The Impact of the COVID-19 Pandemic on Undergraduate Student Performance

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Abstract

The COVID-19 pandemic exacerbated an array of stressors that affected college students. We hypothesized that student performance was negatively impacted by the circumstances of the pandemic and some demographic groups suffered larger decrements than others. To address this, we collected institutional grade data from all students at Iowa State University in the COVID-19-impacted fall 2020 (F20) semester and compared them to a comparison group (CG) which included all students at the institution from 2015-2019. Surprisingly, final grades were 0.21 GPA points higher in F20 compared to the CG ($p < 0.001$) across the undergraduate population. Grades were higher within American Indian ($p = 0.02$), African American ($p = 0.002$), Hispanic ($p < 0.001$), and Asian ($p < 0.001$) subgroups in F20 when compared to the CG. The underlying reasons are unclear and despite the collective stressors experienced by students associated with COVID-19, student performance improved in F20 compared to previous years.

Keywords: pandemic, grades, COVID-19, stress

With the emergence of COVID-19 in the winter of 2019 and the pandemic that followed, the world was thrown into chaos and post-secondary education was not immune from this. Worldwide, colleges and universities closed midway through the spring semester and largely and hastily transitioned from face-to-face delivery to a virtual delivery format that students were forced to accept. These cumulative changes led 33% of undergraduate students to worry about their academic futures (Clabaugh et al., 2021). As universities were closed during this time period, most course participation was done in non-campus facilities and predominantly at home (Firkey et al., 2021) resulting in higher rates of distraction that disproportionately impacted female students compared to male students (Clabaugh et al., 2021). Some of this distraction was caused by an increased need to work to support their families as well as increased childcare responsibilities for younger siblings as day cares, elementary, middle, and high schools closed (Bidwell et al., 2020). Over the course of the summer, reopening plans were made for the coming fall semester (F20) that relied heavily on virtual delivery of course material employing both synchronous and asynchronous instruction.

Accompanying the pandemic were predictable economic calamities at the macro and individual scale that appeared to impact minority groups and people in lower socioeconomic standing with greater severity (Perry et al., 2021), though this was buffered somewhat in the United States by several rounds of government-supplied stimulus payments. Importantly though for students, the COVID-19 pandemic created a host of independent and interdependent stressors related, but not limited to, finances (Hawley et al., 2021; Son et al., 2020), workload (Aristovnik et al., 2020; Aucejo et al., 2020; Hawley et al., 2021; Son et al., 2020), employment (Hawley et al., 2021; Wang et al., 2020), and mental health (depression, anxiety, isolation/loneliness, etc.) (Aristovnik et al., 2020; Firkey et al., 2021; Hawley et al., 2021; Son et al., 2020; Wang et al., 2020). Of note, students from lower socioeconomic backgrounds reported greater stress prior to the pandemic, and this same group reported more financial and other academic impacts caused by the pandemic than students from higher income households (Bono et al., 2020). Perceptions of increased workloads (Aristovnik et al., 2020; Aucejo et al., 2020; Son et al., 2020; Wang et al., 2020) were common amongst students as were rising feelings of frustration (Aristovnik et al., 2020). Elevated stress was not evenly distributed amongst demographic groups as it was increased in females compared to males (Firkey et al., 2021; Wang et al., 2020) and in first- and second-year students compared to third- and fourth-year students (Wang et al., 2020). During the early phase of the pandemic (May

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20th-July 5th, 2020), negative coping behaviors like alcohol consumption and marijuana were increased by 27% and 15% of responding college students, respectively, though nearly 60% reported decreased sexual activity, which may be supportive of effective isolation (Firkey et al., 2021). These feelings of increased stress were well-justified as many students suffered real consequences due to COVID-19-mediated changes. For example, 13% of students reported delayed graduation (Aucejo et al., 2020) with a larger impact on lower income students, 20-40% lost a job or internship (Aucejo et al., 2020; Firkey et al., 2021; Wang et al., 2020), and >50% had difficulty securing basic resources (Firkey et al., 2021).

Pre-pandemic college students of the late 2010's experienced greater levels of stress than college students from 20 years ago (Landin, 2019). A study of mental health illnesses among college students showed that the number of mental health reports were significantly greater in 2019 when compared to the number of reports that occurred just four years prior in 2015 (Oswalt et al. 2020). Additionally, today's college students have experienced more financial concerns since the cost of college has tripled over the last 20 years (Hanson, 2021). The collective stressors created by COVID-19 added to the already elevated level of stress that existed. How the added stress impacted student performance is unknown.

