

## RESEARCH BRIEF 6

# Online Credit Recovery: Patterns of Student Engagement in the Online Program

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## About This Research Brief

This research brief is the sixth in [a series of briefs](#) for the *Online Credit Recovery Study*<sup>1</sup> conducted by the American Institutes for Research. In the first brief, we provided an overview of the study and described the online learning model tested. In the second and third briefs, we highlighted key findings about implementation and initial outcomes for Algebra 1 and ninth-grade English (English 9) credit recovery classes. These two briefs indicated that student use of the online program was lower than expected, with most students completing less than half of the online content (64% of Algebra 1 students and 59% of English 9 students). The fourth brief described key findings about the differences in resources and costs between online and teacher-directed credit recovery classes. The fifth brief reported on the results of focus group interviews we conducted to better understand teachers' experiences teaching the two types of classes.

In this brief, we provide a more detailed look at how students in the online credit recovery classes engaged with and progressed through the online program. In particular, we identify four patterns of student engagement for each subject and describe how these patterns are associated with students' course credit recovery and their prior academic achievement. The findings could help schools develop strategies for identifying students who might need additional support to succeed in a self-paced online credit recovery course.

### Key Findings

- Students enrolled in Algebra 1 and English 9 online credit recovery classes exhibit distinct patterns of engagement based on their interaction with the online program across time.
- Although students had overall higher or lower patterns of engagement, their level of engagement varied, suggesting that it is important for educators to regularly monitor student engagement.
- Students with higher engagement overall passed their credit recovery class at higher rates than students with lower engagement.
- Students' previous academic performance was only marginally useful for identifying which students would go on to have higher or lower engagement with the online program.

## Study Overview

The data for this study come from a larger effectiveness study that compared an online learning model for credit recovery with a more typical teacher-directed credit recovery model. The online learning model implemented for the study included an online curriculum provided by a vendor and credentialed in-class teachers provided by the participating schools. The in-class teachers could provide individualized support and supplement the digital instruction.

Students in the study failed Algebra 1 or English 9 during their first year of high school and retook the course during the summer before their second year of high school. We used a lottery process to determine whether each student enrolled would use the online learning model or their school's teacher-directed class.<sup>2</sup> All classes took place in a standard high school classroom in the Los Angeles Unified School District during the district's 5-week summer session in summer 2018 or 2019. All classes met for 2.5 hours per day and included 24 instructional days.

The analyses for this brief focus on the students who retook Algebra 1 or English 9 in one of the study's online credit recovery classes. Because some students enrolled in the online credit recovery class but never attended the class, our analyses focus on students who enrolled in the class and accessed the online program content for at least 2.5 hours (the equivalent of one full class period). For Algebra 1, the analyses included 254 students across 14 online classes. For English 9, the analyses included 492 students across 35 online classes.<sup>3</sup>

To identify common student engagement patterns, we used an exploratory data analysis technique that groups students based on multiple pieces of information and conducted separate analyses for Algebra 1 and English 9.<sup>4</sup> We used the following information from each student's online program usage data to classify students into different types of student engagement patterns:

- Weekly measures of the amount of time that students were active in the online program
- Weekly measures of the number of lessons that students completed
- The total amount of time that students were active in the online program during the 5-week summer session
- The percentage of all lessons that students completed during the 5-week summer session
- The total number of days that students accessed lessons in the online program, which is analogous to logging into the program, during the 5-week summer session.

These measures provide proxies for the degree to which students engaged with the program (e.g., the amount of time spent in the online program, the number of lessons they completed) and progressed through the program (e.g., lessons completed overall), as well as the consistency with which students engaged with the online program during the 5-week summer session (e.g., time spent in the online program, lessons completed each week).

