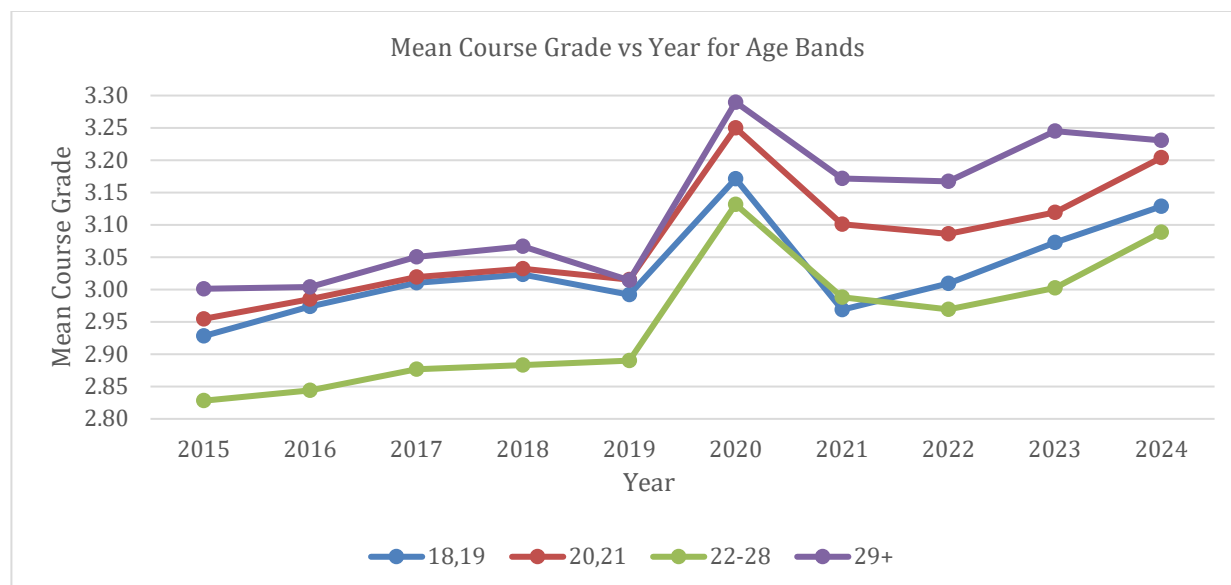

Figure 16. Mean Course Grade for Age Bands Over Time

Figure 16 clearly shows that course grade increased over Covid then reverted to pre-covid trend lines for all age bands. The biggest increase was for the 22 to 28 age band.

Effect on Mean Grades in Different Colleges

Table 3 shows the following abbreviations used for KSU for colleges, which vary widely in size.

Table 3. College Abbreviations Explained

Abbreviation	Full Name of College
ACM	Architecture and Construction Management
Arts	Arts
Bus	Business
Comp	Computing and Software Engineering
Cyber	Institute for Cyber Security
Educ	Education
Eng	Engineering and Engineering Technology
HHS	Health and Human Sciences
Hon	Honors
HSS	Humanities and Social Sciences
S&M	Science and Mathematics
Uni	University

Using the abbreviations from Table 3, Figure 17 is developed to indicate the share of student-courses for each college over Covid. Note that University College (Uni) was phased out in Summer 2021. Figure 18 shows how the college share of total student-course changes over time.
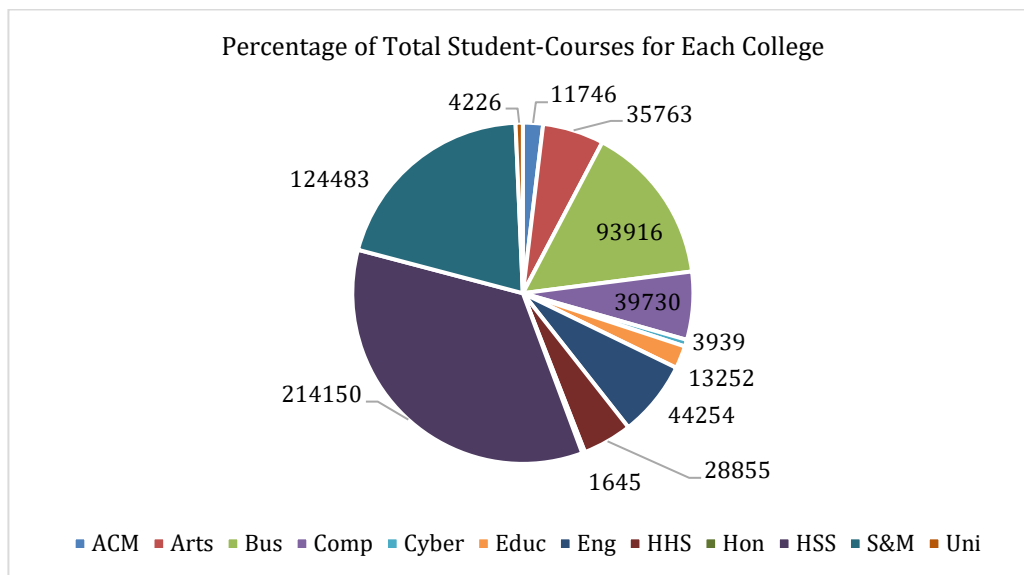
Percentage of Total Student-Courses for Each College