Theoretical Framework

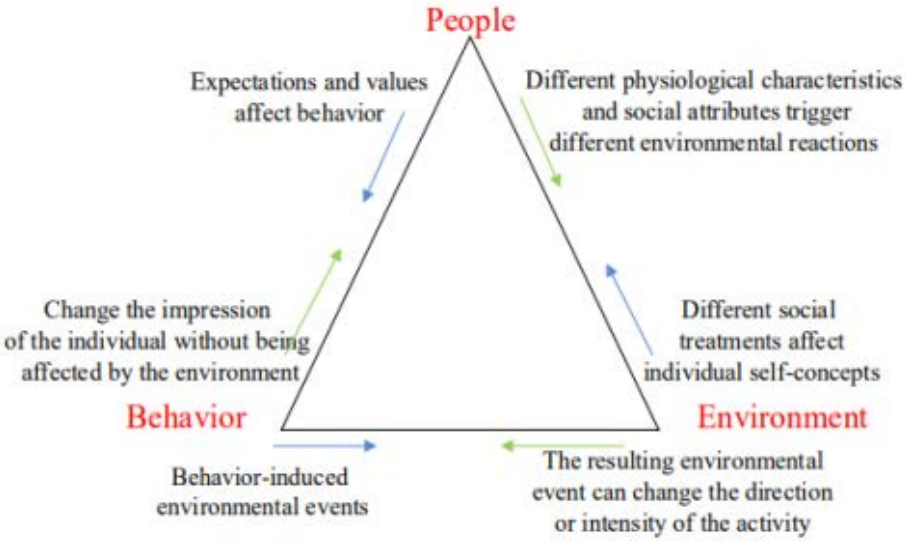
This study utilized Bandura's Triadic Reciprocal Determinism (TRD) theory (1978) to explain the potential impact of the COVID-19 pandemic on student achievement and performance. The theory is comprised of personal/individual factors, behavioral factors, and environmental factors (Devi et al., 2017). Bandura's theory (1978) proposed that there is a reciprocal relationship between these factors; they influence and determine one another (Figure 1) (Devi et al., 2017; McKim et al., 2021; Zhang, 2021; Zhao et al., 2020). Environmental factors refer to the social and physical environments and their influence on an individual's behavior (Devi et al., 2017; Zhang, 2021). Behavioral factors consist of the knowledge and skill needed to perform a certain behavior (Devi et al., 2017). Personal/individual factors seek the cause of human behaviors in internal attributes, including self-perception, knowledge, expectations, and attitude (Devi et al., 2017; Zhang, 2021; Zeng et al., 2020). Though all three factors influence one another, they do not always exert equivalent influence (Zhang, 2021). The TRD theory states that the environment can influence people's attitudes, as well as alter the individual's behavior (Shoulders et al., 2021). An individual's behavior can change their environment, as well as change the attitude of the individual (Shoulders et al., 2021). Lastly, an individual's attitudes, perceptions, and values influence their behavior and can cause varying environmental reactions (Shoulders et al., 2021).

In the context of this study, the personal/individual factors included the students' internal attributes and environmental factors included COVID-19 induced stressors (i.e., state and university COVID-19 policies and mandates, mental health, increased isolation, and decreased finances). Additionally, the behavioral factor included students' academic achievement. In accordance with TRD, the factors are interrelated. Students' attitudes regarding the challenges the environmental conditions pose can influence the students' academic achievement and performance (Shoulders et al., 2021). For example, if a student cannot learn in an online classroom, the student may lose motivation and self-efficacy for the course, and thus decrease their academic performance.

Previous studies have discovered the detrimental impacts of the COVID-19 pandemic on students. The pandemic created a variety of stressors for students in areas such as finances (Hawley et al., 2021; Son et al., 2020), workload (Aristovnik et al., 2020; Aucejo et al., 2020;

Figure 1.

Model of triadic Reciprocal Determinism (Zeng et al, 2020)



Hawley et al., 2021; Son et al., 2020), employment (Hawley et al., 2021; Wang et al., 2020), and mental health (i.e., depression, anxiety, isolation/lonliness, etc.) (Aristovnik et al., 2020; Firkey et al., 2021; Hawley et al., 2021; Son et al., 2020; Wang et al., 2020). Along with these stressors, the COVID-19 pandemic disproportionately impacted minority groups and people in lower socioeconomic standing with greater severity (Perry et al., 2021). These groups suffered financical difficulties (Perry et al., 2021), the loss of a job or internship (Aucejo et al., 2020; Firky et al., 2021; Wang et al., 2020), and the difficulty of acquiring basic resources (Firkey et a., 2021). This study will consider how the environmental factors and individual/personal factors influenced academic achievement during the COVID-19 pandemic.

Purpose

The purpose of this investigation was to determine the extent to which the cumulative experiences of COVID-19 influenced student academic performance. Given the negative association of stress and academic performance (Frazier et al., 2019), we hypothesized that, on the whole, student academic performance would be negatively impacted in the COVID-19-impacted F20 semester compared to previous semesters. We also hypothesized that the experiences of COVID-19 would differentially impact demographic groups.