## Students Exhibited Four Patterns of Engagement in the Online Program

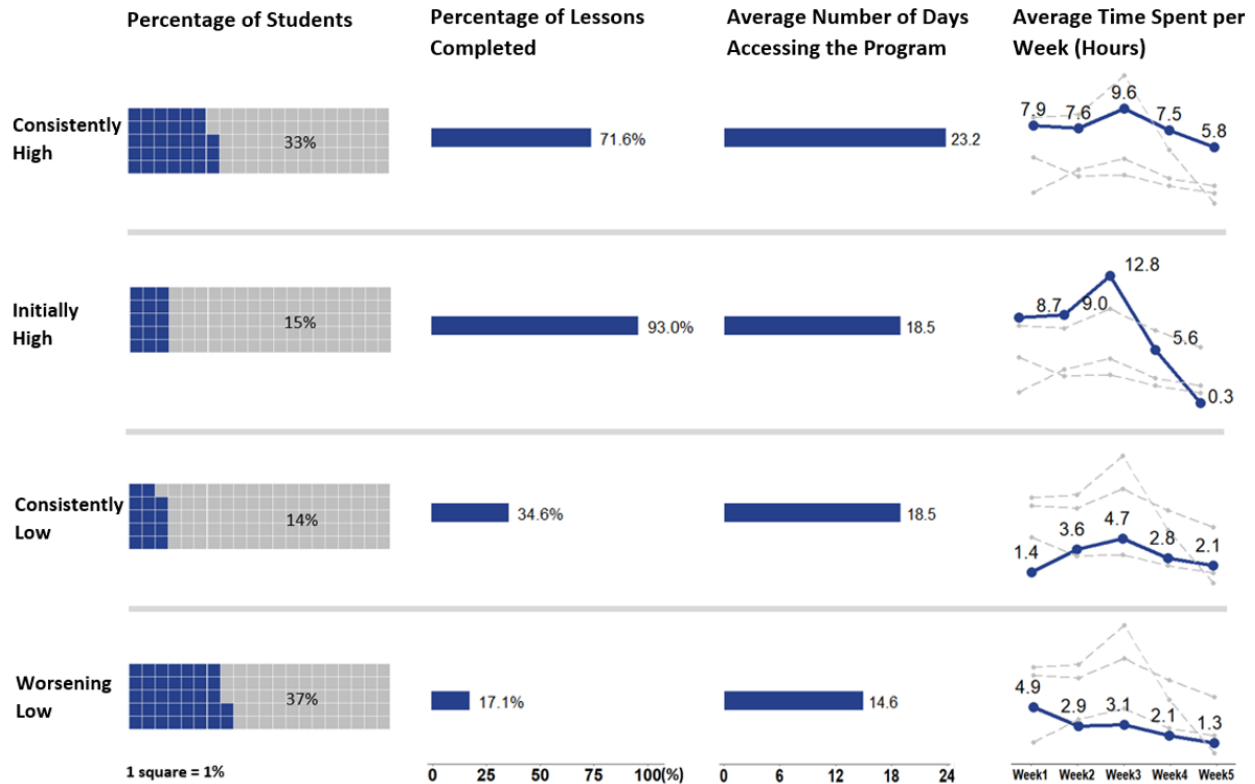
We identified four general patterns of student engagement in the online program for both Algebra 1 and English 9. In naming the groups, we refer to them as demonstrating high or low engagement. It is important to note that we named these groups based on their level of engagement relative to the students in the sample. As we reported in [previous briefs](#) describing the initial study findings for Algebra 1 and English 9, students' use of the online program overall was lower than expected, with approximately half of all students spending fewer than 20 of the recommended 40 hours in the online program.

Although we used five measures to identify the engagement groups, our reporting focuses on only three of the measures. Why? Because the patterns were similar for the total amount of time and the percentage of all lessons completed, as well as the amount of time each week and the percentage of lessons completed each week (see Table A1 in the appendix for the patterns of the total amount of time spent and the weekly percentage of lessons completed).

For Algebra 1, the four patterns of student engagement in the online program were as follows (see Figure 1):

- **Consistently High Engagement** (33%,  $n = 86$ ). On average, students spent 6–10 hours per week logged into the online program, completed 72% of the lessons, and worked on lessons for 23 of the 24 days.
- **Initially High Engagement** (15%,  $n = 38$ ). On average, students spent 9–13 hours per week logged into the online program in the first few weeks but had a significant decline in hours during the last 2 weeks. Students completed 93% of the lessons, the highest percentage of lessons completed among all groups, and worked on lessons for 19 of the 24 days. This group includes some students who finished the online course before the summer session ended, which accounts for the decline in average time spent in the last weeks of the summer term.
- **Consistently Low Engagement** (14%,  $n = 36$ ). On average, students spent 1–5 hours per week logged into the online program, completed 35% of the lessons, and worked on lessons for 19 of the 24 days.
- **Worsening Low Engagement** (37%,  $n = 94$ ). On average, students gradually decreased the time spent logged into the online program from 5 hours in the first week to about 1 hour by the last week. Students completed only 17% of the lessons and accessed content in the online course for 15 of the 24 days. Despite the moderately high amount of time in the online course at the beginning of the summer term, these students had the lowest percentage of lessons completed and number of days accessing online content.

