

## About This Research Brief

This research brief is the 10th in [a series of briefs](#) for the Online Credit Recovery Study<sup>1</sup> conducted by the American Institutes for Research<sup>®</sup> (AIR<sup>®</sup>). This research brief is an extension of the [sixth brief](#), which described patterns of student engagement and progress through an online credit recovery course. For the earlier brief, we focused on classes that participated in the primary evaluation study and examined how engagement changed across the summer session weeks.

For this brief, we expanded the study sample to include more summer credit recovery classes and examined how students focus on different instructional activities. In particular, we identify five patterns of student engagement across Algebra 1 and ninth-grade English (English 9) and describe how these patterns are associated with students' course performance and their background characteristics. Building on the findings in the sixth brief, findings from this extension study offer insights into additional key engagement measures for educators to monitor, aiding in the support of students who may require extra assistance to excel in a self-paced online credit recovery course.

## Study Overview

The study described in this brief addressed two research questions: (1) How do students in an online credit recovery class engage with and progress through the online program? and (2) How are those engagement patterns associated with student course performance and background characteristics?

### Key Findings

- Five patterns of student engagement emerged from online program usage data on total time spent, course progress, and percentage of time spent on various online course activities for students enrolled in Algebra 1 and English 9 online credit recovery classes.
- Patterns of student engagement were associated with students' ninth-grade attendance and course performance but not with eighth-grade standardized test scores in mathematics and English language arts.
- The personalized pacing of online credit recovery may be particularly useful for students who exhibited relatively more academic engagement in ninth grade.
- Some students make relatively little progress in the online program, spending little time in the course after the first 2 weeks. These students are likely to have faced greater academic challenges in ninth grade and may need additional supports to progress through an online credit recovery course.

We utilized online platform log data and district administrative data for students in the Los Angeles Unified School District who were in the expected high school graduation classes of 2021 and 2022, failed Algebra 1 or English 9 during their first year of high school, and subsequently retook the corresponding course through the district's online course offering during the summer. This sample consisted of 3,122 students, including 1,111 students who took an Algebra 1 online credit recovery course and 2,011 students who took an English 9 online credit recovery course.<sup>2</sup>

To identify common student engagement patterns, we used a statistical technique that groups students based on the following measures derived from each student's summer credit recovery online program usage data.<sup>3</sup> The measures provide proxies for the overall degree of engagement in online learning, the distribution of engagement over the course, and the extent of engagement in various activities while using the online program.

- **Total time spent.** The total number of hours that students logged in the online program.
- **Total progress.** The percentage of all lessons that students completed.
- **Time distribution over the course.** The percentage of time that students spent in the online program in the first 2 weeks, second 2 weeks, and last week, respectively, of the 5-week summer session.<sup>4</sup>
- **Time allotment by activity.** The percentage of time that students spent on instruction activities, assignment activities, and testing activities, respectively.<sup>5</sup>

To understand the associations between engagement patterns and student course performance and background characteristics, we examined the associations between students' engagement patterns and their proficiency in course content knowledge in the online credit recovery course. We also examined students' markers of prior academic performance: eighth-grade standardized test scores, the number of semester courses they failed in the fall semester of ninth grade, the number of semester courses they failed in the spring semester of ninth grade, and their ninth-grade GPA.<sup>6</sup>

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

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We identified five general patterns of student engagement in the online program across Algebra 1 and English 9, as follows (Exhibit 1):

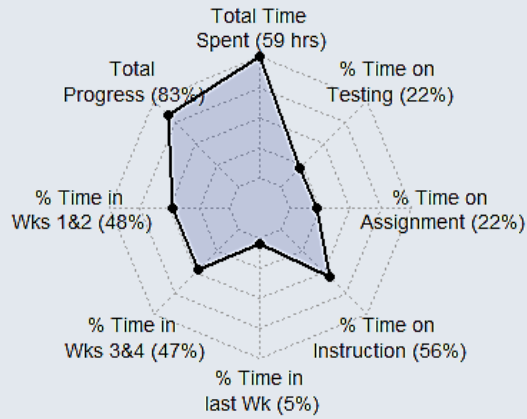
- **Group A: High engagement and good progress, with a focus on instruction activities** (33%,  $N = 1,026$ ). On average, these students logged 59 hours in the online program and completed 83% of the lessons. They dedicated slightly more than half of their learning time to instruction activities (56%) and spent nearly all of their total online time within the first 4 weeks (48% in the first 2 weeks and 47% in the second 2 weeks).

