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## What Do Our Students Think? Perceptions of Transitioning to Remote Learning During the Pandemic at Land-Grant Universities

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### Abstract

The COVID-19 pandemic sparked the rapid transition of 1.9 million university students from in-person to remote learning during the spring of 2020. Popular press and recent research reports highlighted serious challenges many students faced during this time. Yet, some students had a good or even very good remote learning experience. The purpose of this research is to analyze student perspectives of their remote learning experiences in the early phase of the pandemic to provide valuable insights to instructors, inform instructional design, and discuss policy implications. We surveyed students from colleges of agriculture at six land-grant universities, generating a sample of 2,690 completed responses. Students described their academic experience; learning environments (living situations, internet access, etc.); health, safety and family concerns; and emotional stressors. Opportunities for active student engagement, being able to connect with the instructor, and the inclusion of reflective assignments all contributed to an improved learning experience in a specific course. We found that a positive prior online experience and differences in learning environments explained observed differences in overall learning experiences. Students who felt discriminated against in their university settings reported a more negative experience during these tumultuous times, and experiences varied significantly across universities. Contrary to the experiences of women in the labor market, students identifying as female and students living with children reported better overall experiences during the first month of the pandemic.

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## **Introduction**

The COVID-19 pandemic had an unprecedented impact on students in higher education across the United States, forcing universities and colleges into a sudden transition from in-person to remote learning. Early evidence suggests a significant impact on student educational experiences, as well as learning, social, health, economic, housing and other outcomes (Cohen et al., 2020; Chirikov and Soria, 2020; Soria et al., 2020a). Certain student groups, including first-generation students, experienced more financial hardship and other forms of insecurity (Soria et al., 2020b), and international students (Chirikov and Soria, 2020) experienced unique challenges. The disruptions to learning during this time likely reduced learning outcomes and educational experiences in general and worsened or introduced new forms of insecurity into many students' lives (Jaggers et al., 2020). It is further assumed that remote learning will exacerbate already existing student opportunity and achievement gaps. Yet, anecdotal evidence suggests some students had good and even very good experiences while transitioning to remote learning.

Studies examining the impact of COVID-19 in U.S. educational settings are quickly emerging. The majority of studies focus on COVID-19 impacts on students in specific courses or programs (Engelhardt et al., 2020; Unger and Meiran, 2020), or at a single university or college (Aucejo et al., 2020; Jaggers et al., 2020; Murphy et al., 2020). To date, relatively few studies include comparisons of students from multiple institutions, and these studies utilize general recruitment approaches such as social media (Cohen et al., 2020) or a consumer panel from a market research firm (Means and Neisler, 2020). We are aware of only one systematic and coordinated effort to collect data concerning COVID-19 impacts on student experiences from multiple institutions,<sup>7</sup> but have found no study that considers student outcomes with respect to campus characteristics and response.

We examine students' class-specific and overall remote learning experiences as well as enrollment decisions during the pandemic using data collected by the Applied Economics Research Consortium on Student Remote Learning and Resilience. This research group includes faculty from six Land-Grant Research I Institutions: Kansas State University (KSU), Louisiana State University (LSU), North Carolina State University (NCSU), Purdue University (PU), University of California-Davis (UCD), and

<sup>7</sup> The Student Experience in the Research University (SERU) is a consortium of U.S. and international universities who collaborate on generating institutional, comparative and longitudinal data to examine student experiences in these settings. This consortium conducted a special survey on the impact of COVID-19 on student experiences at 10 US public universities in May-June 2020 (SERU, 2020). Several reports have been generated based on this data.

University of Wyoming (UWYO).<sup>8</sup> We analyze observed differences in student experiences and learning outcomes to answer the following questions: (a) What specific course design and teaching techniques were most effective in supporting positive student learning outcomes? (b) What role did student perceptions play when observing differences in student experiences? (c) To what extent and in what ways did student experiences vary across different student subpopulations? Here, we provide a first look at data collected in our initial wave of surveys which were distributed during the summer of 2020. A more detailed analysis of the spring 2020 data, including an examination of the extent the disruption from COVID-19 affects students' likelihood of re-enrolling, and an analysis of a second wave of surveys sent after the conclusion of the fall 2020 term are currently underway.

