

**Efficacy of Online Algebra I for Credit Recovery for At-Risk Ninth Grade Students:
Evidence from Year 1**

Authors and Affiliations:

Jessica Heppen (AIR), Elaine Allensworth (CCSR), Kirk Walters (AIR), Amber Stitzel Pareja (CCSR), Anja Kurki (AIR), Takako Nomi (CCSR) and Nicholas Sorensen (AIR).

American Institutes for Research (AIR)
Consortium on Chicago School Research (CCSR)

Background / Context:

The consequences of failing core academic courses during the first year of high school are dire. Research by the Consortium on Chicago School Research (CCSR) demonstrates that students who fall “off track” during the first year of high school have a substantially lower probability of graduating than students who stay “on track.” In the Chicago Public Schools (CPS), only about one-fifth of off-track freshmen—students who fail more than one semester of a core academic course and/or fail to earn enough credits to be promoted to 10th grade—graduate high school, compared with over 80% of on-track freshmen (Allensworth & Easton, 2005, 2007). Failure of Algebra I is particularly problematic. In CPS, only 13% of students who fail both semesters of Algebra I in 9th grade graduate in 4 years, and the largest share of 9th grade algebra failures occur in the second semester of the course. Elucidating the ways that students can get back on track is of the utmost policy importance.

Credit recovery is one strategy to deal with high failure rates. The primary goal of credit recovery programs is to give students an opportunity to retake classes that they failed in an effort to get them back on track and keep them in school (Watson & Gemin, 2008). Most recently, as schools across the nation struggle to keep students on track and re-engage students who are off track, online learning has emerged as a promising and increasingly popular strategy for credit recovery: more than half of respondents from a national survey of administrators from 2,500 school districts reported using online learning in their schools for credit recovery, with just over a fifth (22%) reporting “wide use” of online learning for this purpose (Greaves & Hayes, 2008).

Despite the growing use of online courses for credit recovery, the evidence base is thin. This paper describes the design, first year implementation, and early outcomes of a randomized control trial that was designed to strengthen the evidence base surrounding online courses used for credit recovery.

Purpose / Objective / Research Question / Focus of Study:

This study is an efficacy trial funded by a grant from the Institute of Education Sciences (IES) National Center for Education Research (NCER). Fifteen CPS high schools are receiving funding to implement two Algebra I credit recovery courses during the summer sessions of 2011 and 2012—one online and one face-to-face (f2f). These courses allow students to recover a ½ credit of Algebra I. The study is designed to address a set of research questions that address the following specific aims:

- 1) To test the efficacy of online Algebra I for credit recovery, compared with standard f2f Algebra I for credit recovery.
- 2) To determine the supporting classroom conditions under which online Algebra I for credit recovery yields higher efficacy.
- 3) To gauge the extent to which credit recovery can help at-risk students get back on track, relative to students who passed Algebra I in 9th grade.
- 4) To gauge the effects of expanding summer credit recovery options through online courses.

In this paper, we will focus on the impact of taking online Algebra I for credit recovery on short-term outcomes for the first cohort of ninth-graders. These include credit attainment in the course and scores on an end-of-course algebra test and on the PLAN assessment (a standardized pre-ACT taken in fall of grade 10). Over the course of this 4-year study, we will continue to follow the first cohort of students, as well as a second cohort, through high school to examine long-term effects on future test scores, coursetaking and likelihood of dropout.

Setting:

The setting for this study is CPS high schools with the largest number of students who failed Algebra I. CPS is the third-largest U.S. district, serving more than 435,000 students in 666 schools, of which 116 are public high schools and 27 are public charter high schools. School reform and improvement have been high priorities in Chicago for a number of years, as high schools in CPS continue to struggle with low student performance and low graduation rates (Kahne, Spote, de la Torre, & Easton, 2006). The overall graduation rate in the district is just 54%. The average composite ACT score for CPS juniors is 17, lower than the 20.5 for juniors in the state of Illinois and well below the score required by most colleges (Allensworth, Correa, & Ponisciak, 2008).

Population / Participants / Subjects:

The target students for this study were first-time freshmen who failed Algebra IB. Within each school, the study team randomly assigned eligible students to condition on site, on the first day of summer school. Students were eligible for random assignment if they failed second semester Algebra I, were willing to enroll in summer credit recovery, and showed up for class on one of the first two days of the term.