- **Group B: High engagement and moderate progress, with a focus on instruction activities** (8%,  $N = 236$ ). Compared with Group A students, this group, on average, logged a similar number of hours (54 hours) in the online program and dedicated a comparable proportion of their learning time to instruction activities (51%). However, Group B students completed fewer lessons (approximately 14 percentage points, or 69% of the lessons) and spent a smaller share of their total online time in the first 4 weeks of the summer session (30% in the first 2 weeks and 34% in the second 2 weeks) than Group A students.
- **Group C: Moderate engagement and moderate progress, with a focus on testing activities** (21%,  $N = 659$ ). Despite spending approximately 20 fewer hours logged into the online program compared with Group B (35 hours), students in Group C still completed a similar percentage of lessons (73% of the lessons). They devoted more than half of their time to testing activities (56%) and concentrated most of their total online time within the first 2 weeks (64%)—nearly all of it within the first 4 weeks (97%).
- **Group D: Low engagement and poor progress, with a general focus on activities** (11%,  $N = 333$ ). On average, these students logged into the online program for just 22 hours and completed only 24% of the lessons. When working with the online program, they maintained a general focus on activities, with slightly more time on assignment activities (40%). They concentrated most of their total online time in the first 2 weeks (75%), indicating that they either stopped attending the class or disengaged early in the summer session.
- **Group E: Low engagement and poor progress, with a focus on instruction activities** (28%,  $N = 868$ ). Group E students logged the fewest hours in the online program (14 hours) and completed the lowest percentage of lessons (21%). Unlike Group D students, students in Group E devoted most of their total online time to instruction activities (64%). Like Group D students, they also concentrated most of this time in the first 2 weeks (85%).

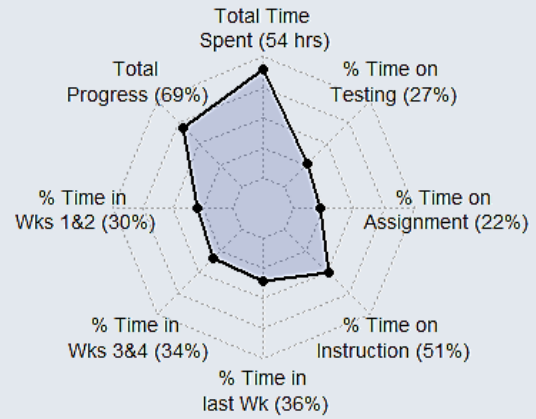
The distribution of group memberships was similar for Algebra 1 and English 9 courses but did differ based on whether students took the credit recovery course before their second year of high school or waited until later. Nearly half of the students who enrolled in the online credit recovery course during the first summer after failing their courses were classified into Group C, demonstrating moderate engagement and progress, with a focus on testing activities. In contrast, students who enrolled in later summers were more distributed across the different engagement groups, with approximately a third classified as Group A students demonstrating a high level of engagement and progress and another third classified as Group E, characterized by low engagement and poor progress (see Exhibit A1 in the appendix).