Methods

De-identified midterm grades, final course grades, and demographic information were obtained from the Office of Institutional Research at Iowa State University. Because of our approach (deidentified, existing data), our study was exempt from required Institutional Review Board (IRB) approval. The dataset contained midterm grade, final course grade, and demographic information for 69,387 unique individuals from fall semesters from 2015 through F20. Midterm grades are letter grades that are reported halfway through the semester for students earning C- and below. Mid-semester grades of C and higher are not reported. Midterm and final letter grades were transformed into quantitative variables according to a 4.00 grade point average (GPA) scale (Table 1). Non-letter grades that do not contribute to the GPA were identified and excluded from these quantitative analyses. These items included: Incomplete (I), No-Pass (NP), Pass (P), Satisfactory (S), and Course Drops (X), which collectively accounted for 15.7% of the final grades reported in the dataset. To assess student performance, we relied on the number of midterm grades per student per term (midterm count), average midterm grade per student per term, final grade per student per term, and differences between final and midterm grade within a semester. Distributions of midterm and final grades for each term were found to be normally distributed through kurtosis and skewness tests.

Data from the fall of 2015 through the fall of 2019 were pooled to form a comparison group (CG). Pooling of 2015-2019 data allowed us to perform a two-mean comparison of the CG to the F20 data. Therefore, t-tests were performed to address whether pre-pandemic grades differed from 2020 grades. The F20 and CG groups were further divided into demographic groups, which included major classification, classification by year, admission type, sex, ethnicity, and first-generation student status. T-tests were performed to test for significant differences between F20 and the CG within each demographic group. Midterm and final grades from the CG and F20 were fit to linear models to test for significance within a group (CG or F20) across the fixed demographic variables. Orthogonal contrasts were performed to compare levels within each variable for each dataset.

Table 1.

Conversion of letter grades to a grade point average scale of 4.00

Letter Grade	Quality Points (Recoded Value)
A	4.00
A-	3.67
B+	3.33
B	3.00
B-	2.67
C+	2.33
C	2.00
C-	1.67
D+	1.33
D	1.00
D-	0.67
F	0.00

Findings and Results

Demographics

Demographics of the students within the dataset are identified by year in Table 2. Undergraduate enrollment peaked in 2016 and has steadily declined. Transfer student enrollment, as a percentage of the total student population, has declined by 3.45% since 2015. Enrollment of Black and White students (as a percentage of the total) have remained steady while enrollment of Asian and Hispanic students has steadily increased since 2015 by 0.99% and 1.84%, respectively. Enrollment of Indigenous American/ Native Alaskan students and students who preferred not to indicate ethnicity have declined. Collectively, students in these demographic groups made up between 3.5-5.5% of the student population over the years included in the data set. The percentage of first-generation college students has declined almost 6% since 2015. The proportion of female students, male students, and STEM major students have remained steady from 2015 to 2020.

Table 2.

Student demographics by year

	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
N	29,520	30,224	29,957	29,248	27,934	26,567
Classification Year[1]						
1	23.82%	22.76%	21.09%	21.37%	20.88%	19.72%
2	21.71%	21.87%	21.89%	21.05%	21.42%	21.04%
3	23.91%	23.78%	24.34%	23.71%	23.50%	24.62%
4	30.56%	31.59%	32.68%	33.87%	34.20%	34.62%
Admission Type[2]						
Direct	77.75%	78.67%	79.25%	80.17%	80.93%	81.21%
Transfer	22.24%	21.32%	20.73%	19.82%	19.06%	18.79%
Sex[3]						
F	43.12%	42.64%	42.34%	42.24%	42.64%	43.35%
M	56.88%	57.36%	57.66%	57.76%	57.36%	56.65%
Ethnicity[3]						
Amer. Ind.	0.24%	0.19%	0.19%	0.19%	0.18%	0.15%
Black	2.69%	2.62%	2.64%	2.67%	2.50%	2.65%
White	75.76%	74.55%	74.32%	74.92%	75.52%	76.60%
Asian	2.90%	3.11%	3.19%	3.46%	3.58%	3.89%
Hawaiian	0.09%	0.08%	0.09%	0.06%	0.06%	0.07%
Hispanic	4.67%	5.07%	5.35%	5.90%	6.30%	6.51%
≥ 2 Races	2.20%	2.29%	2.29%	2.43%	2.63%	2.85%
No Answer	4.76%	5.21%	5.18%	4.54%	4.08%	3.27%
First Generation Student Status[4]						
N	72.66%	73.90%	73.17%	74.25%	76.57%	78.64%
Y	27.34%	26.10%	26.83%	25.75%	23.43%	21.36%
STEM Major[5]						
N	50.73%	50.41%	49.23%	48.23%	49.02%	48.77%
S	49.27%	49.59%	50.77%	51.77%	50.98%	51.23%

Note. [1]Classification Year: 1=Freshmen, 2=Sophomore, 3=Junior, 4=Senior
[2]Admission Type: Direct=Direct from High School
[3]Etnicity: In some cases, the Ethnicity column was left blank
[4]Sex: F=Female, M=Male
[5]First Generation Student Status: N = Not a 1st gen. student, Y=1st generation college students
[6]STEM Major: N=Major is NOT within a STEM field, S=Major is within a STEM field

Midterm Grade Performance

To determine the extent to which midterm grade performance was impacted by COVID-19, we compared midterm grades from the CG to the F20 group. Two measures of midterm grades were examined: midterm count and average midterm grade (Table 3). The midterm count was similar between the CG and F20 groups ($p>0.05$), but students that had midterm reports had midterm grades that were, on average, significantly lower in F20 than in the CG ($p < 0.001$).