In our data collection, we focus on students enrolled in majors within colleges of agriculture, because students from agricultural or rural communities may have faced an especially challenging transition to remote learning. As campuses closed, these students returned home where they likely faced pressure to assist with family businesses (e.g., farming or other enterprises). In addition, poor internet connectivity in many rural areas (Sents, 2020) and limited access to alternative internet service locations (e.g., public libraries) may have compounded challenges faced by students living in these communities. Our goal is to inform instructor efforts, instructional design, and university policy during this time of crisis and beyond. We provide insights about changes in learning outcomes and experiences, overall student welfare and the likelihood of degree completion. We further explore whether learning outcomes differed for historically underrepresented and under-resourced subpopulations (e.g., students from different racial, ethnic or socio-economic backgrounds) to provide guidance regarding more targeted assistance that can ensure positive learning outcomes and academic success for all of our students.

### **Survey Design and Data Collection**

We designed and distributed a survey to students from colleges of agriculture at six universities with a combined enrollment of approximately 17,000 students. These universities are diverse in their size, geographic locations, student population, and the predominant type of agricultural production in each state. The study design and survey procedures were approved by the Internal Review Board at each participating university. In the summer of 2020, each investigator distributed a comprehensive online survey organized in four sections via Qualtrics®.<sup>9</sup> In the first section, we asked

<sup>8</sup> The Carnegie Classification of Institutions of Higher Education describes Research I universities as doctoral universities with very high research activity.

<sup>9</sup> Two universities provided incentives by entering participating students in a lottery for small cash prizes (e.g., five \$50 and twenty \$50 gift cards). If students opted out of participating in the survey, they were still able to enter the lottery after contacting the PI at their respective school.

students about academic experiences, including questions about students' perceptions about their spring 2020 remote learning experience, characteristics of the course that influenced them the most, and their general attitude toward remote instruction. In the second section, we asked the students about their current family situation, health and safety concerns, and current living conditions. This section included questions about student emotional health, mental well-being, concerns about their own and their family's safety and health, as well as health risk preferences. In the third section, students were asked about financial and personal obligations that may affect re-enrollment decisions as well as their plans for the fall. A final section consisted of questions about student background and demographic information, including political preferences and student attitudes towards and experiences with implicit bias and discrimination. While our survey design predates many of the new COVID-19 studies referenced here, we are able to relate our findings to what has already been reported and hope to add additional insights.

### Descriptive Survey Statistics

Our final sample consists of 2,690 mostly complete survey responses received. This represents an overall response rate of 15.22%, ranging from 3.08% to 30.78% across universities as reported in Table 1. Most universities were able to promote the survey with the support from the Dean's office and distributed it with an official email from the Dean or Dean of Undergraduate Education to send to each student in the college individually. However, PU sent emails from their Agricultural Economics Department to all students in the College of Agriculture. Additionally, differences in academic calendars, campus policies that resulted in students returning home under different schedules, and the fact that many universities were already surveying their students likely contributed to the observed differences in response rates across universities.

**Table 1. Summary of Respondents by University Location**

University	Number of Students Contacted <sup>a</sup>	Number of Respondents (Response rate)	Percent of Sample
Purdue University (PU)	2,803	110 (3.08%)	4.09%
Louisiana State University (LSU)	1,432	133 (9.29%)	4.94%
University of Wyoming (UWYO)	967	240 (24.82%)	8.92%
North Carolina State University (NCSU)	2,660	500 (18.80%)	18.59%
Kansas State University (KSU)	2,326	716 (30.78%)	26.62%
University of California-Davis (UCD)	7,485	991 (13.24%)	36.84%
Total	17,673	2,690	100

<sup>a</sup> The number of students contacted corresponds to the most recent undergraduate student numbers (2019-20) for the colleges of agriculture.

