How do Quiz and Homework Submission Times Affect Students' Performance in a Flipped CS1 Class?

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ABSTRACT

This poster presents an analysis of students' quiz and homework submission times in a flipped introductory programming course (CS1) using MATLAB. A total of 145 engineering students were divided into three sections where every week they were expected to watch the prerecorded content videos and complete a quiz before the class on Monday. During the class, students practiced short programming problems while after the class students were expected to submit a homework assignment by the end of the week. We studied their quiz and homework submission times to gauge and categorize their behavior. Four major categories of submission time clusters were analyzed based on when the weekly quizzes and homeworks were due. We found that students who submitted the quizzes and homeworks 24 hours prior to the submission deadline had significantly higher exam scores as compared to students who submitted during the last 24 hours. Additionally, we found that this difference was only significant for students who did not have prior programming experience. This indicates that early submission of assignments can help students who do not have prior programming experience in improving their overall course performance.

CCS CONCEPTS

• **Social and professional topics** → **CS1**; **Model curricula**.

KEYWORDS

Flipped class, CS1, MATLAB, Non-majors, Student behavior

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1 EXTENDED ABSTRACT

As the adoption of the flipped classroom pedagogy increases in introductory programming courses, students are expected to familiarize themselves with the weekly course content before the class [1]. This has increased the instructors' expectations from the students as students are now expected to engage with the course content prior to the class. Understanding how outside classroom engagement with the course content affects students' overall course performance can give insights into effective student behavior and can guide the design of flipped CS1 classes [4]. Prior research on analyzing student behavior with their course performance has had mixed results [2–4].

Here we present the analysis of 145 engineering students who took a flipped CS1 course using MATLAB. We studied their quiz and homework submission times to gauge and categorize their behavior. Four major categories of submission time clusters were analyzed based on when the weekly quizzes and homeworks were due. Results from a one-way ANOVA indicate that students who, on average, submitted quizzes and homeworks prior to 24 hours before the assignment's due date had significantly ($\alpha = 0.05$) higher exam scores as compared to students who submitted during the last 24 hours ($F(3,141) = 3.28$, $p=0.023$). This is similar to findings from Shaffer et al. [3], and Willman et al. [4]. On analyzing further, we find that this difference is insignificant with the students who do have prior programming experience ($F(3,50) = 0.52$, $p=0.585$) but is significant with students who do not have prior programming experience ($F(3,87) = 0.36$, $p=0.017$). It was also found that students who did not have prior programming experience and who submitted their quizzes and homeworks 24 hours before scored equivalently when compared to students who did have prior programming experience and also submitted the quiz and homework 24 hours before. This indicates that early submission of assignments can help students who do not have prior programming experience in improving their overall course performance.

While many factors impact students' performance, the results of this analysis suggest that instructors can encourage certain types of behavioral engagement with certain student populations in flipped CS1 courses either through instructional design or through explicit recommendation. This could especially be helpful as a growing number of students with mixed abilities enroll in CS1 courses.

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