Figure 1. Patterns of Engagement for Students Taking an Algebra 1 Online Credit Recovery Class



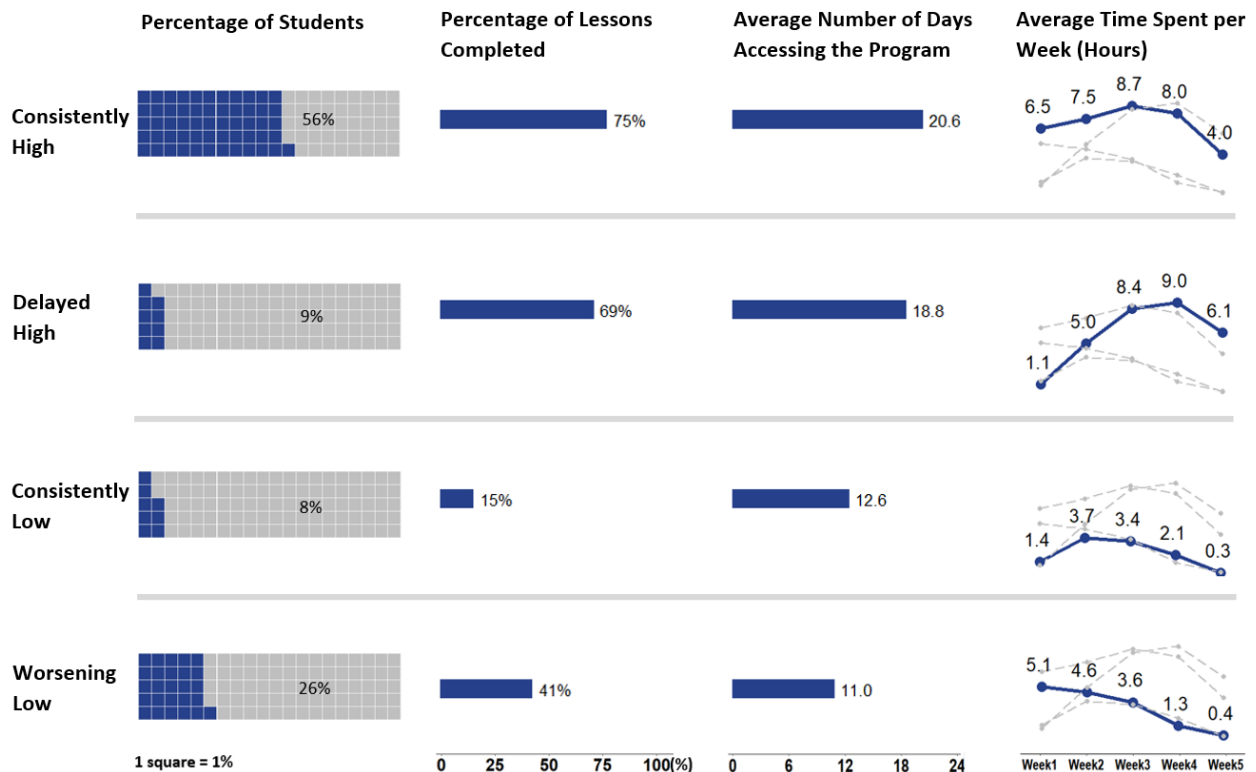
Note. Based on 254 students who took an online Algebra 1 credit recovery class in summer 2019 and who were active in the online program for at least 2.5 hours. *Percentage of Students* is the percentage of students in each engagement pattern group who took the online Algebra 1 course. *Percentage of Lessons Completed* is the average percentage of all lessons in the online program that students in each engagement pattern group completed during the summer term. *Average Number of Days* is the average number of days (out of 24 instructional days) students in each group accessed the online program. *Average Time Spent Per Week* is the average number of hours that students were active in the online program each week for each engagement pattern group.

For English 9, the four patterns of student engagement in the online program were as follows (see Figure 2):

- **Consistently High Engagement** (56%,  $n = 276$ ). On average, students spent at least 6 hours per week logged into the online program in the first 4 weeks but had less activity in the last week. Students completed 75% of the lessons, the highest percentage of lesson completion among all groups, and worked on lessons for 21 of the 24 days.
- **Delayed High Engagement** (9%,  $n = 46$ ). On average, students rapidly increased the time spent from 1 hour to 5 hours during the first 2 weeks and then spent at least 6 hours per week logged into the online program for the rest of the summer session. Students completed 69% of the lessons and worked on lessons for 19 of the 24 days. Lower engagement in the first couple of weeks may partially be caused by factors outside the control of students, such as delays in getting access to the online program.
- **Consistently Low Engagement** (8%,  $n = 41$ ). On average, students spent less than 4 hours per week logged into the online program across all 5 weeks. Students completed only 15% of the lessons, the lowest percentage among all groups, and worked on lessons for 13 of the 24 days.