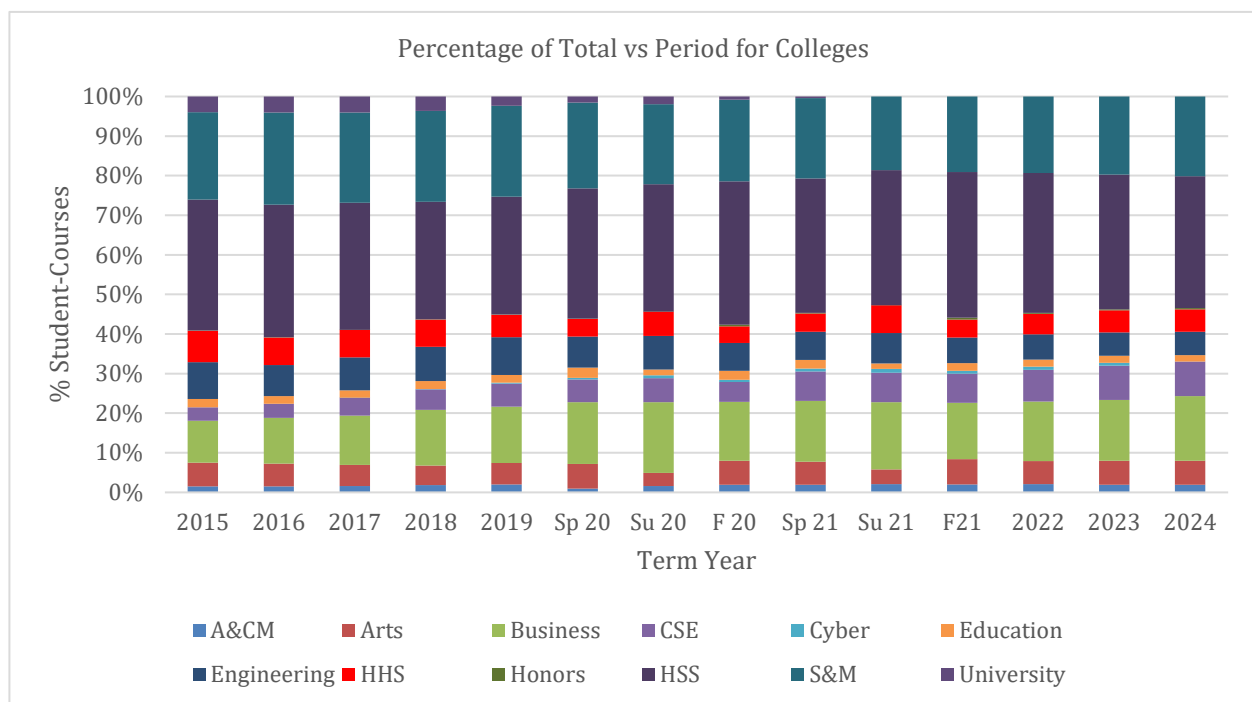*Figure 17. College Student-Course Share, 2020 to 2021*