We provide additional select summary statistics in Table 2. Our sample includes both newly enrolled freshmen intending to start in fall 2020, and students who had just completed the spring 2020 term.

**Table 2. Select Summary Statistics for Overall Remote Learning Experience, Select Demographics, and Learning Environment Variables**

Variable	N <sup>a</sup>	Mean	Standard Deviation	Min	Max
Prior Remote Experience (1=Very poor)	1,515	3.56	1.04	1	5
Spring 2020 Remote Experience (1=Very poor)	1,748	2.93	1.18	1	5
Female	2,299	0.74	0.44	0	1
White	2,690	0.59	0.49	0	1
Hispanic	2,690	0.11	0.32	0	1
Black	2,690	0.03	0.16	0	1
Asian	2,690	0.17	0.38	0	1
American Indian or Alaskan Native	2,690	0.02	0.13	0	1
Living with Children	2,690	0.06	0.25	0	1
Secure Housing (1= Strongly disagree)	2,325	4.53	0.74	1	5
Adequate Place to Study (1= Strongly disagree)	2,341	3.68	1.21	1	5
Computer (1= Strongly disagree)	2,342	4.73	0.57	1	5
Reliable Internet (1= Strongly disagree)	2,340	3.89	1.14	1	5
Initial Spring 2020 GPA	1,674	3.29	0.58	0	4.41

<sup>a</sup> The number of observations for the variables listed here vary due to completeness of survey responses and the fact that freshmen who would begin attending in Fall 2020 were included in the survey sample. These students were not shown questions related to Spring 2020 university experiences.

The majority of students (74%) who completed the survey identify as female (n=2,299), with a small number of students identifying as non-binary or self-identified (n=18), or who preferred not to reveal their gender identity (n=13). At NCSU' College of Agriculture and Life Sciences, 47.9% of the students were female compared to 77.7% of the students in UCD's College of Agriculture & Environmental Science who identified as female. While falling within this range, greater survey participation by female students has been repeatedly documented in traditional and online formats prior to and during the pandemic (e.g., Smith 2008).

Across all universities, the majority of our student respondents were white (59%). The largest minority group of students identified as Asian (17%), and the

smallest group identified as American Indian or Alaskan Native (1.7%). Eleven percent of students identified as Hispanic. A small group of students (6.4%) were living with children in their household during the initial pandemic period and living with children in the household was slightly positively correlated with American Indian and Alaskan Native ( $\rho=0.01$ ) and Black identities ( $\rho=0.03$ ), and slightly negatively correlated with White ( $\rho=-0.02$ ) and Hispanic ( $\rho=-0.02$ ) identities.

We asked students a variety of questions regarding their study and learning environment including a ranking of their access to “good” or reliable internet (on a scale from 1=strongly disagree to 5=strongly agree). Student respondents’ mean rating was 3.89, suggesting they generally agreed that they had reliable internet access. However, we acknowledge two things: (i) due to online survey distribution, respondents with poor or no internet access may be under sampled; and (ii) variation in responses for this measure (i.e.,  $\sigma=1.14$ ) was larger when compared to many of the other ratings summarized in Table 2. Although the average student rated secure housing as “Very Good” ( $\mu=4.53$ ), they rated their access to a good place to study significantly lower or as “Good” on average ( $\mu=3.68$ ). Only 64% of respondents agreed or strongly agreed that they had access to a good place to study, and this rating is the only rating with more variation ( $\sigma=1.21$ ) than the internet access rating. Students’ ratings of access to an adequate place to study was highly correlated with ratings of good internet access ( $\rho=0.50$ ) and moderately correlated with agreement about having a secure place to live ( $\rho=0.29$ ). Furthermore, the presence of children in the home was slightly negatively correlated with having an adequate place to study ( $\rho=-0.02$ ).