We also investigated if specific populations were more negatively impacted by the circumstances of the global pandemic by comparing midterm grades from the CG to F20 within year classification, admission type, sex, ethnicity, first-generation student status, and major type. Midterm counts were similar between the CG and F20 for all comparisons (data not shown); however, midterm grades were impacted within demographic groups (Table 4). Freshmen, sophomores, direct-from high school students, Caucasian, and Hispanic students had midterm grades that were lower in F20 than in the comparison years. Lower midterm grades were also observed in F20 across both sexes, in STEM majors, and regardless of first-generation status. These data support the hypothesis that academic performance of some demographic groups was more negatively impacted than other demographic groups.

Differences between demographic groups within a dataset (CG or F20) were also considered for each dataset by fitting midterm grades from the CG and F20 to a linear model, which included fixed effects of the demographic variables. All demographic effects played a significant role in average midterm grades from the CG ($p < 0.01$). Orthogonal contrasts showed that freshmen in the CG had significantly lower midterm grades when compared to a group comprised of sophomores, juniors, and seniors together ($p < 0.001$). No significant differences existed for sophomores, juniors, or seniors individually when compared to the combination of all other classifications ($p > 0.05$). Transfer students and male students earned lower midterm grades than direct-from-high school and female students, respectively ($p < 0.001$). Caucasian students earned midterm grades that were, on average, higher than non-Caucasian students ($p < 0.001$), while Black students earned midterm grades that were lower than midterms of non-Black students ($p < 0.01$). Midterms of Hispanic students were similar to the midterm grades of non-Hispanic students as were midterms of Asian students and non-Asian students ($p > 0.05$). First generation students and STEM students from the CG had midterm grades that were lower than non-first generation ($p < 0.001$) and non-STEM ($p < 0.01$) students, respectively.

F20 midterm grades were modelled in the same manner as CG midterm grades. Admission type, sex, and first-generation status showed a significant link to F20 midterm grades ($p < 0.05$), while classification year, ethnicity, and STEM status did not influence F20 midterms ($p > 0.05$). Transfer, male, and first-generation students had significantly lower midterms in F20 than direct-from-high school ($p = 0.03$), female ($p < 0.001$), and non-first-generation ($p = 0.04$) students, respectively. Orthogonal contrasts demonstrated that differences between Caucasian and non-Caucasian students approached significance ($p = 0.08$), but all other within-ethnicity comparisons were not significantly different.

Final Grade Performance

To determine the extent to which the final grade was impacted by COVID-19, we compared the earned final grades from F20 to the GC. Differences between these groups are in Table 5. Counter to our hypothesis, students in the F20 semester earned grades that were 0.21 GPA points higher than students in previous terms ($p < 0.001$).

Although F20 final grades were greater than final grades in the CG for the entire population and for those students with midterms, we hypothesized that the experiences of the global pandemic would have negative effects on some demographic groups. To assess this hypothesis, we compared final grades from the CG to F20 within classification, admission type, sex, ethnicity, first-generation student status, and major type (Table 6). Students with a Hawaiian or Pacific Islander ethnic background had similar final grades in the F20 and GC. However, in every other demographic category (student year, admission type, sex, ethnicity, first generation student, major type) students performed better and earned higher final grades in F20 that in the CG ($p < 0.05$).

Table 3.

Differences in midterm counts and midterm grade severity between fall 2020 and the comparison group

Midterm Counts	M	SD	t-value	p-value
F20	1.73	1.05	0.9671	0.1668
Pooled F15-191	1.67	0.88		
Midterm Grades				
F20	0.85	0.61	7.0602	<0.001***
Pooled F15-191	0.92	0.53		

Note. **p < 0.05, **p < 0.01, ***p < 0.001*

[1]Data from fall of 2015 through fall of 2019 were pooled to form one comparison group

Table 4.