Figure 18. Colleges' Shares of Student-Courses Over Time

All the information in Figures 16 and 18 allows the analysis of the mean course grade for each college over time that is represented in Figure 19. The data clearly illustrates the phasing out of University College and the concurrent rise of the Cyber program. During the observed period, the proportions of other programs remained relatively stable. University College was gradually phased out and ultimately abolished by Summer 2021. In contrast, the Cyber program, which began in Spring 2020, emerged as an all-online, stand-alone institute rather than a traditional college. This program's rapid growth reflects the increasing demand for cybersecurity education and the flexibility of online learning. By 2024, the business college had absorbed the Cyber courses, integrating them into its curriculum to provide a more comprehensive educational offering. This transition highlights the dynamic nature of academic institutions as they adapt to evolving educational needs and technological advancements. The integration of Cyber courses into the business college curriculum underscores the importance of cybersecurity skills in the modern business landscape.
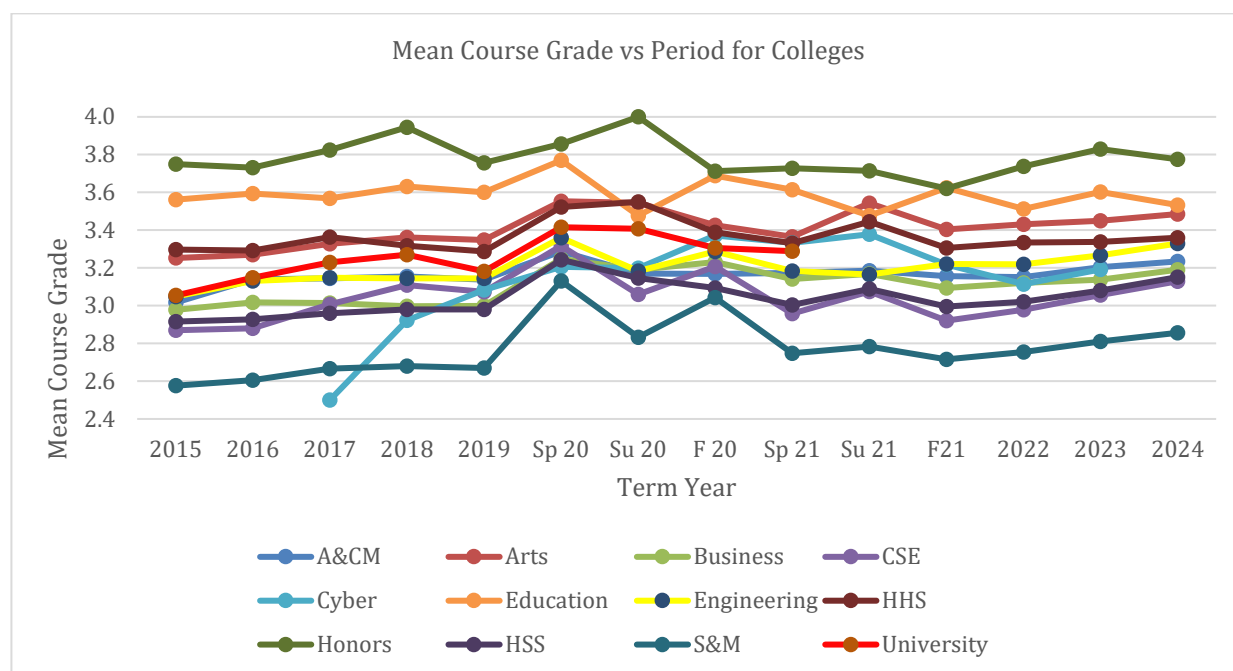
Figure 19. Mean Course Grade for Each College Over Time

It is noteworthy that all colleges, except the Honors College, experienced a rise in mean course grades when Covid-19 first struck. Following this initial increase, most colleges saw a reversion to their pre-Covid grade trends. The grade patterns across different colleges were generally erratic, but certain colleges, including Humanities and Social Sciences (HSS), Business (Bus), Engineering (Eng), Architecture and Construction Management (A&CM), and Computing and Software Engineering (Comp), exhibited similar patterns and average mean grades over the analyzed time frame. This consistency suggests that these colleges maintained stable grading trends irrespective of demographic factors or teaching modalities.