In addition to demographic information, socio-economic background, and learning environment, we also asked students about their previous online learning experiences. Eighty six percent of respondents had experience learning online prior to the COVID-19 pandemic. As we report in Table 2, the average student rating for their prior online experience is 3.56, and significantly higher than their average rating of their pandemic online learning experience (2.93). There is little variation in the mean of pre-pandemic remote learning experiences across universities. Students at LSU rated their pre-pandemic experience with remote learning the highest ( $\mu=3.8$ ), while students at PU rated it the lowest ( $\mu=3.5$ ). We see greater variation in student ratings of remote learning across universities during the pandemic, but average ratings fell across all universities relative to non-pandemic experiences. At four of six universities, students with prior online learning experience reported greater dissatisfaction with remote learning than those without prior online learning experience. The only locations where students without prior online learning experience found pandemic remote learning to be worse than those students with prior online learning experience were LSU ( $n=27$ ,  $\mu=2.81$ ) and PU ( $n=9$ ,  $\mu=2.22$ ).

## **Differences in Course-specific Learning Experiences**

We begin our regression analysis by examining student experiences in a specific course during the pandemic in order to draw conclusions about what instructors can do to improve student experiences and offer support while teaching remotely. Prior to the pandemic, the use of “chalk and talk” remained the preferred teaching style in most Economics classes (Engelhardt, 2020). Empirical evaluations of technology innovations, including introductions of online tools, concluded that no type of technology use was consistently associated with learning gains. However, previous studies did not detect harmful effects either (Johnson and Meder, 2020), and select studies indicate the potential for improvements in learning outcomes, especially in course designs, described as blended or hybrid approaches that assign and test for the completion of specific tasks such as watching videos or reading assigned chapters prior to attending problem-based class sessions (e.g., Swoboda and Feiler, 2016). The existing literature provides no clear prediction regarding the effect of the transition to a remote teaching and learning environment. Many instructors likely struggled with the rapid transition to teaching online during the spring 2020 term and a variety of factors might explain observed differences in student learning outcomes.

In order to be able to gain specific insights into what instructors can do to support student learning moving forward, we asked students to think about a course they took in the spring that was the most influential (good or bad) in shaping their perception of remote learning during the pandemic. We then asked specific questions regarding this class including how they would rate their learning experience in this course compared to the other courses they took. Students rated their experience in the specific course as 3.15 on average or “neither better or worse”. The highest percent of students (28.19%) chose this average rating, followed by 26.64% who indicated their experience in this particular course was “better”. Only 10.53% of students felt that the experience in the course that shaped their perception of remote learning was “a lot worse” than their experience in other classes, while 14.82% felt that their experience was “a lot better”. We began our analysis of these differences in students’ reported specific learning experiences by running regression specifications that included student behaviors, motivations, perceptions, and specific course components. We then added student demographics, grades received, and variables that were meant to capture differences in individual circumstances and learning environments. We also included university-fixed effects to capture unobserved differences across the six universities. However, none of the student-specific variables were statistically significant in our regression analysis. Similarly, university fixed effects were not statistically significant, suggesting that course design and teaching style, as well as student perceptions are key determinants of better learning outcomes across all student groups and campuses in this remote environment. Table 3 reports results of ordered Probit regressions with



robust standard errors (Wooldridge, 2002) that include student behaviors, motivations, course design, and key course components as explanatory variables.

**Table 3. Regression Results of Specific Course Experiences During the Pandemic**

(1=A lot worse...5=A lot better)