Comparison of midterm grades between the pooled 2015-2019 comparison group and fall 2020 grades by demographic

	Fall 2015-2019[1]		Fall 2020			
	M	**SD**	**M**	**SD**	**t-value**	**p-value**
Classification Year[2]						
1	0.92	0.52	0.86	0.61	7.1563	<0.001***
2	0.93	0.52	0.85	0.62	2.4225	0.0157**
3	0.91	0.54	0.84	0.61	0.0409	0.5163
4	0.90	0.58	0.78	0.69	0.3581	0.3609
Admission Type[3]						
Direct	0.94	0.52	0.86	0.61	7.3709	<0.001***
Transfer	0.87	0.54	0.82	0.61	1.1200	0.1315
Sex[4]						
F	0.97	0.52	0.89	0.60	4.3572	<0.001***
M	0.89	0.53	0.83	0.62	5.5690	<0.001***
Ethnicity[5]						
Amer. Ind.	0.79	0.55	0.87	0.69	0.3849	0.6432
Black	0.81	0.52	0.80	0.59	1.3500	0.9107
White	0.94	0.53	0.86	0.61	6.0659	<0.001***
Asian	0.91	0.52	0.83	0.60	1.3554	0.0886
Hawaiian	0.92	0.49	0.54	0.68	--	--
Hispanic	0.87	0.53	0.82	0.62	2.7975	0.005**
≥ 2 Races	0.90	0.51	0.82	0.61	1.0212	0.1544
No Answer	0.93	0.54	0.83	0.66	1.6619	0.0493*
First Generation Student Status[6]						
N	0.93	0.53	0.85	0.62	5.7161	<0.001***
Y	0.90	0.53	0.83	0.61	4.1728	<0.001***
STEM Major[7]						
N	0.94	0.53	0.85	0.62	4.4726	<0.001***
S	0.91	0.52	0.86	0.61	5.4634	<0.001***

Note. **p < 0.05, **p < 0.01, ***p < 0.001*
[1]Classification Year: 1=Freshmen, 2=Sophomore, 3=Junior, 4=Senior
[2]Admission Type: Direct=Direct from High School
[3]Etnicity: In some cases, the Ethnicity column was left blank
[4]Sex: F=Female, M=Male
[5]First Generation Student Status: N = Not a 1st gen. student, Y=1st generation college students
[6]STEM Major: N=Major is NOT within a STEM field, S=Major is within a STEM field

Table 5.

Comparison of final grades between the pooled 2015-2019 comparison group and fall 2020 final grades

Final Grades	M	SD	t-value	p-value
F20	3.1625	0.8603	14.5984	<0.001***
Pooled F15-19[1]	2.9481	0.8541		

Note. **p < 0.05, **p < 0.01, ***p < 0.001*
[1]Data from fall of 2015 through fall of 2019 were pooled to form one comparison group

Differences between demographic groups were analyzed for each dataset by fitting final grades from the CG or F20 to a linear model, which included fixed effects of the demographic variables. STEM student status was not a significant effect on final grades in the CG ($p > 0.05$). However, all other demographic variables significantly contributed to final grades in the CG ($p < 0.001$). Orthogonal contrasts showed that all levels of classification year were significantly different from each other, and seniors outperformed freshmen by 0.39 GPA points ($p < 0.01$). Direct-from-high school, female, and non-first generation out-performed transfer, male, and first-generation students ($p < 0.001$), respectively. Caucasian students earned final grades that were, on average, 0.28 GPA points higher than the final grades of non-Caucasian students in the CG ($p < 0.001$). African American students earned final grades that were 0.51 and 0.25 GPA points lower than final grades of Caucasian and Hispanic students ($p < 0.001$), respectively.

Fall 2020 final grades were modelled in the same manner as the CG final grades. All demographic effects were significant contributors to F20 final grades ($p < 0.001$). STEM students earned final grades that were 0.09 GPA points lower than grades of non-STEM students. Academic performance of all levels of classification year were significantly different from each other, and seniors outperformed freshmen ($p < 0.001$). This finding is similar to what was observed in the CG, however, the difference between freshmen and seniors was slightly larger in F20 (0.50 GPA points) compared to the difference observed in the CG (0.39 GPA points). Direct-from-high school, female, and non-first-generation students continued to out-perform transfer, male, and first-generation students in F20 ($p < 0.001$), respectively. African American students continued to earn final grades that were 0.42 and 0.21 GPA points lower than the F20 final grades of Caucasian and Hispanic students, respectively. The differences observed between these groups were smaller in F20 than in the CG. While these differences are alarming, it does not appear that differences between ethnicities were caused or exaggerated by the global pandemic.

Deviations between midterm grades and final grades

We also examined the final grades of the subpopulation of students with midterm grades reported. Across the CG and F20, final grades of students with midterms were lower than those students that did not have midterm grades reported ($p < 0.001$). This finding was expected as midterm grades are designed to serve as mid-semester warnings for students underperforming in a course. However, of the students in the CG and F20 with midterms, final grades of students who had midterms reported in F20 were 0.34 GPA quality points higher than final grades of students who had midterms reported in the CG ($p < 0.001$; Table 7). This indicates that despite lower midterm grades in F20, students in F20 were better able to recover from poor performance in the first half of the semester than students in the CG. This outcome also did not support our hypothesis that COVID-19 would negatively affect student performance.

The observed differences between final grades of students with midterms in the CG and F20 suggested that students who earned midterm grades in F20 were more likely to recover from the midterm warning and earn a C (GPA=2.00) or higher by the end of the term. To examine this, we compared deviations between midterm and final grades for all students who earned midterms in the CG and in F20. Across midterm-receiving populations, there was a larger deviation between midterms and final grades in the F20 population compared to CG ($p < 0.001$, Table 8).

