

Reflections on a Plague (Academic) Year:

A Multiyear Comparison of Student Investment, Engagement, and Performance in Undergraduate Physiology Courses During the COVID-19 Pandemic

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Our multiyear analysis of **LMS data** from three different physiology courses found:

#1 Easily obtained LMS data about **student engagement** and **time investment** correlates with **performance** in undergraduate physiology courses.

By comparing 2020 and 2021: **#2** Overall consistency between “online” and in-person data suggests that students were **similarly engaged** through LMS in both learning modalities. If the 2020 AY was “abnormal”, then we still have not returned to normal.



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STUDY RATIONALE AND OVERVIEW:

The COVID-19 pandemic continues to alter the landscape of higher education. In Fall 2020, the University of Connecticut operated remotely with most courses offered in a distance learning format. In Fall 2021, students returned to campus for in-person classes. Although there has been a great deal of speculation by students and faculty alike, the impact of these abrupt transitions on students are still unknown. Here we explore **student engagement, investment, and performance** in three undergraduate physiology courses by **comparing course LMS data** from the Fall 2020 and 2021. We analyzed the **time** students invested in LMS based instruction, the frequency of **engagement** with the course LMS, and correlated these metrics with **overall student performance**. We demonstrate that easily obtained LMS data offers useful, quantifiable insights to inform teaching practice, course evaluation, and student support measures. Our work contradicts a popular narrative that students were not adequately engaged by “online” learning during the 2020-2021 academic year, since our students engaged similarly (or better). As pressure mounts to undo student support measures put in place during the pandemic, our data may serve as a warning to departments, graduate programs, and other stakeholders that the effects of the pandemic on students are ongoing despite strong institutional desires for normalcy.

QUESTION 1: DID ENGAGEMENT CORRELATE WITH PERFORMANCE IN 2020 vs. 2021?

Yes, for most students!

Grades and year were validated as predictive parameters in GLMs of student LMS logins using Poisson distributions. Correlates are strongest in courses with high enrollments and heavy use of LMS based instruction/assessment. Z values are reported from individual parameters within each course model.

Significance reported as $P < 0.001$ **, $P < 0.01$ *

COURSE	B Grade	C Grade	D Grade	Fail	Semester
A&P	-0.076**	-0.159**	-0.25**	-0.409**	-0.047**
Animal Phys.	-0.127**	-0.23831**	-0.451**	-0.483**	-0.101**
Model Sys.	-0.129**	-0.136*	-----	-0.202**	0.049*

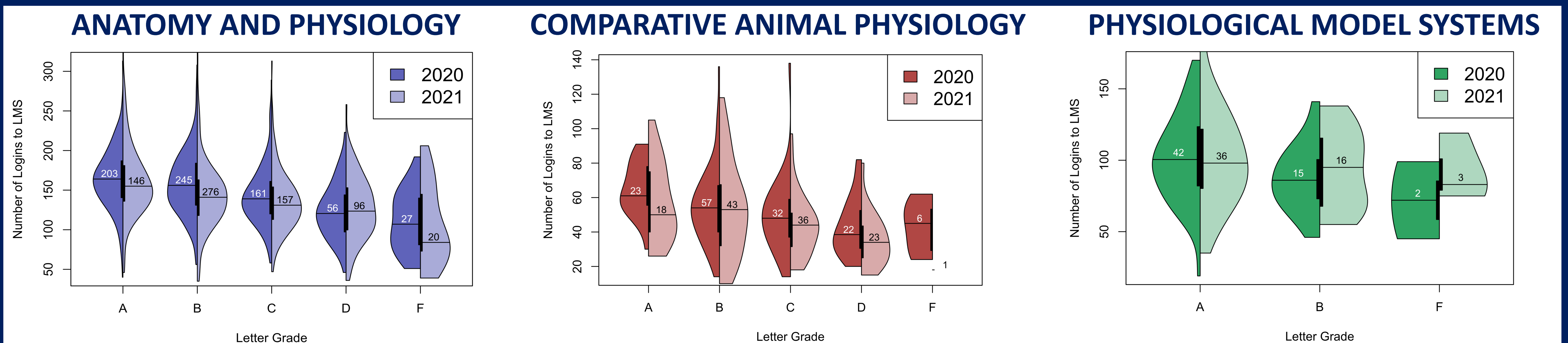


Figure 1: Grades correlate with LMS access in 2020 and 2021. Student grades were plotted against the number of logins to the course LMS over the course of a semester. Violin plots represent distribution of individual student data. Numbers denote group sample sizes. The overall median of each cohort varied between years for Anatomy and Physiology (148 in 2020 vs. 140 in 2021), Animal Physiology (53 in 2020 vs. 44 in 2021), and Physiological Model Systems (98 in 2020 vs. 96.5 in 2021)

QUESTION 2: DID TIME INVESTED IN LMS CORRELATE WITH PERFORMANCE IN 2020 vs. 2021?