Independent Variables	Student Perceptions	Student Perceptions (Worse: 1,2, 3)	Student Perceptions (Better: 3,4,5)
Live lectures	-0.052 (0.086)	-0.258 (0.135)	0.153 (0.105)
Attendance of remote lectures (1=strongly disagree)	-0.025 (0.031)	-0.013 (0.040)	-0.040 (0.044)
Completion of remote assignments (1=strongly disagree)	0.030 (0.040)	-0.024 (0.053)	0.088 (0.059)
Interest in course (1=strongly disagree)	0.051 (0.036)	0.006 (0.049)	0.101* (0.049)
Gained knowledge (1=strongly disagree)	0.406*** (0.041)	0.392** (0.052)	0.190** (0.059)
Connected with instructor (1=strongly disagree)	0.175*** (0.030)	0.221*** (0.044)	0.060 (0.036)
Felt that others cheated (1=strongly disagree)	0.013 (0.024)	0.009 (0.035)	0.016 (0.031)
Active student engagement	0.491*** (0.062)	0.476*** (0.098)	0.284*** (0.078)
Online take-home/open book exams	0.222*** (0.066)	0.173 (0.101)	0.170* (0.084)
Online closed book exams	-0.246*** (0.069)	-0.123 (0.099)	-0.199* (0.092)
Graded participation	0.063 (0.061)	-0.056 (0.097)	0.111 (0.074)
Collaborative work outside of class meetings	0.061 (0.067)	0.094 (0.102)	0.040 (0.085)
Graded group assignments	-0.051 (0.073)	0.126 (0.114)	-0.152 (0.095)
Regular quizzes	0.074 (0.062)	0.093 (0.091)	0.035 (0.079)
Final paper or project	0.047 (0.061)	0.122 (0.096)	-0.012 (0.076)
Reflection assignments	0.378*** (0.068)	0.326** (0.120)	0.255** (0.078)
University fixed effects	Yes	Yes	Yes
Pseudo R <sup>2</sup>	0.143	0.155	0.059
Observations	1475	810	1025

Note: Ordered Probit regressions with university fixed effects (UCD as base) and robust standard errors, Standard errors in parentheses, \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

In Table 3, column (1) reports results for the entire range of possible responses, and column (2) and (3) report the results for worse or better experiences only.<sup>10</sup> Whether lectures were taught live or pre-recorded did not affect student experiences significantly during this first remote teaching term. Although, when a course incorporated active student engagement during online class sessions (e.g., questions and polls), student experiences improved significantly. Instructors that created these opportunities for active engagement likely helped students to keep focused and maintain interest in the material covered, and thus significantly improved the learning experience. This effect was significant and larger when focusing our analysis on students who rated their experiences lower. It was significant, but smaller in regressions focusing on higher ratings as well. Notably, individual student characteristics, including the grade a student received in this specific class, were not significant and did not explain differences in student learning experiences.

Whether students felt that they gained knowledge contributed significantly to a more positive student experience on average. The difference between a better and a lot better experience was further explained by whether a student was interested in the course. Finally, when students felt they were able to connect with their instructor, their learning experience significantly improved.

Not surprisingly, take home or open book exams improved students' learning experience during these anxious times, and closed book exams decreased it. While this might also be true in in-person classes, the effect might be even more pronounced in this remote environment as proctoring requirements increased student anxiety and raised privacy concerns.<sup>11</sup> In terms of additional specific class components, only the incorporation of reflection assignments—opportunities for students to reflect on the covered material and their performance—significantly improved learning experiences. The inclusion of regular quizzes and opportunities for collaborative work outside of class further improved student experience in some specifications, although the regressions reported here do not return a significant effect.