Deviations between midterms and final grades were also explored within demographic groups (Table 9). Within most demographics, F20 deviation was larger than the deviation between midterms and final grades observed in the CG. However, students with a senior classification had a smaller deviation in F20 when compared to the CG (GPA difference = 0.13; $p < 0.05$). Additionally, differences in grade deviation between F20 and the CG were not significant for Indigenous American students and for students who declined to provide ethnicity on their admission applications. The lower number of students in these groups affected our ability to detect significance despite the numerical change. In general, the majority of students with midterms were able to improve their grades to a greater degree in F20 than in the CG.

Discussion

The global COVID-19 pandemic impacted many aspects of academic life and created additional barriers for student learning. Most immediately, this forced a hasty transition to heavy reliance on virtual instruction during the spring 2020 semester, followed by a more deliberate adaptation to virtual instruction for the F20 semester, which often included synchronous and asynchronous course delivery. Despite the change in course modality, many of the disruptive stressors broadly associated with COVID-19 remained. We hypothesized that these collective stressors

Table 6.

Comparison of final grades between the pooled 2015-2019 comparison group and 2020 final grades by demographic

	Fall 2015-2019[1]		Fall 2020			
	M	**SD**	**M**	**SD**	**t-value**	**p-value**
Classification Year[2]						
1	2.88	0.89	3.16	0.85	12.97	<0.001***
2	2.95	0.86	3.22	0.86	3.94	<0.001***
3	2.94	0.83	3.08	0.89	4.25	<0.001***
4	3.16	0.73	3.36	0.83	4.88	<0.001***
Admission Type[3]						
Direct	2.99	0.83	3.20	0.84	12.70	<0.001***
Transfer	2.80	0.90	3.01	0.92	7.31	<0.001***
Sex[4]						
F	3.11	0.78	3.31	0.79	16.38	<0.001***
M	2.82	0.89	3.05	0.89	6.24	<0.001***
Ethnicity[5]						
Amer. Ind.	2.70	1.00	3.18	0.81	2.08	0.023*
Black	2.42	0.94	2.72	0.99	2.99	0.002**
White	3.00	0.83	3.20	0.84	9.02	<0.001***
Asian	2.83	0.90	3.12	0.88	5.30	<0.001***
Hawaiian	2.66	0.83	2.67	1.15	0.54	0.598
Hispanic	2.70	0.91	2.95	0.95	3.22	<0.001***
≥ 2 Races	2.79	0.94	3.07	0.95	1.80	0.036*
No Answer	2.98	0.82	3.21	0.82	2.92	0.002**
First Generation Student Status[6]						
N	3.00	0.83	3.20	0.84	12.04	<0.001***
Y	2.80	0.89	3.02	0.92	8.32	<0.001***
STEM Major[7]						
N	2.98	0.85	3.22	0.84	15.03	<0.001***
S	2.92	0.86	3.11	0.88	6.38	<0.001***

Note. **p < 0.05, **p < 0.01, ***p < 0.001*
[1]Classification Year: 1=Freshmen, 2=Sophomore, 3=Junior, 4=Senior
[2]Admission Type: Direct=Direct from High School
[3]Etnicity: In some cases, the Ethnicity column was left blank
[4]Sex: F=Female, M=Male
[5]First Generation Student Status: N = Not a 1st gen. student, Y=1st generation college students
[6]STEM Major: N=Major is NOT within a STEM field, S=Major is within a STEM field

Table 7.

Comparison of final grades of students who had midterms reported between the pooled 2015-2019 comparison group and fall 2020

Final Grades of Students with Midterms	M	SD	t-value	p
F20	2.8836	0.9120	23.5769	<0.001***
Pooled F15-19[1]	2.5397	0.8522		

Note. **p < 0.05, **p < 0.01, ***p < 0.001*
[1]Data from fall of 2015 through fall of 2019 were pooled to form one comparison group

Table 8.

Average deviation between midterm and final grades across the pooled 2015-2019 comparison group and fall 2020

Difference between midterm and final grades	M	SD	t-value	p
F20	0.81	0.98	8.9446	<0.001***
Pooled F15-19[1]	0.75	0.85		

Note. **p < 0.05, **p < 0.01, ***p < 0.001*
[1]Data from fall of 2015 through fall of 2019 were pooled to form one comparison group

would negatively affect student performance in F20 and that students from some demographic groups would be more negatively impacted than other demographic groups. Objective evaluation of midterm performance supported this hypothesis; however, final grades were higher in the COVID-19-impacted F20 compared to the pooled fall semesters from 2015-2019, which was in stark contrast to our hypothesis.