- **Worsening Low Engagement** (26%,  $n = 129$ ). On average, students gradually decreased the time spent logged into the online program from 5 hours in the first week to less than 1 hour by the last week. Students completed 41% of the lessons and worked on lessons for only 11 of the 24 days.

Figure 2. Patterns of Engagement for Students Taking an English 9 Online Credit Recovery Class



Note. Based on 492 students who took an online English 9 credit recovery class in summer 2018 or summer 2019 and were active in the online program for at least 2.5 hours. *Percentage of Students* is the percentage of students in each engagement pattern group who took the online English 9 course. *Percentage of Lessons Completed* is the average percentage of all lessons in the online program that students in each engagement pattern group completed during the summer term. *Average Number of Days* is the average number of days (out of 24 days) students in each group accessed the online program. *Average Time Spent Per Week* is the average number of hours students were active in the online program each week for each engagement pattern group.

For both Algebra 1 and English 9, the main factor differentiating the two groups with high patterns of engagement and the two groups with low patterns of engagement is the number of hours that students were active in the online system.

- For the high engagement groups, one engagement pattern was active in the online program for a relatively high number of hours across all 5 weeks, whereas the other had a period when they were active for relatively fewer hours. For Algebra 1, the period of less activity occurred at the end of the summer session, and for English 9, it occurred at the beginning of the summer session.
- For the low engagement groups, for both Algebra 1 and English 9, one engagement pattern demonstrated a consistently low level of online program activity, whereas the other demonstrated a decline in online program activity across time.

For both Algebra 1 and English 9, the four patterns of engagement can be combined into two groups, one representing high engagement overall and one representing low engagement overall. Students in the two high engagement groups spent significant time in the online program during the summer session (an average of 34.8 total hours in Algebra 1 and 34.0 total hours in English 9) and completed most of the online lessons (an average of 78% of the lessons in Algebra 1 and 74% of the lessons in English 9). Conversely, the low engagement students spent minimal time in the program (an average of 8.8 total hours in Algebra 1 and 14.0 total hours in English 9) and completed less than half of the lessons (an average of 22% of the lessons in Algebra 1 and 35% of the lessons in English 9).

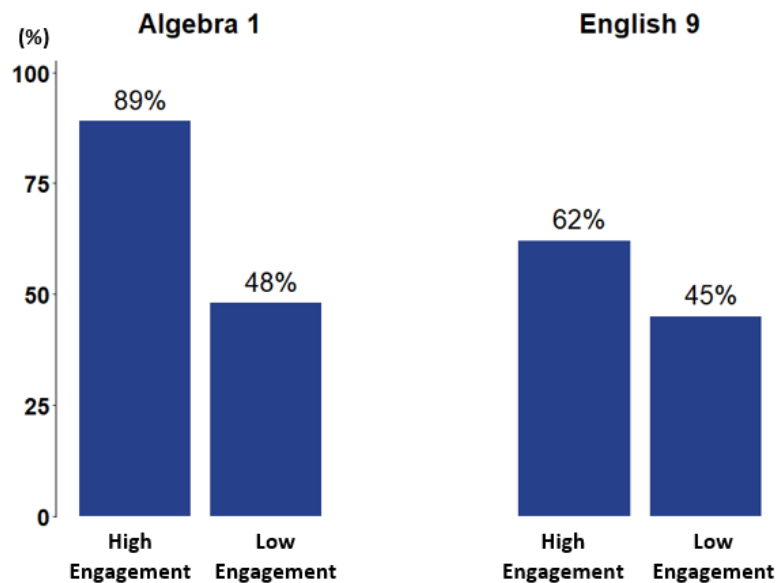
For the remaining analyses presented in the brief, we examined whether being in a high or low engagement group is associated with recovering course credit and students' baseline academic characteristics. Our rationale for comparing these outcomes for the overarching high and low engagement groups, instead of the four patterns of engagement, is twofold. First, the small sample sizes in some of the engagement groups would have reduced our ability to reliably identify differences among the four groups. Second, comparing students with high engagement and low engagement provides useful information about the most policy-relevant distinction in student engagement. For those interested, we include descriptive information for each pattern of engagement per subject in the appendix (Table A2).