### **Differences in the Overall Learning Experience**

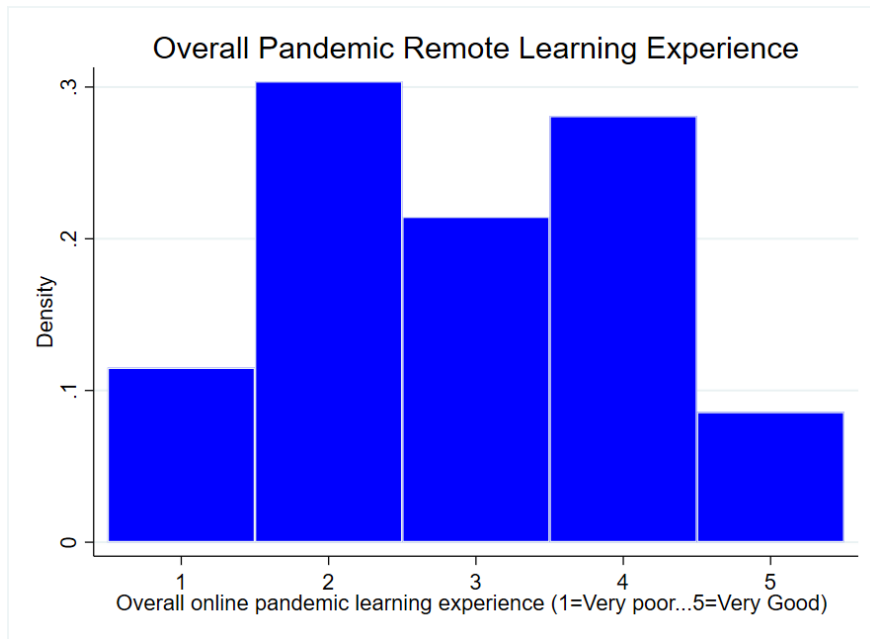
To add context, we asked students about their overall learning experience during this early stage of the pandemic. We report the distribution of students' rankings of their overall learning experience during the spring 2020 term in Figure 1. We observe that students were more likely to rate their remote learning experience as either "very good" and "good" or "poor" and "very poor" than "neither poor nor good" (i.e., average). While the mean overall ranking was 2.92, and 21.45% of students chose this average

<sup>10</sup> The "neither better or worse" (3) response is included in both regressions and can be viewed as a neutral response or base.

<sup>11</sup> We are not aware of any studies that allow us to compare this response to student perceptions prior to the pandemic.

option, 41.88% rated their experience more negatively (11.50% as “very poor”) and 36.67% had a more positive impression (8.58% as “very good”). The graphical representation and percentages indicate that overall student experiences varied considerably. While many students struggled, some students also had a good or even very good experience.

**Figure 1. Distribution of Student Rating of their Spring 2020 Remote Learning Experience During the Pandemic**



We explore possible explanations for these striking differences in ordered Probit regressions once more and report the results for four alternative regression specifications in Table 4.

In Table 4, columns (1) and (2) report regression results focusing on academic controls only, while column (3) adds student demographics and differences in learning environments. Finally, in column (4), we add additional and more specific controls as proxies for additional challenges students might have faced during the pandemic.

The estimates reported in Table 4 indicate that while having had a prior online learning experience did not explain differences in the experience during the pandemic, a positive prior experience did result in a better experience during the pandemic. Differences in GPA among students entering the spring term and student status (e.g., senior standing) did not significantly contribute to observed differences, although many instructors reported that seniors had an especially hard time with the transition. These students saw many of their job prospects disappear, at least temporarily. Overall learning experiences further varied significantly across universities. Students at KSU, PU, and UWYO reported more negative experiences than students at UCD and LSU on average.

**Table 4. Regression Results of Overall Student Experiences with Online Learning During the Pandemic (1=Very poor...5=Very good)**