In year 1 (summer 2011) the study included 18 pairs of online and f2f sections of second semester algebra (Algebra IB) in 15 CPS high schools. A total of 290 students were assigned to take the online course, and a total of 306 students were assigned to take the f2f course. Among the online students, 62% were male and 39% had passed first semester algebra during the freshman year. Among the f2f students, 65% were male and 38% had passed first semester algebra during their freshman year.

Participating schools tended to be larger than other high schools in CPS—the average number of students enrolled in study high schools was 1785 students, compared to 729 students in non-study high schools—with higher algebra failure rates. In other ways, they were similar to other schools in the district. One exception is that the study schools, on average, served a higher proportion of Hispanic students and students in which English was not the primary home language.

Intervention / Program / Practice:

The study is designed to test whether at-risk students who failed second semester Algebra I can achieve higher rates of success if they take an online course for credit recovery than if they retook the failed course in the standard f2f format. The theory of action behind this study is represented in Figure 1 in Appendix B. Students fail algebra because they are poorly engaged in the class and put in little effort—the strongest predictors of 9th grade course failure are students' attendance and work effort (Allensworth & Easton, 2007). Low engagement leads students to learn little and to subsequently fail. Because they lack an understanding of algebra, they struggle

in subsequent classes, particularly in mathematics and science. Failure in these classes, combined with failure in algebra, leads students to have insufficient credits to graduate. As the likelihood of obtaining sufficient credits diminishes, students eventually drop out.

Online credit recovery potentially interrupts this process in two ways. First, the delivery can be a more individualized, interactive experience. Furthermore, students receive personal support and monitoring from on-site mentors. These characteristics—individualization, interactive pedagogy, and personal support—have all been associated with greater engagement and learning (Archambault et al., 2010; Lee & Smith, 1999; Newmann et al., 1996; Slavin & Madden, 1989). Students should be more engaged and more likely to persist in the course, thus more likely to learn algebra content and receive course credit. These short-term outcomes should lead to improvements in other short-term achievement outcomes, including scores on the mathematics exam (that includes an algebra portion) taken in the fall of 10th grade. Better algebra skills should also make students more likely to pass their subsequent mathematics and science classes, and make greater progress toward graduation.

The online course used in the study was developed by Aventa Learning, a provider that CPS has used extensively in recent years. Students took the course in computer labs at their local high schools, in the presence of a trained on-site mentor. They also had an online algebra teacher, provided by Aventa. The control condition is the typical f2f Algebra IB course offered in schools participating in the study. The course followed the standard CPS Algebra I curriculum and was taught by a teacher in each participating school.

Research Design:

The design of the study involves on-site student-level random assignment of students to either online or f2f Algebra I credit recovery courses in participating CPS high schools. The focus of student recruitment was on freshmen who failed second semester Algebra because they are positioned to get back on track in mathematics if they recover the ½ credit early on in high school. Students were blocked by gender and whether they passed or failed first semester Algebra and then randomly assigned to condition on site, on the first days of summer school. On-site random assignment was planned to prevent the inclusion of large numbers of no-shows in the intent-to-treat (ITT) analyses.

In summer 2011, the study team randomly assigned a total of 596 students to condition (306 to online and 290 to f2f) across 36 sections (18 online and 18 f2f), yielding an average of 16.6 students per section. Table 1 in Appendix B shows the distribution of students by and across condition on the blocking characteristics.

The study was designed to have sufficient power to detect effects on student achievement and other outcomes ranging between 0.14 and 0.19 standard deviations, for analyses conducted separately by cohort.* During the first summer of implementation, actual sample sizes were lower than the target sample sizes, but still provide adequate power to detect effects on student achievement outcomes.

* These minimum detectable effect sizes (MDESs) are reasonable based on previous research that finds the average effect of online learning relative to f2f is about 0.24 standard deviations (U.S. Department of Education, 2009).

This within-school, student-level randomized design establishes the core comparison that allows us to examine the impact of taking online Algebra I for credit recovery on students' mathematics proficiency (score on end-of-course Algebra assessment and the PLAN) and credit attainment in Algebra I.

Data Collection and Analysis:

This paper will focus on outcomes based on the following measures:

- A study-administered end-of-course assessment that includes a range of Algebra I topics. The assessment was administered to all consenting students participating in the credit recovery courses in summer 2011.
- The PLAN assessment of the ACT Educational Planning and Assessment System (EPAS). Algebra subtest scores on the PLAN serve as a short-term achievement outcome because the assessment will be taken by students in the study within 3 months of summer school, in fall 2011. PLAN scores will be collected for all cohort 1 students from administrative records.
- Performance in the summer 2011 credit recovery course, including course grades and credit attainment, collected via administrative records.

