

Online Learning as a Remedy for Course Failure: An Assessment of Credit Recovery as an Intervention to Earn Credits and Graduate from High School

The high school graduation rate has been rising each year since 2002 with new record-high graduation rates being set on an annual basis since 2011. This ever-climbing graduation rate has led many to be skeptical about how high schools are graduating more students without a corresponding rise in national test scores (Heitin, 2016). Recent national media reports have indicted *credit recovery* as a culprit, naming this type of course as a tool high schools are using to graduate students who do not have the skills to be college or career ready. National Public Radio called credit recovery a “questionable quick fix,” Education Week wrote about it as “a scandal,” and the New York Times included it as part of a system that has produced a “counterfeit high school diploma” (Gardner, 2016; Rich, 2015; Turner, 2015).

Credit recovery (CR) refers to online courses that students take after previously failing a traditional version of the course, representing a shift from students repeating courses the following school year or earning course credit in an after school or summer school program. Recent estimates indicate that CR has become a popular intervention for districts and schools. In the 2009-10 school year, nationwide enrollment in CR was estimated at over 1.1 million (Queen & Lewis, 2011). In 2013, Connecticut became the first state to mandate high schools offer CR if the school has a dropout rate of eight percent or higher (Murin, Powell, Roberts, & Patrick, 2015). In North Carolina, three quarters of high schools had at least one student enrolled in CR in 2014-15, and 30 percent of students who failed a course in 2013-14, around 25,000 students, were enrolled in a credit recovery version of that course the following year (author’s analysis). CR courses, often developed and administered by private corporations, have infiltrated public schools nationwide without any evidence that the courses develop the same knowledge and skills as traditional courses or that these courses are effective at increasing the graduation rate (Carr, 2014; Heppen et al., 2016).

The purpose of this dissertation is to elucidate the prevalence and impacts of CR on students and schools. Using data from North Carolina Public Schools, this study will be the first to utilize statewide administrative data to explore CR course taking from both public (i.e., state virtual school) and private

providers. The first essay will investigate if students enrolled in CR are more likely to graduate from high school and enroll in postsecondary education than other students who fail courses, with special attention to populations of students who historically have the lowest high school graduation rates (i.e., students of color and low-income students) using a school and year fixed effects strategy with within-school propensity score matching. The second essay leverages the recent implementation of CR options in North Carolina high schools for a comparative interrupted time series approach with school fixed effects to explore the impact of adding CR options at the school level on graduation and dropout rates, especially at low-performing schools that are more likely to face accountability sanctions for low graduation rates and schools that highly utilize credit recovery courses. This paper will also explore possible unintended consequences of CR implementation, including higher initial course failure rates in traditional courses and lower proficiency levels on end of course exams.

Theoretical Framework

In 2008, the Department of Education amended Title I of the No Child Left Behind Act of 2001 (NCLB) to include *other academic indicators* as part of the definition of adequate yearly progress (AYP), the measure of school quality that determines if schools are to face sanctions. For high schools, a four-year adjusted cohort graduation rate overall and disaggregated by student subgroups joined test scores as part of their AYP determination in the 2010-11 school year. At the same time, an optional state-based incentive program, Race to the Top, offered large financial incentives to states that developed accountability systems that heavily sanctioned low-performing schools as determined by test scores and high school graduation rates and required turnaround models that were highly disruptive to be implemented in five percent of the state's schools that were the lowest achieving ("Overview Information; Race to the Top Fund; Notice Inviting Applications for New Awards for Fiscal Year 2010; Notice," 2010).

These policy changes (the amended AYP calculation and Race to the Top) represent an exogenous shock to high schools that Clemens and Cook (1999) argued would lead to institutional change. In particular, this institutional change can take the form of organizational learning where the

actors within the institution will invest in technological innovations that can be used, “to accommodate newly adopted institutional rules to existing practices, resources, and competing schemas” (Clemens & Cook, 1999, p. 452). The technological innovation in this case is credit recovery (CR).

Online learning had only recently become available to high schools nationwide due to the high prevalence of both access to computers and the internet, so high schools could easily utilize this technology to offer CR. Focusing on earning course credit would have been a likely strategy for schools to adopt to increase graduation rates because course credits are an official state-wide requirement for graduation in all but one state (North Dakota) (“Standard High School Graduation Requirements (50-state),” 2016). Prior research confirms that these state-level credit accumulation requirements, overall, and students failing courses, at the individual level, predicts a lower likelihood of graduating from high school (see Allensworth & Easton, 2005; Bowers, 2010; Mac Iver & Messel, 2013; Plunk, Tate, Bierut, & Grucza, 2014).