During COVID-19, students experienced frustrations regarding greater workloads in online courses (Aristovnik et al., 2020; Aucejo et al., 2020; Hawley et al., 2021; Son et al., 2020), finances (Bidwell et al., 2020; Hawley et al., 2021; Son et al., 2020) and increased familial responsibilities (Bidwell et al., 2020). Further, greater levels of stress were experienced among students from racial and ethnic minority groups (Clabaugh et al., 2021) and low-income students (Perry et al., 2021) regarding their academic futures and financial situations. We reasoned that these collective stressors were not evenly distributed and therefore, while we expected that, overall, student performance would suffer during F20 compared to CG, we also expected that this deficit would be exaggerated in some demographic groups. Remarkably, the number of midterms per student were resistant to COVID-19-mediated changes. While early support for our hypothesis was found when the severity of midterm grades was considered, final grades were improved in F20 compared to CG in nearly every demographic group and students that earned midterm grades were better able to recover in F20 than students in CG.

To gain additional insight into the surprising improvement in student performance in F20 compared to the CG, we considered several factors that could influence measures of student performance. Students acknowledged decreased opportunities for social interaction as a significant stressor. Speculatively, this decreased interaction time may have provided additional time for other activities like class preparation, which could translate into improved performance.

We also attempted to quantify other variables that could impact final grades. First, if there were a greater number of non-letter grades reported, they may mask lower grades. Non-letter grades are final grade reports that do not factor into the students GPA. An instructor assigns an “Incomplete” (I) when students are given additional time to complete coursework outside of the normal term dates. Students can take courses as “Pass” (P) or “No-Pass” (NP). Using this system, if a student earns a grade of D- or higher in a P/NP designated course, a P would be reported on their transcript. If the student earns an F in a P/NP course, it would appear as a NP. Likewise, some courses use a “Satisfactory” (S) system of grading where S indicated that the student completed the course with a passing grade. If they do not pass, a letter grade of F would be reported. Lastly, if a student drops a course during the semester, an “X” would be displayed on their transcript. In all cases, these non-letter grades do not influence the overall GPA. Typically, non-letter grades come from student requests due to the possibility of earning a low letter grade. Therefore, if greater numbers of non-letter grade reports existed in F20, it may help explain an overall increase in average final grades. While there was an increase in the number and percent of total grades reported for I, these grades represent only 0.22% of all grades reported (Table 10). Therefore, this seems unlikely to account for increased GPA in F20. The frequency of other non-letter grades in the CG were similar to or lower than non-letter grades in F20.

The increased reliance on un-proctored exams in F20 came with it the possibility of increased academic dishonesty. Certainly, more frequent cheating could positively influence student performance as measured by reported grades. While difficult to objectively assess, we used referrals to the Dean of Students office for dishonesty

Table 9.

Deviations between midterms and final grades by demographic across the pooled 2015-2019 comparison group and fall 2020

	Fall 2015-2019[1]		Fall 2020			
	M	**SD**	**M**	**SD**	**t-value**	**p-value**
Classification Year[2]						
1	0.69	0.83	0.81	0.98	7.67	<0.001***
2	0.77	0.85	0.81	0.99	3.49	<0.001***
3	0.81	0.86	0.80	0.99	2.54	0.098
4	0.90	0.88	0.77	1.02	-1.74	0.044*
Admission Type[3]						
Direct	0.76	0.85	0.82	0.98	7.73	<0.001***
Transfer	0.72	0.84	0.77	0.96	4.56	<0.001***
Sex[4]						
F	0.81	0.83	0.84	0.99	5.45	<0.001***
M	0.71	0.86	0.79	0.97	7.10	<0.001***
Ethnicity[5]						
Amer. Ind.	0.65	0.93	0.39	1.06	-0.85	0.456
Black	0.65	0.78	0.72	0.95	2.32	0.022*
White	0.77	0.85	0.81	0.98	5.83	<0.001***
Asian	0.62	0.83	0.86	1.00	3.23	0.002**
Hawaiian	0.67	0.95	0.81	1.15	--	--
Hispanic	0.63	0.83	0.73	0.97	3.71	<0.001***
≥ 2 Races	0.63	0.84	0.79	1.00	2.95	0.004**
No Answer	0.81	0.87	0.84	1.06	0.95	0.172
First Generation Student Status[6]						
N	0.77	0.86	0.82	0.98	6.30	<0.001***
Y	0.69	0.82	0.78	0.97	6.80	<0.001***
STEM Major[7]						
N	0.78	0.85	0.88	1.01	6.16	<0.001***
S	0.72	0.85	0.74	0.94	6.50	<0.001***

Note. **p < 0.05, **p < 0.01, ***p < 0.001*
[1]Classification Year: 1=Freshmen, 2=Sophomore, 3=Junior, 4=Senior
[2]Admission Type: Direct=Direct from High School
[3]Etnicity: In some cases, the Ethnicity column was left blank
[4]Sex: F=Female, M=Male
[5]First Generation Student Status: N = Not a 1st gen. student, Y=1st generation college students
[6]STEM Major: N=Major is NOT within a STEM field, S=Major is within a STEM field

Table 10.