Independent Variables	Academic Controls	Academic Controls (2)	Demographic Controls	Detailed Demographic Controls
Prior online experience (1=yes)	-0.064 (0.071)			
Prior online experience (1=very poor)		0.254*** (0.031)	0.226*** (0.032)	0.224*** (0.032)
Initial GPA	0.077 (0.047)	0.045 (0.051)	-0.068 (0.054)	-0.066 (0.055)
Senior standing	0.017 (0.093)	-0.001 (0.102)	-0.022 (0.104)	-0.014 (0.106)
KSU	-0.342*** (0.064)	-0.372*** (0.070)	-0.362*** (0.089)	-0.388*** (0.090)
LSU	-0.031 (0.126)	-0.027 (0.145)	-0.000 (0.156)	0.009 (0.155)
NCSU	-0.197* (0.086)	-0.252** (0.094)	-0.162 (0.112)	-0.161 (0.113)
PU	-0.248* (0.113)	-0.186 (0.130)	-0.227 (0.142)	-0.234 (0.143)
UWYO	-0.244* (0.098)	-0.316*** (0.096)	-0.305** (0.108)	-0.324** (0.110)
Black			-0.223 (0.164)	-0.119 (0.174)
Hispanic			-0.106 (0.105)	-0.079 (0.105)
Asian			0.035 (0.088)	0.052 (0.091)
Access to computer (1=strongly disagree)			0.015 (0.063)	0.005 (0.063)
Access to stable internet (1=strongly disagree)			0.109*** (0.031)	0.113*** (0.031)
Access to adequate place to study (1=strongly disagree)			0.267*** (0.029)	0.265*** (0.029)
Female			0.211** (0.070)	0.198** (0.071)
Living with children			0.248* (0.121)	0.254* (0.123)
Went home			-0.073 (0.061)	-0.089 (0.062)
Went home (international)			-0.350 (0.233)	-0.361 (0.239)
International student				-0.004 (0.153)
Working on farm or in family business during pandemic				0.114 (0.083)

Discriminated against in University setting (1=yes)				-0.222* (0.106)
Pseudo R <sup>2</sup>	0.007	0.028	0.074	0.076
Observations	1,651	1,419	1,360	1,360

Note: Ordered Probit regressions with university fixed effects (UCD as base) and robust standard errors, Standard errors in parentheses, \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

We are not able to detect statistically significant differences for Black, Hispanic, and Asian students compared to students identifying as White. However, students who felt that they experienced discrimination at their universities did report a worse overall learning experience on average.<sup>12</sup> Contrary to the widely reported disproportionate negative impact of the pandemic on women in the workplace overall (e.g., McKinsey, 2020; Gallup, 2021) and in academia (e.g., Deyugina et al. 2021), female students reported an overall better learning experience than male students on average.<sup>13</sup> Similarly, students living with children during the pandemic also reported a better experience overall. These effects are robust to alternative specifications not reported here, including focusing on young children only and interaction terms for female students and students living with children. While these students might have had higher opportunity costs of time and needed to multitask during the pandemic, the added flexibility of being able to attend classes from home, as well as already established study habits, schedules and strong motivations to succeed might have contributed to this effect. Prior to the pandemic, female students tended to earn better grades in college classes than male students (e.g., DiPrete and Buchmann, 2013), and at least one other study confirms that this trend continued during the initial phase of the pandemic (e.g., Engelhardt et al. 2020). It remains to be seen if the pandemic changed learning experiences and learning outcomes once these learning situations and additional stresses became more permanent. We will test for differences by gender when analyzing enrollment and re-enrollment decisions and embark on a more detailed analysis of the effects of the pandemic on subpopulations of students based on additional socio-demographic variables and economic stressors (e.g., loss of income, food insecurity, family obligations, and mental health) experienced over several terms.

When analyzing differences in students learning environments, we detected the largest effect for differences in student ratings of whether they have an adequate place

<sup>12</sup> We asked students how much they agreed or disagreed with three specific statements related to discrimination: “I have been personally affected by racist acts, discrimination or implicit biases against racial groups and other minorities.”, “I am discriminated against at my university.”, and “I urge my university to address racial injustices and discrimination against minorities on campus and in their curricula.” Differences in student responses to the second statement are included in the reported regression. Differences in responses to the other two statements were not significant.

<sup>13</sup> Due to the small number of students that identify as non-binary or chose other options, we do not include other gender identities in our analyses.

to study. An increase in this rating significantly increased the likelihood of reporting a good experience.<sup>14</sup> The effect of differences in internet access, while also significant, is smaller in magnitude. However, as we already pointed out, these variables are correlated, and we may be underestimating the effect of reliable internet due to sample selection. Finally, as our analysis focuses on students in colleges of agriculture, we wanted to control for potential differences in learning experiences for students that helped at farms and in business operations after returning home. While we might be under-sampling these students once more as they have faced more severe time constraints, and hence were less likely to respond to our survey, we do see a significant increase in the percentage of students who work on farms or in businesses during these early stages of the pandemic in our data. Only 7.36% of students reported working on a farm or small business prior to the pandemic, and this percentage almost doubled to 13.42% during the spring 2020 term. Nevertheless, we do not detect a significant difference in overall experience among students who reported working in these operations during the early stages of the pandemic. It is worth noting that we detect significant differences in the overall student experience across schools, and that these differences might be an indication of socio-economic differences and additional hardships that we have not been able to accurately capture in our analysis so far.