The successful recovery of a credit lost to course failure, the exact purpose that CR courses are designed to fulfill, represents a direct plausible strategy to increase high school graduation rates and, consequently, postsecondary attendance rates (Murin et al., 2015; Watson, Gemin, & Ryan, 2008). If CR is a successful intervention to increase credit accumulation, then theoretically offering CR would lead to higher high school graduation and postsecondary attendance rates. In particular, low income, black, and Hispanic students have had higher dropout rates and lower graduation rates than other students, making CR an intervention likely targeted at these student populations (“Digest of Education Statistics, 2015,” n.d., “National Center for Education Statistics,” n.d.).

However, CR might not be designed to benefit the population it is intended to serve: at-risk students who fail courses in high school. In fact, there are several related studies that indicate that the population of students who fail courses in high school would be particularly ill-suited to succeed in an online learning environment. Students who fail courses in high school, often labeled at-risk students, are more likely to have low technological and online skills than students who do not fail courses in high school (Judge, 2005; Kuhlemeier & Hemker, 2007; Oliver, Osborne, Patel, & Kleiman, 2009; Valadez &

Duran, 2007). Also, students who fail one class are more likely to have failed other courses as well, indicating multiple skill deficits that would make a complicated online platform challenging to successfully master (Bowers & Sprott, 2012; Judge, 2005; Roderick, 1994).

Further, the unintended consequences of interventions designed to quickly and effectively respond to accountability targets are well documented (see Balfanz, Legters, West, & Weber, 2007; Dee, Jacob, & Schwartz, 2013; Jennings & Bearak, 2014). For instance, Dee and colleagues (2013) found that NCLB led schools to reduce instructional time in science and social studies. Placing students in CR instead of repeating the course in full could lead to lower test scores of CR students as compared to course repeaters if CR courses do not develop similar knowledge or skills. Also, CR could be viewed as more desirable to students than passing the course the first time if it allows students to be off-task on the internet during school hours, leading to higher first time course failure rates (Fong, Jaquet, & Finkelstein, 2014; Heppen et al., 2016; Ingerham, 2012). While all of the above effects of CR are theoretical possibilities, few researchers have focused empirical examination on CR or its consequences, and the literature exploring both the potential positive and negative effects of CR is extremely limited.

Literature Base on Credit Recovery

Even though CR has grown in popularity across the country, very few peer-reviewed studies have focused on CR. The only study published to date that assesses the effect of CR using a strong research methodology is a randomized control trial conducted in 17 Chicago high schools. The study randomly assigned students who failed Algebra I in ninth grade to either face-to-face (i.e., traditional) or CR summer school. Students in the CR course, provided through Aventa Learning, were significantly less likely to earn course credit and received lower Algebra I posttest scores than the students in the face-to-face condition. However, the researchers find no statistically significant differences on the outcomes measured during the second year of high school including the likelihood of passing subsequent math courses and scores on math tests (Heppen et al., 2016). Despite the extremely high internal validity of this RCT, this study has limited generalizability due to including only Algebra I CR, using one CR provider,

and the limited time period of the study. Further evidence is necessary to grow a literature base on the effectiveness of CR as a tool for gaining academic proficiency and graduating from high school.

Credit Recovery in North Carolina Public Schools

North Carolina represents an excellent state on which to study the prevalence and effects of CR. North Carolina is similar to other states in that schools have the option of offering CR through a private provider or through the state-run virtual public school (Murin et al., 2015). At least half of all states have state-run virtual schools that provide individual courses to brick-and-mortar schools. As well, many schools offer CR courses through privately-run national online course providers. Implementation of CR courses at the school level in North Carolina has been at the school's discretion, so schools varied in the timing of CR implementation.

Data and Sample

The data is from an administrative database in North Carolina that is hosted through the Education Policy Initiative at Carolina (EPIC), a unit of the University of North Carolina at Chapel Hill with a sample including all public school students, teachers, schools, and districts in the state. At this time, CR course taking information is available between 2011-12 and 2015-16 for courses offered by private providers and between 2007-08 and 2015-16 for courses administered through the state-wide virtual school. I anticipate data becoming available on privately provided CR courses between 2007-08 and 2010-11 in the near future. All other variables are available between 2007-08 and 2015-16. Outcome variables that will be available through these administrative data include whether or not a student dropped out or graduated from high school, course failure rates, and scores on the high school end-of-course exams. Many other variables are available through EPIC that will be utilized for this paper including, but not limited to, student demographics, test scores, special education status, disciplinary referrals, attendance, and prior grades in high school and in middle school. At the school-level, demographics, academic performance, disciplinary incidents, class sizes, teacher experience, and teacher performance information will be collected among other covariates. Analyses on one essay will include postsecondary

education outcomes for which data from the National Student Clearinghouse will be linked to the EPIC data to determine if students enrolled in a postsecondary institution after high school.

