

# **Predictive Capacity of Learning Management System Student Access Data Regarding Course Performance**

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## **Abstract**

Most colleges and universities have adopted online learning management systems (LMS) to manage student-facing course content. During the COVID-19 pandemic when in-person instruction was significantly hindered (Spring 2020-Spring 2021), LMS became the center of learning. As schools return to in-person instruction, LMS remains a viable tool in education, complementing in-person instruction. However, beyond assisting in content management and dissemination, most LMS track student interactions and enable instructors to view such data. The objective of this Work-in-Progress study is to assess the predictive capacity of such data for students' final course grade and how analysis may be used to inform future course design.

## **Keywords**

LMS

## **Introduction**

Even before the COVID-19 Pandemic, many higher education institutions were already utilizing web-based tools to communicate with students and share course related resources. While early use may have been targeted for online courses, schools have widely adopted them as an alternative tool for student-faculty communication.<sup>1,2</sup> Faculty may now provide course content and accept assignment submissions virtually for in-person classes. In addition, students are able to message the instructor via the LMS rather than email.

Much research has been conducted to investigate the performance of LMS tools and their acceptance by faculty and students.<sup>3-8</sup> Faculty also create new and innovative ways to blend their in-person and online interactions with students to streamline course management while providing more personalized learning experiences.<sup>9-11</sup> However, much of this research requires access and advanced analysis of a wide variety of data points.<sup>12-14</sup> This study investigates if the most easily accessed data for a given faculty could have any predictive capacity for student performance in the course. Such a tool could enable faculty to perform early interventions with students whose interaction with online course material may not set them up for academic success. Expansions of this work-in-progress will investigate additional metrics available in Canvas to identify any that faculty may be able to reliably use to identify and intervene with students of concern.

## **Methods**

This observational study employed data collected from Canvas, the LMS used at The Citadel, via the New Analytics built-in tool. The data included each student's final course grade, total page views, and total participation. The page views represent the number of times the student accessed

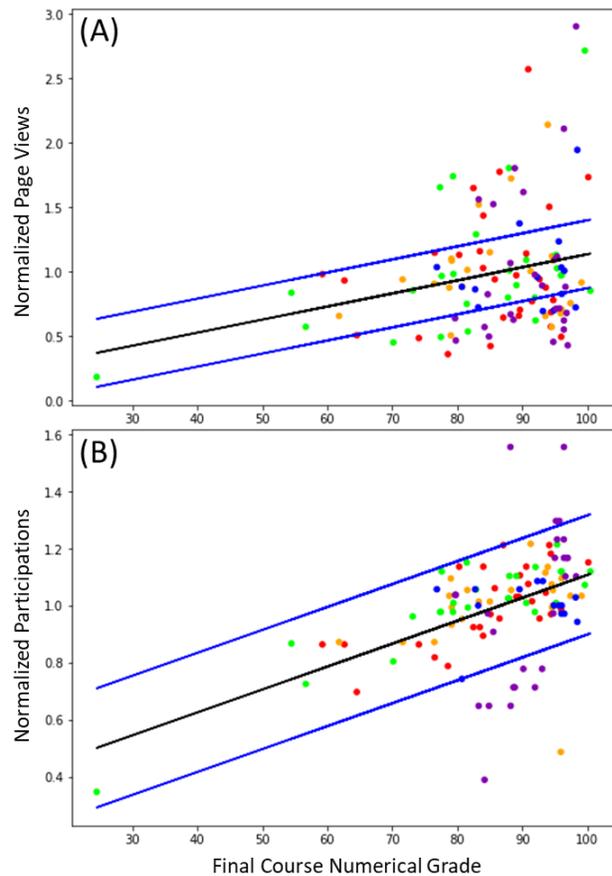
any page within the course website. Participation includes student actions such as turning in an assignment, commenting in a discussion board, or viewing a supplemental video. The analysis included five courses (2- junior level and 3 senior level) taught by the authors in Academic Year 2020-2021. Across all courses, there are a total of 117 sets of final course grade and associated Canvas data. While preliminary data presents all students together, additional analysis will control for differences in year group and course assignment structures.