Honors College, however, displayed an opposite reaction to Covid, with mean grades initially diverging from the general trend. By the summer of 2021, the mean grades in the Honors College began to align more closely with the patterns observed in other colleges.

In terms of specific disciplines, the College of Education consistently had the highest mean course grades, while the College of Science and Mathematics had the lowest. The Arts and HSS followed with relatively high mean grades, while other colleges maintained similar grade levels. The pre-Covid grading patterns largely continued post-Covid, although there was a noticeable disruption during the pandemic.

Discussion

This study examined the longitudinal effects of course modality, the Covid-19 pandemic, and student demographics on mean course grades and academic performance at Kennesaw State University (KSU) from 2015 to 2024. It attempted to answer three questions and offer insights into how course modalities and demographics can shape grade outcomes.

This study asked: *Did average course grades vary before, during, and after the Covid shutdown?*

The most prominent finding is the sharp increase in mean course grades during the Covid-19 shutdown (Spring 2020–Fall 2021), followed by a gradual return to pre-pandemic trends. This aligns with studies by Karadag (2021), Tillinghast et al. (2023), and Supriya et al. (2021), which reported grade inflation during the pandemic due to lenient grading policies and emergency adaptations. The temporary nature of this inflation, as observed in our data, supports Engelhardt et al. (2022), who noted that while GPAs remained stable, grade inflation was evident due to policy shifts rather than improved learning outcomes and raises the question about the effectiveness of grades as indicators of student learning.

For the second question: D*id students from different demographics, different methods, and in different colleges of the university have different student final grade outcomes before, during, and after Covid?*

The study confirms demographic disparities in academic performance. Female students consistently outperformed male students, a trend supported by Thiele et al. (2014) and Moodie (2021). Black students had the lowest mean grades across all modalities, echoing findings by Massey and Probasco (2010) and Xu and Jaggars (2014), who attribute such disparities to systemic inequities and differences in access to educational resources. Interestingly, the hybrid modality

appeared to narrow some demographic gaps. For example, Moodie (2021) found that black students benefited more from hybrid courses than other groups. This suggests that hybrid learning may offer a more equitable instructional format, potentially mitigating some structural disadvantages.

The Covid-19 period saw the greatest grade increases among students with lower prior GPAs, possibly due to grading leniency. However, this group also experienced the steepest declines post-pandemic, indicating that the temporary boost did not translate into sustained academic improvement. Grades increased with course level, with senior-level courses showing the highest mean grades. This trend is expected, as upper-level students are typically more academically prepared. However, the post-Covid plateau in senior course grades suggests a potential shift in instructional rigor or student engagement at advanced levels. Consistent with Alwarthan et al. (2022) and Moodie (2022), prior GPA emerged as the most significant predictor of course performance. This underscores the importance of academic momentum and suggests that interventions targeting students with lower GPAs could be particularly impactful.

While most colleges followed the general pattern of grade inflation during Covid-19 and subsequent normalization, Honors College deviated, showing a decline during the pandemic. This may reflect a mismatch between the Honors student profile and the online learning environment, as suggested by Blau and Drennan (2017). Conversely, the College of Education consistently had the highest mean grades, possibly due to differences in assessment practices or student characteristics. The College of Science and Mathematics had the lowest mean grades, consistent with Baklavas and Krassas (2024), who found that practical and lab-based courses were more disrupted by the pandemic. These disciplinary differences highlight the need for tailored instructional strategies across academic units.

Since the patterns were consistent across modalities, demographics, and colleges, it suggests that these metrics do not significantly affect mean grade patterns. This finding aligns with the argument by Campbell and Cabrera (2014) that average grades and GPA may not be reliable indicators of student learning. Although GPA and course grades are often the primary indicators available, this study raises important questions about their effectiveness as measures of learning, as supported by Cognard-Black et al. (2019) and Schwab et al. (2018).

Finally: *Do course grades of students with different demographics vary amongst the different modalities?*

Throughout all years, hybrid courses consistently produced the highest mean grades, outperforming both face-to-face (F2F) and online modalities. This suggests that the blended format—combining in-person and online elements—may foster a more effective learning environment and is supported through findings by Carper and Friedel (2021) and Fidalgo-Blanco et al. (2020), who emphasized the pedagogical advantages of hybrid formats, including flexibility, increased engagement, and better alignment with student preferences. However, as noted by Nguyen (2015) and Cavanaugh and Jacquemin (2015), modality comparisons often suffer from selection bias. While our study uses prior GPA as a variable, further research is needed to confirm causality.