Essay One: Are Credit Recovery Courses a Valid Intervention to Address Course Failure?

The focus of this essay is on the effect of CR course taking on student-level outcomes. In particular, if credit recovery is an effective intervention, at the student-level, to help students graduate from high school despite having failed a course. This study will explore the following research question: *To what extent are students who take credit recovery courses more likely to graduate from high school or enroll in postsecondary education than students who fail classes but do not enroll in credit recovery overall and for groups of students who have historically low graduation rates?*

Method

This study will have to address the primary threat to considering the effects estimated by comparing students who failed courses and enrolled in CR to students who did not enroll in CR as a credible causal estimate — the assignment of students is not independent of the outcome. In other words, the concern is that student's assignment to CR could be correlated with higher/lower graduation and postsecondary attendance rates. The strategies that I will use to identify a causal effect are school and year fixed effects with within-school propensity score matching of students. All analyses will be conducted at the student-level, comparing failing students overall and by student subgroup including economically disadvantaged students, black students, and Hispanic students.

The school and year fixed effects strategy will address threats to causal estimates based on if assignment to CR is systematically different between schools or between years in ways that also influence the outcomes. The school and year fixed effects address these potential issues by centering all of the variables in the model based on the school mean and year mean of that variable such that each value represents the deviation from the school and year mean. All findings will be within-school and within-year treatment effect estimates.

The remaining threats to internal validity are due to within school and within year endogeneity of the decision for some students to be assigned to CR while other students who failed courses are not. To

address this concern, I will utilize a within-school-year propensity score matching procedure. Propensity score matches will be conducted within school-year based following Xu and Jagers (2011). Propensity score matching procedures are designed to account for the lack of randomization in selection into treatment, in this case the non-random assignment of students to CR (Rosenbaum & Rubin, 1983; Rubin, 1974). Calculating propensity scores provides an estimate of the probability of assignment to treatment that Rosenbaum and Rubin (1983) propose can produce a sample where assignment to treatment is independent of the outcome in that sample, an assumption known as strong ignorability. According to Stuart (2010), the likelihood of this assumption holding true using a matching strategy is reasonable with a set of covariates that predict both assignment and the outcomes of interest. In this study, the dataset includes many key covariates at the student and school level that will be used for matching, including covariates measured when students are in middle school, such as test scores and courses taken. With this set of covariates, the propensity scores will match on and control for both the observed covariates as well as unobserved covariates to the extent that the unobserved are correlated with the observed (Stuart, 2010). For instance, students might be more likely to be assigned to CR if they are seen as having the academic skills to easily learn the material, but failed the course due to poor attendance, with attendance as one of the covariates in the propensity score matching procedure. Or, students might be more likely to be assigned to CR if they are highly motivated. Motivation in high school is likely correlated with many of the covariates including GPA, attendance, on-time grade promotion, disciplinary infractions/consequences, and enrollment in accelerated coursework in high school and middle school.

Contribution and Limitations

This paper will present the first available estimates of the effect of CR course taking on high school graduation and postsecondary attendance, allowing policymakers for the first time to make informed decisions about CR especially for student populations with historically low graduation and postsecondary attendance rates. These estimates of the impact of CR will be limited by the possibility that assignment to treatment within schools is endogenous in ways that are unrelated to the covariates used in the propensity score matching procedure. However, by employing covariates such as middle school test

scores, GPA, and attendance rates the bias in the estimates due to non-random assignment to CR within schools will be reduced. The remaining magnitude of bias will be an issue to the extent assignment to CR is correlated with an omitted variable that is not correlated with the covariates in the study. Also, generalizability of these estimates will be limited to schools with CR where there is variation in assignment to CR among the students who fail courses. This generalizability limitation is due to the school fixed effects strategy which will implicitly only compare students within schools when there are both students assigned to CR and course retakes in a school.

Essay Two: Is Credit Recovery an Effective Policy to Induce Higher Graduation Rates While Avoiding Unintended Consequences?