The central research questions regarding the efficacy of online Algebra I for credit recovery versus f2f Algebra I for credit recovery are tested with 2-level models (with students nested within schools) that compare the outcomes of students in the online classes with those in the f2f classes. All analyses include the full ITT sample of online and f2f students. Analyses of achievement outcomes will employ hierarchical linear models controlling for student- and school-level covariates. Results will be reported both in their original metric and as effect sizes. Analyses of binary outcomes (i.e., whether students recovered the credit, or not) will employ hierarchical generalized linear models that assume a Bernoulli sampling distribution and logit link function (Raudenbush and Bryk 2002; McCullagh and Nelder 1998). Results will be reported in terms of differences in predicted probabilities (of participating, for example, in an advanced course sequence) and odds ratios.

Findings / Results:

The first year of implementation this study has been completed, and in this paper we will report on the effects of taking online Algebra I credit recovery compared with retaking Algebra I as a standard f2f summer course on students' mathematics proficiency (scores on end-of-course assessment and on the PLAN) and credit attainment. The results are not yet available; we will be collecting student scores on the PLAN and on their credit attainment during the fall of 2011. All data will be collected and analyses will be completed in time for presentation at the SREE Spring 2012 conference.

Conclusions:

The conclusions will be based on data from the first year of implementation. In short, we will be able to draw initial conclusions from this experimental study on the relative impact of online Algebra I credit recovery compared with a standard f2f algebra credit recovery course on students' likelihood of recovering the credit and on their mathematics proficiency (particularly algebraic content).

Appendix A. References

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Appendix B. Tables and Figures

Figure 1. Theory of Action Behind Summer Online Algebra Credit Recovery

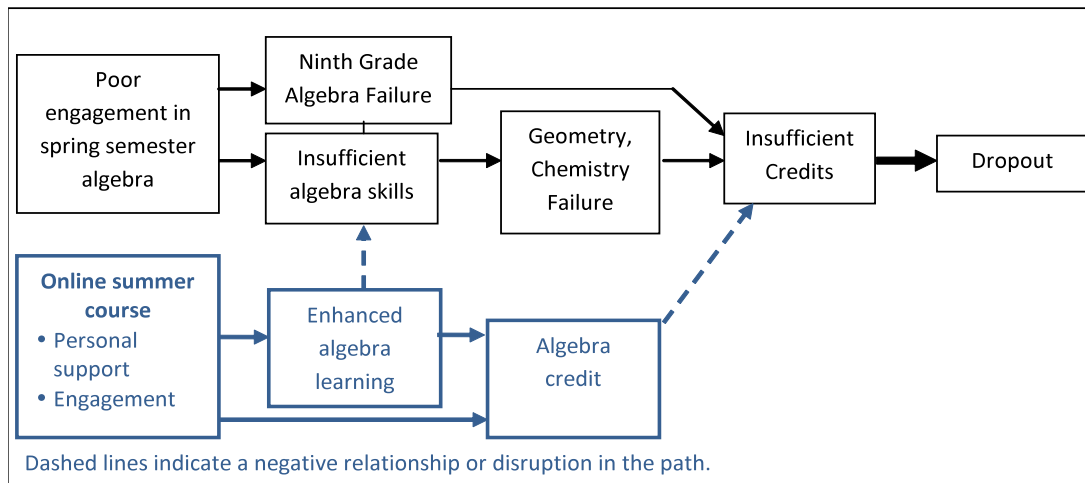


Table 1: Number and Percentage of Students Per Condition by Block, Summer 2011

Condition	Gender	Passed Algebra IA		Failed Algebra IA		Algebra IA Status Unknown		Total
		Number	Percent of Students by Condition	Number	Percent of Students by Condition	Number	Percent of Students by Condition	
F2F	Female	44	15%	28	10%	31	11%	103
	Male	70	24%	58	20%	59	20%	187
	<i>Total</i>	<i>114</i>	<i>39%</i>	<i>86</i>	<i>30%</i>	<i>90</i>	<i>31%</i>	<i>290</i>
Online	Female	45	15%	37	12%	35	11%	117
	Male	73	24%	60	20%	56	18%	189
	<i>Total</i>	<i>118</i>	<i>39%</i>	<i>97</i>	<i>32%</i>	<i>91</i>	<i>30%</i>	<i>306</i>