Yes, for courses that relied on LMS based instruction and assessment!

Letter grades and year were used as predictive parameters in GLMs of student time spent in LMS using normal distribution. Z values are reported from individual parameters within each course model. Correlates are strongest in Human Anatomy and Physiology and Animal Physiology. Significance reported as $P < 0.001$ **, $P < 0.01$ *

COURSE	B Grade	C Grade	D Grade	Fail	Semester
A&P	-1367.9**	-2146.4**	-3570.0**	-4289.3**	391*
Animal Phys.	-534.0*	-1057.9**	-1311.9**	-1381.9**	-119.6
Model Sys.	-624.25	-46.26	-----	-1355.56	-50.45

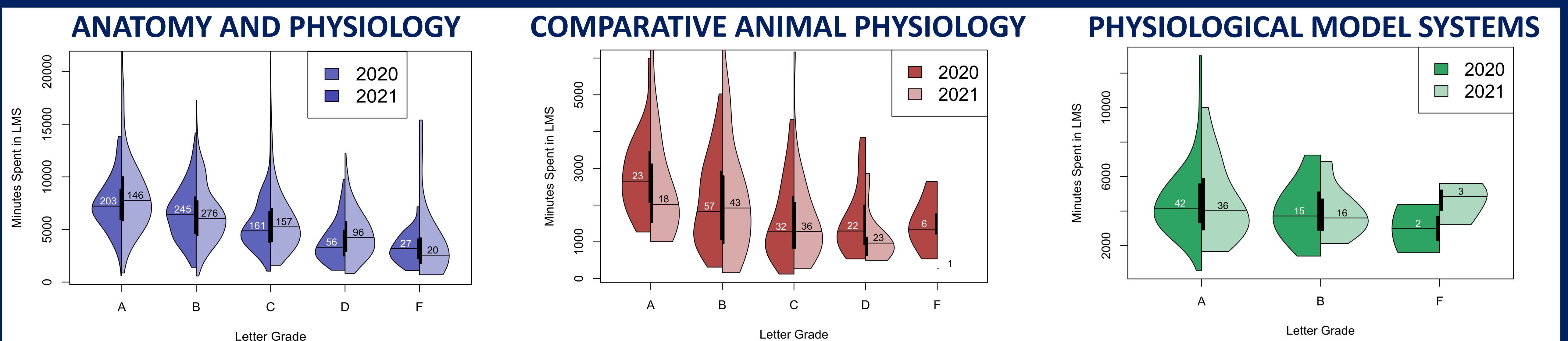


Figure 2: Grades correlate with time in LMS in 2020 and 2021. Student grades were plotted against minutes spent in the course LMS in a semester. Violin plots represent distribution of individual student data. Numbers denote group sample sizes. The overall median of each cohort varied between years for Anatomy and Physiology (5985 in 2020 vs. 5829 in 2021), Animal Physiology (1808 in 2020 vs. 1380 in 2021), and Physiological Model Systems (4092 in 2020 vs. 3890 in 2021).

HOW CAN LMS DATA BENEFIT INSTRUCTORS?

- STUDENT INTERVENTIONS**
Comparing individual students to course medians for in-progress courses may help to identify at-risk students, and create interventional opportunities prior to a high-stakes assessment (e.g., quiz, examination, final project)
- PEDAGOGICAL ASSESSMENT**
Instructors require better tools to evaluate the effects of pedagogical changes, that go beyond student performance. LMS data provides insight into student investment, and engagement with new, revised, or existing LMS components.
- TEACHING PORTFOLIO & PTR**
Student evaluations are unreliable metrics of teaching effectiveness. Comparing LMS data across years can quantitatively demonstrate how a course has evolved over time and/or compare individual sections of a multi-section course.