The preliminary analysis as reported in this “Work-In-Progress” study included normalization of final course grade, page views, and participation to the class average. In this way, the class average is equal to 1, those who participate/view more than average are greater than 1, and those who participate/view less than average are between 0 and 1. Linear regression and data visualization were performed in Python. A 99% confidence interval is shown in Figure 1 for linear regressions.

### Results and Discussion

The preliminary analysis seeks to understand the predictive capacity of LMS analytics toward student performance, as measured by their final course grade. By definition, page views would always be a much larger value than participation. Page views for the “home page” within the course site would increase every time a student logs into the course. However, for courses that provide online reading material or nest documents inside assignments, page views may be a meaningful predictor of engagement, and possibly student performance.

As seen in Figure 1, both page views and participation correlate positively with the final course grade. This positive trend is somewhat predictable; students who do not skip assignments will have a better course grade. Further investigation into the types of participation for those with high grades and above average participation rates will be performed for a larger future data set to draw more significant conclusions. As hypothesized, there is less noise in the participation data set (i.e. the data is better bounded by the 99% confidence interval). However, it is possible that a non-linear model would be a better fit for the page view data.



**Figure 1:** Students’ final numerical course grade (out of 100 total points) versus normalized (A) page views or (B) participations. Different courses are shown with different point colors. The black line shows a linear regression for the entire data set. The blue lines bound the 99% confidence interval.

To further clarify trends observed, the students’ final course grades were clustered by letter, based on a standard ten-point scale, and once again visualized against the normalized page views

and participation (Figure 2). The findings are similar to that of the linear regression data in Figure 1. Higher grades have higher view and participation rates. However, clustering by letter grade demonstrates more clearly how much variance there is within a single achievement bracket.

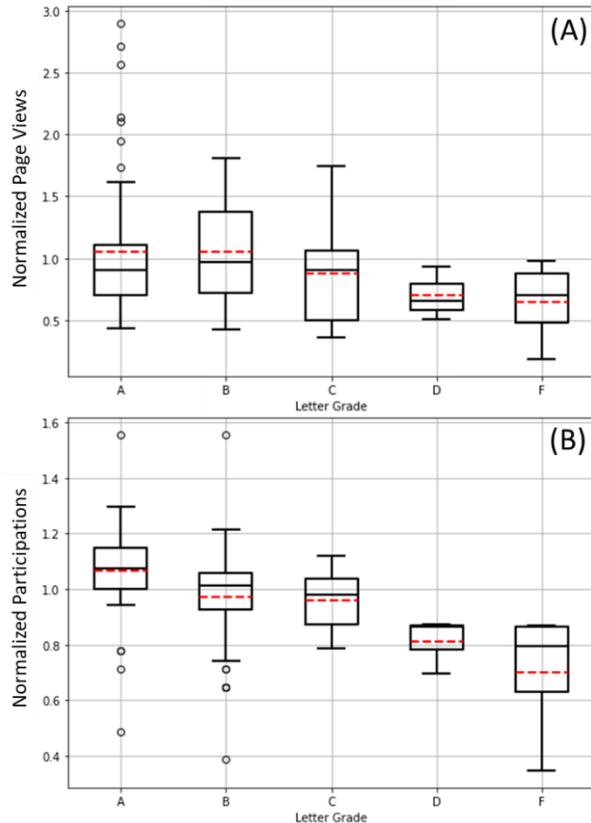
### Future Research

Utilizing the data organization and analysis tools prepared herein, this research will continue to address the following questions. The data set will be expanded to include approximately 10 different courses taught by multiple different instructors between Fall 2020 and Spring 2022.

1. How do different cohorts (i.e., year groups) utilize Canvas resources differently in courses with unchanged content between different years/semesters?
2. To what level does an individual student's utilization of Canvas resources change between courses?
3. How does instructors' course design strategies (i.e. the types of materials posted online) affect student participation via Canvas?

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**Figure 2:** Students' final letter grade and normalized (A) page views or (B) participations with course content. The box and whisker plot (in black) show median, IQR, and outliers. The red dashed line indicates the average for each letter grade.

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