# Exhibit 1. Patterns of Engagement of Students Taking a Summer Algebra 1 Online Credit Recovery Class

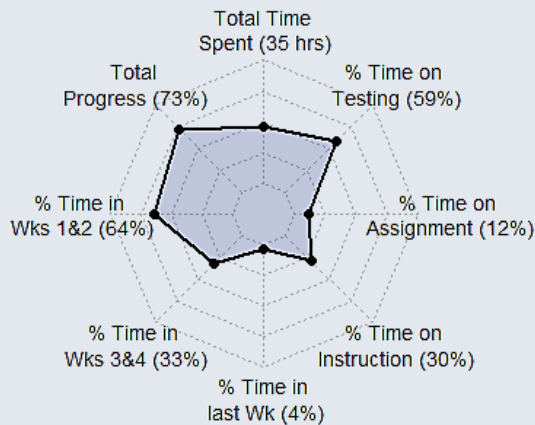
**A. High-Good: Instruction focus (N=1026)**



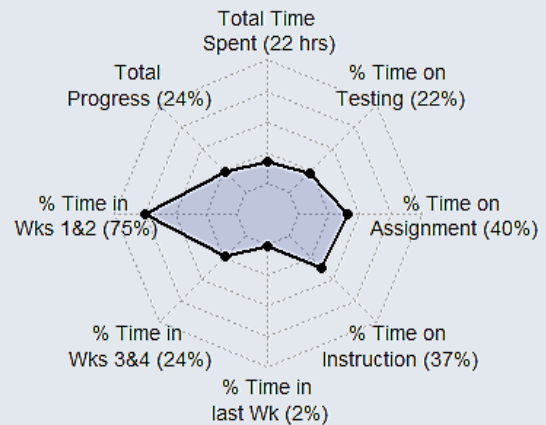
**B. High-Mod: Instruction focus (N=236)**



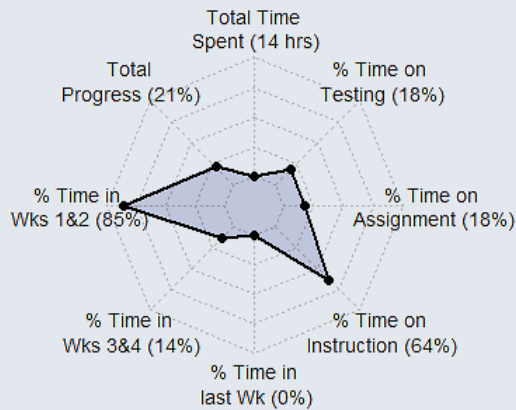
**C. Mod-Mod: Testing focus (N=659)**



**D. Low-Poor: General focus (N=333)**



**E. Low-Poor: Instruction focus (N=868)**

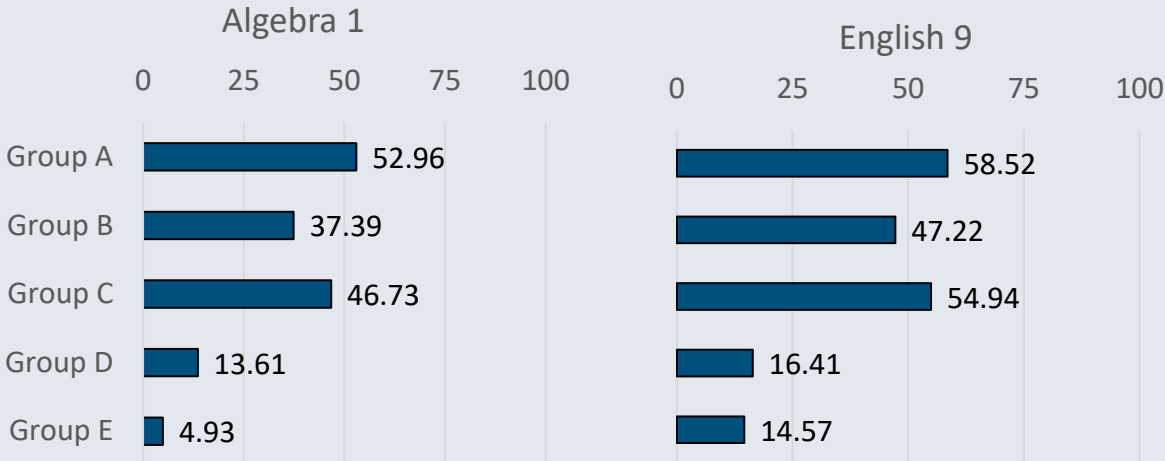


# Patterns of Student Engagement Were Associated With Proficiency in Course Content Knowledge in the Online Credit Recovery Course

We found significant differences in proficiency in course content knowledge across the five engagement groups for both Algebra 1 and English 9 courses. Proficiency in course content knowledge is calculated automatically by the online program based on student performance in the program’s assignment and testing activities for the entire online course, students receiving no credit for tests they do not complete. Overall, students who had high or moderate engagement and progress (Groups A, B, and C) attained a significantly higher level of proficiency in course content knowledge compared with students with low engagement and progress (Groups D and E). See Exhibit 2.