### **Discussion and Further Research Directions**

This first look at our comprehensive and longitudinal survey data collected since the start of the pandemic in March 2020 suggests that student learning experiences at the beginning of the pandemic varied significantly. However, commonly used demographic controls were not able to adequately explain the observed differences. Moreover, contrary to the overwhelming evidence of the disproportional hardships experienced by women during the pandemic and its implications for performance and labor force participation across a wide range of professions, female students and students living with children had a better rather than worse experience than other students. These observed positive experiences during the early stages of the pandemic confirm what previous studies have reported even prior to the pandemic: female students tend to perform better in college than male students. What remains somewhat unclear is how the pandemic will affect gender differences longer-term. For instance, female students might have postponed their studies more often than male students, and trends might reverse once new learning modalities and experienced hardships became more permanent.

<sup>14</sup>We did not detect any significant differences in student responses to this question across female and male students. The correlation between this variable and the female indicator is only moderately negative ( $\rho=-0.08$ ).

We further find that students who felt discriminated against in their university reported worse overall experiences. This suggests lack of statistical significance when considering race and ethnicity might not be an indication that opportunity gaps for historically underrepresented and under-resourced minorities did not persist during this rapid transition. Rather, it serves as a powerful reminder that identifying heterogeneous effects across subpopulations of students will require a more thorough investigation of socio-economic stressors, family responsibilities, as well as physical and mental health factors. The significant and sizable effects of whether students had an adequate place to study and a reliable internet connection, as well as significant differences across universities are an additional indication that explaining which of our students struggle more than others will require an in-depth understanding of their individual circumstances.

In contrast to our results for the overall student experience, when analyzing differences in student experiences in a specific course, student experiences were similar across all six universities and among different groups of students. Thoughtful course design and an emphasis on effective teaching were just as important during these unusual times as they were prior to the pandemic, although it might have required even more effort and time commitment as instructors had to adapt to this remote learning quickly. Students valued courses that created opportunities for active engagement via polls and clicker questions. They also had a better experience when they were able to connect with their instructors. Instructors were able to further improve students learning experience by creating reflective assignments for their students. In general, making the material relevant to students and allowing them to feel that they expanded their knowledge contributed to a better learning experience in a specific course even during these challenging times. Finally, and perhaps less surprisingly so, student experiences in a specific course were influenced by the type and format of exams given. Preliminary results not reported here further suggest that students strongly desired hybrid instruction as an alternative to purely remote classes. However, we observed a high degree of variability in hybrid instruction course design among and within institutions. We will continue our analysis in this regard. While instruction was almost exclusively offered online during the spring 2020 term, we observed significant differences in learning modalities starting in fall 2020. We will continue our analysis of factors that affected students' enrollment decisions and actual enrollment for the fall 2020 term. In addition to considering differences in students' risk perceptions, attitudes towards social distancing, mask wearing and quarantining; we are incorporating students' willingness to get vaccinated. Finally, extending our analysis to include official student records will allow us to examine how behaviors and experiences changed over time and what implications differences in student experiences have for more immediate and longer-term learning outcomes. One trend that is already clearly visible in the data is that grade distributions have shifted towards a larger share of

students receiving an A. It is likely not just in this regard that the rapid transition to remote learning and teaching will have a long-lasting impact even once we return to a new normal. We hope that our continued analysis of this data will inform both instructional design and university policy during these unprecedented times and offer more insight when attempting to address existing opportunity and achievement gaps in higher education.

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