## Patterns of Student Engagement Were Associated With Recovering Course Credit

Whether a student had high or low engagement in the online program was associated with whether students passed the course and recovered course credit. As one might expect, students in the high engagement groups recovered course credit at a higher rate than students in the low engagement groups for both Algebra 1 and English 9 (see Figure 3). This difference was particularly pronounced for students taking Algebra 1. These results suggest that students' success at recovering course credit in an online class may benefit from educators monitoring multiple measures of student engagement in the online program across all weeks of the academic term.



**Figure 3. Online Credit Recovery Rates for Students in the High Engagement and Low Engagement Groups for Algebra 1 and English 9**



*Note.* Based on 254 students who took an online Algebra 1 course in summer 2019 and 492 students who took an online English 9 course in summer 2018 or summer 2019 and were active in the online program for at least 2.5 hours. For Algebra 1 and English 9, the average difference between the high and low engagement patterns was statistically significant ( $p < .05$ ).

## Prior Academic Performance Helps Predict Student Engagement Patterns But May Not Be Useful Enough to Reliably Identify Students at Risk for Low Engagement

Although we anticipated that all students in the online credit recovery classes had experienced prior academic struggles, we wanted to investigate whether differences in students' background academic characteristics could be used to identify those students who may face challenges engaging in the online program. To do this, we examined the correlations between being in a high or low engagement group and students' ninth-grade attendance rates, the number of ninth-grade classes they failed, and whether their eighth-grade standardized test score was far below standards.

There were some significant differences in prior academic characteristics between students in the high and low engagement groups (see Table A3 in the appendix). For both Algebra 1 and English 9, students with high engagement in the online program had significantly higher ninth-grade attendance rates. The attendance rates for the Algebra 1 high and low engagement groups were 93% and 91%, respectively; for English 9, the attendance rates were 87% and 83%, respectively, for the high and low engagement groups. Regarding the number of courses that students failed in the ninth-grade, students in the Algebra 1 low engagement groups failed approximately two more courses than students in the high engagement group (3.2 versus 5 failed courses), but the difference for English 9 was not statistically significant. The percentage of students with

eighth-grade standardized test scores far below standards did not differ significantly for the high and low engagement groups for either Algebra 1 or English 9.

When we look more closely at the magnitude of the average differences between the high engagement and low engagement groups on these prior academic performance measures, we conclude that although some differences were statistically significant, yet these background academic characteristics are far from perfect predictors of whether students demonstrated high or low engagement in their online credit recovery course. Other important factors, such as motivation, are not readily captured in existing data systems, and they may predict whether students engage with online learning.

## Implications

The findings about student engagement in the online program provide useful information that can inform educators' efforts to support students taking online credit recovery courses.

- The analysis of engagement patterns demonstrates that even among students with relatively similar prior academic performance, students interacted with and participated in the online program in distinctly different ways. Of particular interest is that initial engagement in the first couple of weeks, as measured by the number of hours students were active in the online program, did not necessarily align with their overall engagement in the course during the summer term. For example, when we look at the pattern of engagement groups for English 9, we see that the Delayed High Engagement group started the summer session with quite low engagement (1.1 hours on average during the first week) but increased the amount of time they were active in the online program as the summer term went on. These students ended up completing 69% of the online lessons. Demonstrating a different trend, students in the Algebra 1 and English 9 Worsening Low Engagement groups began the summer term devoting approximately 5 hours of time to the online program during the first week, but this time quickly dropped off, and both groups went on to complete fewer than half of the online lessons (17% for Algebra 1 and 41% for English 9).
- The results reinforce how engagement with the online program is important for a student's success in an online credit recovery course. For both Algebra 1 and English 9, more students in the high engagement groups recovered course credit than students in the low engagement groups. It is important to note, however, that we do not know whether students in the low engagement groups would have had more success in a typical teacher-directed credit recovery class. It could be that these students would have had low engagement in any type of credit recovery class.
- Students' ninth-grade academic performance is only marginally useful for identifying which students may have lower engagement with the online program and subsequently greater difficulty completing the online class.

Taken together, these three findings point to the importance of actively monitoring student engagement throughout the term to determine which students need additional support to continue progressing through the online class.