Number and percentage of non-letter final grades by year

Non-Letter Grades[1]	F15	F16	F17	F18	F19	F20
			N (%)[2]			
I	99 (0.06%)	121 (0.07%)	211 (0.12%)	239 (0.14%)	270 (0.17%)	340 (0.22%)
NP	68 (0.04%)	79 (0.05%)	110 (0.06%)	93 (0.06%)	73 (0.05%)	91 (0.06%)
P	623 (0.37%)	576 (0.34%)	363 (0.21%)	578 (0.34%)	609 (0.38%)	408 (0.27%)
S	19451 (11.63%)	19476 (11.35%)	19143 (11.18%)	18802 (11.21%)	17158 (10.66%)	15655 (10.25%)
X	7416 (4.43%)	7131 (4.15%)	6855 (4.00%)	6681 (3.98%)	6431 (3.99%)	6058 (3.97%)

Note. *[1]I=Incomplete, NP=No Pass, P=Pass, S=Satisfactory, X=Course Dropped*
[2]Expressed as a percentage of the total number of grades reported for the term

Table 11.

Institutional-wide reports of academic misconduct by year

	F15	F16	F17	F18	F19	F20
			N %[1]			
Academic Misconduct Cases	207 (0.70%)	118 (0.39%)	140 (0.47%)	81 (0.28%)	99 (0.35%)	188 (0.71%)
Total Dean of Students Referrals	446 (1.68%)	405 (1.34%)	494 (1.65%)	382 (1.31%)	338 (1.21%)	385 (1.45%)
Academic Misconduct Cases per Total Referrals	46%	29%	28%	21%	29%	49%

Note. *[1]Expressed as a percentage of students enrolled for the term*

as an indicator of this outcome (Table 11). When expressed as a percent of total students enrolled there were more academic misconduct cases in F20 compared to most previous semesters with startling elevations compared to F16-19. However, the absolute and relative number of these cases are insignificant compared to the student population of each term, so it is unlikely academic misconduct is the only factor contributing to the 0.21 GPA point increase in final grades that was observed in F20. It is possible that cases of academic misconduct went unreported during a time where remote learning was common and exams were either un-proctored or virtually proctored; however, the extent to which cheating occurred in F20 compared to previous semesters is unknown.

Academic rigor is difficult to quantify but could positively affect student performance as assessed by earned grade. For example, increased allowance of course material during exams potentially could increase the exam grade. Additionally, increased frequencies of curved grading would make it appear as though a student achieved a higher grade than they earned. Anecdotally, the frequency of both of these factors was increased in F20 compared to previous semesters. Objective quantification of these and other course adaptations that may positively affect student performance was beyond the scope of this investigation, though we acknowledge the potential impact it could have and recognize it as a key area of future research. We discovered that student course loads were similar in F20 and CG (Table 12), which is partially reflective of students' perceived academic rigor during a semester. This eliminates the possibility that a lighter course load allowed improved performance in enrolled courses.

A notable limitation of this work is that we were restricted to data available through the Institutional Research Office, which includes information about biological sex but not gender, hence the interaction of gender and the impact of COVID-19 is not known and the impact of COVID-19 on members of the LGBQ+ community was beyond the scope of this investigation.

Table 12.

Average credit loads by year

	F15	F16	F17	F18	F19	F20
Average number of credits per term	14.76 ± 2.69	14.71 ± 2.68	14.73 ± 2.72	14.71 ± 2.73	14.71 ± 2.75	14.72 ± 2.70

Conclusions, Implications, and Recommendation

In conclusion, despite lower midterm grades and counter to our hypothesis, overall student performance was greater in the COVID-19 F20 semester compared to previous fall semesters. This contrasts with Bandura's TRD theory (1978) as an individual's environment, their behavior, and the individual themselves are interrelated, and often influence each other. Though students experienced a plethora of COVID-19 induced stressors (environment), it did not appear to affect students' attitude and motivation (personal/individual) due to the lack of change in academic performance (behavior). However, as student internal attributes were not specifically studied, we cannot conclude the effects the pandemic had on an individual's internal attributes. More research into how the pandemic affected students' internal attributes is suggested to further investigate the impact of the COVID-19 pandemic on the student population.

Despite the numerous stressors associated with COVID-19, students across several demographic groups performed better in F20 compared to previous fall semesters. The underlying reason(s) for this unexpected conclusion is not clear but does not appear to be due to decreased course load or a greater number of non-letter grades reported. The extent to which rigor of individual classes or testing was altered during F20 compared to previous semesters is unknown and could have a significant impact on final grade. Cases of academic dishonesty appeared to increase in F20 compared to previous semesters, but still represents a small percent of the student body. Alternatively, if this number disproportionately underestimates instances of cheating in F20 compared to other semesters it could have a significant impact on final grades. Optimistically, there is also a chance decreased occasions for social interaction provided additional opportunities for studying, which could also have a significant impact on student performance. The researchers recommend further investigation into the potential underlying reason(s) for this unexpected conclusion. This includes rigor of individual classes and potential cases of academic dishonesty during the F20 semester.

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