While demographic variations existed, overall grade patterns remained stable across modalities, indicating that factors such as ethnicity, age, and sex had a secondary influence on performance. Notably, female students outperformed male students, and black students had the lowest average grades, underscoring the need for targeted academic support. Prior GPA emerged as the strongest predictor of course outcomes, while older students showed greater variability in performance. The consistent patterns across modalities suggest that while the mode of instruction impacts overall performance, demographic factors play a secondary role in influencing mean grade trends.

Conclusion

Given the growing adoption of online and hybrid formats, further research is needed to explore the long-term benefits of hybrid learning, particularly for diverse student populations. The main conclusion is that there was a large increase in course grades over Covid for all demographics and that this increase has residual effects after Covid. This study contributes to the literature by highlighting the effect of Covid on grades over many demographic groups.

Recommendations

Based on the results of this study, several future research questions emerge. Since the data only extends through 2024 and shows a reversion in mean course grades from the Spring and Summer 2020 online switch to pre-Covid trend levels, it is important to investigate whether grade inflation will continue at the same rate. The overall increase in mean course grades during Covid-19 raises questions about the validity of grades as a measure of learning. The observed grade inflation suggests that grades may not accurately reflect student learning outcomes, highlighting the need for alternative assessment methods.

There are also other potential demographics that may influence student grades, such as average daily hours of sleep and study. Zollanvari et al. (2017) argues that limited measures like GPA overlook important aspects of potential success, such as resilience. Future studies should consider these factors to provide a more comprehensive understanding of student performance. With observed increases in mean course grades and potentially enhanced

student learning in the hybrid teaching modality, adoption of more flexible teaching modalities and movement away from traditional F2F instruction should be investigated. This area lacks sufficient research and warrants further exploration to determine the most effective teaching methods for diverse student populations.

Another demographic factor not examined in this study is whether a student is first-generation. As suggested by Holmes and Slate (2017), this could be a valuable demographic to investigate, as first-generation students may face unique challenges that impact their academic performance. Additionally, the study did not consider the effects of section sizes or student course loads on grades. Karas (2021) reported that larger class sizes lead to lower grades, while Huntington-Klein and Gill (2020) found no relationship between course load and GPA. Further research should explore these variables to better understand their impact on student performance.

Limitations

While this study offers valuable insights, several methodological constraints should be acknowledged. First, the analysis was based on data from a single institution and although the data was robust, it limits the ability to concretely extrapolate the findings to other universities and students. If the dataset could be expanded to encompass multiple institutions, a more comprehensive analysis could be completed to help determine whether the observed effects are consistent across different educational environments.

Second, course grade was used as the primary indicator of student learning, which, while practical, may not fully capture the complexity of educational outcomes. Course grades reflect multiple factors, including assessment styles, grading policies, and individual instructor approaches, which may not always align with actual learning gains.

Third, another limitation stems from the study's lack of assessment of differences in attitudes toward various instructional modalities, which may have a significant impact on academic performance. The literature suggests that student preferences and perceptions regarding different learning environments, such as in-person, hybrid, or fully online formats, could influence engagement, motivation, and overall success. While this study did not explore attitudinal differences, future research could investigate how modality preferences shape learning outcomes and contribute to academic performance.

Fourth, as the analysis compares populations not samples on census, one cannot use sample statistics as a tool to give numbers such as p-values. Standard statistics were designed for samples.

Despite these limitations, this study provides a foundation for further investigation and highlights important directions for future research. Addressing these constraints in subsequent studies could yield deeper insights into the factors that influence student success across diverse educational settings.

Ethic Statement

As the registrar of KSU replaced the student names with random numbers, KSU's IRB determined that students' written permission was not needed to use this data. No generative AI was used in this research or in the writing of this paper.

Declarations

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. The authors assert that approval was obtained from the institutional review board (IRB) at Kennesaw State University, as all the students' names were replaced by random numbers. The submission has not been published, nor is it before another journal for consideration.

Generative AI Statement

No generative AI was used in this research or in the writing of this article.

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