## Appendix

Table A1. Total Time Spent and Weekly Percentage of Lessons Completed, Algebra 1 and English 9

	Algebra 1				English 9			
	Consistently high	Initially high	Consistently low	Worsening low	Consistently high	Delayed high	Consistently low	Worsening low
Total time spent across 5 weeks (hours)	36.5	38.4	14.6	14.3	34.7	29.6	10.8	15.0
Percentage of lessons completed per week								
Week 1	14%	22%	2%	6%	14%	1%	1%	12%
Week 2	13%	26%	8%	3%	13%	11%	5%	13%
Week 3	14%	28%	10%	3%	16%	18%	5%	11%
Week 4	16%	17%	8%	2%	21%	24%	3%	3%
Week 5	15%	0%	7%	2%	10%	15%	0%	2%

Note. Based on 254 students in the Algebra 1 classes and 492 students in the English 9 classes.

**Table A2. Online Credit Recovery Rate and Average Prior Academic Performance for Each Pattern of Engagement Group, by Algebra 1 and English 9**

	Algebra 1				English 9			
	Consistently high	Initially high	Consistently low	Worsening low	Consistently high	Delayed high	Consistently low	Worsening low
Course credit recovery rate (%)	86	95	53	47	59	78	49	43
Attendance rate in ninth grade (%)	93	94	91	92	87	84	79	84
Number of failed courses in ninth grade	3.5	2.6	5.1	5.0	4.7	5.5	6.4	5.0
Far below standards in eighth-grade math (%)	70	67	79	81	—	—	—	—
Far below standards in eighth-grade English (%)	—	—	—	—	51	66	66	55

Note. Based on 254 students in the Algebra 1 classes and 492 students in the English 9 classes. Number of failed courses in ninth grade is based on the total number of semester-based classes failed during the fall and spring semesters. Far below standards in eighth-grade math and far below standards in eighth-grade English are defined as scoring in the bottom achievement level on the state assessment (labeled “standard not met” in California).

**Table A3. Prior Academic Characteristics of Students in High Engagement and Low Engagement Groups for Algebra I and English 9**

	Algebra 1			English 9		
	High engagement	Low engagement	p-value	High engagement	Low engagement	p-value
Attendance rate in ninth grade (%)	93	91	.02*	87	83	.02*
Number of failed courses in ninth grade	3.2	5.0	.00*	4.8	5.4	.16
Far below standards in eighth-grade math (%)	69	80	.09	—	—	
Far below standards in eighth-grade English (%)	—	—		53	57	.40

Note. Based on 254 students in the Algebra 1 classes and 492 students in the English 9 classes. High engagement is the average for the two patterns of engagement labeled as having high engagement for each subject. Low engagement far below standards in eighth-grade math and far below standards in eighth-grade English are defined as scoring in the bottom achievement level on the state assessment (labeled “standard not met” in California).

\* Average difference between the high engagement groups and the low engagement groups is statistically significant ( $p < .05$ ).

## Notes

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<sup>2</sup> Students classified with an English language development (ELD) level of 1, 2, or 3 (out of 5) were excluded from the study. Per district policy, students with an ELD level below 4 should not be enrolled in online courses. Students with an ELD level of 4 or 5 were allowed to participate in the study.

<sup>3</sup> The Algebra 1 course covered content selected from two semester-based courses (Algebra 1A and Algebra 1B) and was part of the study during the 2019 summer session only. English 9 refers to two separate semester-based courses (English 9A and English 9B) that were part of the study during the 2018 and 2019 summer sessions. Some students in the study enrolled in the online credit recovery class but never attended the class. For our analysis of student engagement with the online program, we focused on students who both enrolled in one of the study's online credit recovery classes and accessed the online program, which we define as spending at least 2.5 hours in total in the online program (the equivalent of one full class period). This sample restriction excluded 24 Algebra 1 students and 29 English 9 students from the study sample.

<sup>4</sup> More specifically, we used multivariate time-series clustering with a dynamic time warping algorithm (Berndt & Clifford, 1994), which allowed us to find the similarity in both the observed values at each time point and the pattern of the data during the 5-week summer session. We determined the optimal number of pattern groups based on a set of cluster separation and similarity indices: the Silhouette index (Rousseeuw, 1987), the Davies-Bouldin index (Davies & Bouldin, 1979) and the Dunn index (Dunn, 1974). These indices proposed for the four pattern groups are an acceptable representation of students for both Algebra 1 and English 9. For Algebra 1, the index values were 0.31, 1.45, and 0.05, respectively; for English 9, the index values were 0.29, 1.16, and 0.04, respectively.

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