This essay focuses on the effect of implementing CR at the school-level to assess the effectiveness of CR as a policy lever for schools to increase graduation rates. Also, this essay will investigate the potential for unintended consequences of this policy decision. This essay will address the following research questions: *(1) To what extent does introducing credit recovery options at the school-level increase the graduation rate or decrease the dropout rate? (2) To what extent is offering credit recovery associated with the unintended consequences of higher rates of face-to-face course failure and lower proficiency rates on the end of course exams? (3) Are the effects, positive or negative, of credit recovery more pronounced at schools with low graduation rates or higher CR enrollment rates?*

Method

The empirical method for this essay is comparative interrupted time series (CITS). This method is designed to estimate effect sizes by approximating the deviation at the time of treatment for the treated group from pre-intervention differences between treatment and control subjects. The CITS design is more likely to produce causal estimates than its predecessor, the difference-in-differences (DD) design, because CITS evaluates the extent to which the deviation of the treatment group from its pre-treatment trend is more or less than the comparison group's deviation from the pre-treatment trend (Somers, Zhu, Jacob, & Bloom, 2013). DD performs a simpler calculation, comparing deviations from pre-treatment means. If the treatment and control groups appear to differ based on pre-treatment means while in reality

the treatment group's baseline trend accounts for the deviation post-treatment, then the DD effect estimate will be biased but the CITS effect estimate will not be biased. The use of CITS is limited to studies where data is available in at least four years prior to treatment. For this study, I have collected the data necessary to identify schools that implemented CR courses between 2011-12 and 2015-16 and plan on collecting data between 2007-08 and 2010-11 to identify schools with CR in those years in order to make the CITS design feasible.

Based on data collected thus far, 114 out of approximately 600 high schools added CR options between 2012 and 2016. The CITS model will be estimated using the following model,

$$(1) y_{st} = \beta_0 + \beta_1 CREver_s + \beta_2 AfterCR_t + \beta_3 CREver_s \times AfterCR_t + \beta_4 Year_t + \beta_5 CREver_s \times Year_t + \beta_6 y_{st-1} + \beta_k \mathbf{X}_{st} + \delta_s + \varepsilon_{st}$$

where y_{st} is the outcome for school s at time t , representing either graduation rates, dropout rates, course failure rates, or end of course exam proficiency rates. $CREver_s$ equals one for all schools that implement CR during this time period, and $AfterCR_t$ equals one for the time period after the schools implement CR. The value of $AfterCR_t$ will vary based on the year of CR implementation. The variables $CREver_s$ and $AfterCR_t$ with the interaction $CREver_s \times AfterCR_t$ are all part of the traditional DD model. The variable $Year_t$ begins with a value of zero in the baseline year, and the variable $Year_t$ and interaction $CREver_s \times Year_t$ are the variables added into the DD model to make it into a CITS model. The coefficient on β_1 represents baseline mean differences between the treatment and control groups, and the β_2 coefficient represents mean changes for the comparison group that occurs at the time the intervention goes into effect. The β_4 coefficient represents the pre-treatment trend for the comparison group, and the β_5 coefficient represents the pre-treatment trend for the treatment group. The β_3 coefficient represents the treatment effect or the deviation on the outcome for treatment schools during treatment. This equation includes the prior year value on the outcome, y_{st-1} , such that the outcome can be interpreted as a change over time or value-added estimate. A vector of controls, \mathbf{X} , is also included to control for time-varying school characteristics. The δ_s variable represents the school fixed effect, and ε_{st} is the error term.

The basic assumption of the CITS model is that both CR and non-CR schools' outcomes would experience similar changes over time in absence of the introduction of CR, the *parallel assumption*. This assumption will be tested with several validity checks based on the advice of Angrist and Pischke (2009) including examining if the treatment and control schools changed demographically due to treatment status and investigating if changes in the outcomes happened after CR implementation and not vice-versa (i.e., the *Granger* test). Passing these validity checks would bolster the claim of that the CITS estimates are causal since they would be evidence that the data conforms to the parallel assumption.

Contribution and Limitations

This paper will help to answer several questions and concerns posed by major news outlets about CR. Specifically, these estimates will be evidence of if CR is actually being used to induce higher high school graduation rates while leading to negative unintended consequences as presupposed by many journalists. The results will be biased to the extent that the parallel assumption is violated such that schools with CR would not experience similar changes over time in absence of CR, but fixed effects will eliminate bias due to differences between schools. Also, the extent to which CR differs in other states from North Carolina will limit the generalizability of the estimates to other contexts. For instance, if other states have higher or lower quality virtual schools or impose differential requirements on which private vendors schools are allowed to contract to for CR courses, then the results from North Carolina would not generalize to those states.

Conclusion

As CR continues to be a popular use of online learning in high schools across the country, information on both the enrollment in and effects of CR are notably lacking. Just as with many other popular interventions, policymakers and online learning providers are not waiting for evidence on the effectiveness of CR to expand its use nationwide. As schools and districts implement CR to try to lower dropout rates and raise graduation rates, information about its efficacy will be vital to their efforts. At the same time, CR would ideally come without major tradeoffs in academic proficiency. This dissertation will help educators to make informed decisions about CR utilization.

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