On average, students in Group A demonstrated more proficiency than students in the other groups in course content knowledge for both Algebra 1 and English 9. However, students in Groups A and C did not significantly differ in their demonstrated proficiency level of content knowledge for the English 9 online credit recovery course. Although Group C students spent less total time in the online program than Group A and B students, they demonstrated the second highest proficiency level of content knowledge and significantly outperformed students in Group B. This may be because the Group C students came into credit recovery with a better grasp of the course content and could focus their time on demonstrating mastery through the testing activities without spending as much time on the instructional activities. If so, Group C captures the types of students for whom the more personalized pacing of the online course may work particularly well.

**Exhibit 2. Overall Proficiency in Course Content Knowledge as Measured in the Online Program, by Engagement Group**



*Note.* Overall proficiency in course content knowledge ranges from 0 (no assignments/test questions correctly answered) to 100 (all assignments/test questions correctly answered).

## Patterns of Student Engagement Were Associated With Student Background Academic Characteristics

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Despite all students in the online credit recovery classes having experienced previous academic difficulties, engagement patterns in the online program were significantly correlated with ninth-grade attendance, course failure, and GPA but not with eighth-grade standardized test scores in mathematics and English language arts (see details in Exhibit A2 in the appendix). Specifically, students in the higher engagement groups tended to enter credit recovery with relatively stronger academic performance than did students in the lower engagement groups:

- Students with a ninth-grade attendance rate of 95% or higher were the most likely to be in the high engagement groups (Groups A and B) for both Algebra 1 and English 9.
- Students in Group A had failed fewer courses in the fall semester of ninth grade compared with students in Group E. With respect to the spring semester of ninth grade, students in Groups A, B, and C had failed fewer courses compared with students in Group E. These differences only emerged among students taking English 9, not Algebra 1.
- Across both subjects, students in Groups A and C had a higher ninth-grade GPA, on average, than students in one or both of the low engagement groups (Groups D and E).

## Implications

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Expanding upon earlier discoveries and recommendations described in the sixth brief, the results of this study offer additional insights to support students in online credit recovery courses:

- Student engagement patterns should be monitored—not just based on overall time spent and progress over the course, but also on how students allocate their time across different learning activities.
- The personalized pacing of online credit recovery may be particularly useful for students who exhibited relatively more academic engagement in ninth grade. These students are more likely to follow one of two pathways for positive course progression: (a) dedicating time in the online program to working through the different types of program activities at a reasonable pace and (b) focusing on testing activities to demonstrate course content knowledge at a faster pace.
- Some students make relatively little progress in the online program, spending little time in the course after the first 2 weeks. These students are likely to have faced greater academic challenges in ninth grade and may need additional supports to progress through an online credit recovery course.

Although these findings identify different ways in which students progress through an online credit recovery course and who might need additional supports, we also found a great deal of variation in how students engage with online credit recovery. More research is needed to understand what challenges students face when trying to progress through an online credit recovery course and what supports they need to succeed.

## Reference

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Rousseeuw, P. J. (1987). Silhouettes: A graphical aid to the interpretation and validation of cluster analysis. *Journal of Computational and Applied Mathematics*, 20, 53–65.  
[https://doi.org/10.1016/0377-0427\(87\)90125-7](https://doi.org/10.1016/0377-0427(87)90125-7)

# Appendix

**Exhibit A1. Distribution of Group Membership by Subject and Course Timing**

Variables		Total sample size	Group A	Group B	Group C	Group D	Group E
Subject	English 9	1,111	36%	8%	20%	8%	28%
	Algebra 1	2,011	27%	7%	23%	15%	28%
Course timing	1st summer	812	16%	8%	47%	11%	17%
	2nd summer	1,461	38%	8%	12%	10%	32%
	3rd/4th summers	849	38%	7%	12%	11%	32%

*Note.* We combined the third and fourth summers because only 29 students enrolled in online credit recovery courses during their fourth summer term.

**Exhibit A2. Students’ Background Academic Characteristics by Engagement Pattern in the Online Credit Recovery Course**

	Algebra 1					English 9				
	Group A	Group B	Group C	Group D	Group E	Group A	Group B	Group C	Group D	Group E
Percentage of students with ninth-grade attendance rate $\geq$ 95%	34.0	38.2	30.5	26.1	22.8	30.4	26.2	21.8	25.0	27.3
Percentage of students with ninth-grade attendance rate of 90%–94%	36.3	31.6	42.6	39.4	35.0	32.2	38.8	31.0	33.9	28.7
Percentage of students with ninth-grade attendance rate of 85%–89%	13.5	19.7	12.9	13.3	16.1	14.9	8.8	12.4	11.9	14.5
Percentage of students with ninth-grade attendance rate of 75%–84%	8.9	7.9	8.6	11.5	15.1	11.9	14.4	17.6	17.3	15.3
Percentage of students with ninth-grade attendance rate $<$ 75%	7.3	2.6	5.5	9.7	10.9	10.5	11.9	17.1	11.9	14.2
Average eighth-grade standardized test scores	-0.66	-0.53	-0.60	-0.70	-0.74	-0.43	-0.40	-0.50	-0.59	-0.52
Average ninth-grade GPA	1.46	1.40	1.41	1.23	1.31	1.38	1.35	1.35	1.31	1.20
Average number of courses failed in the fall semester of ninth grade	1.89	2.07	2.16	2.19	2.22	2.30	2.38	2.38	2.51	2.68
Average number of courses failed in the spring semester of ninth grade	2.75	2.72	2.72	3.13	3.07	2.68	2.74	2.69	3.07	3.29

*Note.* For students enrolled in Algebra 1, the eighth-grade standardized test score is the z-score transformation of the scaled score on the mathematics assessment. For students enrolled in English 9, the eighth-grade standardized test score is the z-score transformation of the scaled score on the English language arts assessment.



## NOTES

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<sup>2</sup> Students who were expected to graduate high school in 2021 and 2022 started their ninth-grade (freshman) year in the fall of 2017 and 2018, respectively. We restricted the analysis to students who accessed the online program content for at least 2.5 hours so that the results were not skewed by students who enrolled in the online credit recovery class but never attended the class or only attended for a single day.

<sup>3</sup> We used k-means clustering in which all measures were normalized to the same scale, with a mean of 0 and a standard deviation of 1. We used the average silhouette width of clusters (Rousseeuw, 1987) to identify the optimal number of clusters and found that five clusters maximize the average silhouette and accounted for 52% of the total variance.

<sup>4</sup> The summer session spans 5 weeks, but we coded the final week as a combination of the fifth week and any subsequent weeks to accommodate students (only four students) who continued their work beyond the regular 5-week session.

<sup>5</sup> Instruction activities are those offered to facilitate course learning, including warm-up, direct instruction, and summary activities; assignment activities are tasks assigned to students to practice their understanding of and thinking about course material, such as project work, group discussion, writing, and presentation activities; testing activities are assessments administered to students to evaluate their comprehension and mastery of course content, including quizzes, unit tests, and the cumulative exam.

<sup>6</sup> We carried out the following tests: (a) chi-square tests of independence to examine the associations between students' engagement patterns and their gender and ninth-grade attendance rates and (b) multivariate analysis of variance (MANOVA) tests to examine the associations between students' engagement patterns and their final grade in the online credit recovery course, their eighth-grade standardized test scores, the number of semester courses they failed in the fall semester of ninth grade, the number of semester courses they failed in the spring semester of ninth grade, and their ninth-grade GPA.



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