Making Connections

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Academic outcomes for North Carolina Virtual Public School credit recovery students

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Key findings

This study examined academic outcomes for students enrolled in credit recovery programs offered by the North Carolina Virtual Public School (NCVPS) and other programs.

- NCVPS credit recovery students were less likely than other credit recovery students to be economically disadvantaged, and a greater proportion entered high school proficient in math and reading.
- There was little difference in short-term success rates (such as end-of-course exam scores) between NCVPS credit recovery students and other credit recovery students in the state.
- On measures of longer-term success, NCVPS credit recovery students were less likely to graduate than other credit recovery students, but those who did graduate were more likely to graduate on time (that is, within four years).
- Black NCVPS credit recovery students were less likely than students of other racial/ethnic groups to reach proficiency in the recovered course (as measured by test scores) but were more likely to succeed in subsequent coursework in the same subject area after completion of the credit recovery course.

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Summary

Across the Regional Educational Laboratory Southeast Region there is growing interest in strengthening the presence of online learning in all public schools to help equalize education opportunities for all students and prepare students for a digital future. For instance, the North Carolina General Assembly has required that the state transition to digital learning tools by 2017, and work is under way to meet that goal.

This study was designed to expand stakeholders' understanding of one pre-existing aspect of digital learning that helped inspire the state's transition—the extent to which online learning is already providing digitally enhanced options for students at risk of dropping out. Both virtual schools and state education agencies are interested in learning more about the reach of credit recovery programs (which allow students to retake required courses to make up graduation credits for courses they failed) and how outcome data differ across credit recovery options. These questions also are important to district-level personnel, especially in North Carolina. Though North Carolina dropout rates have decreased and graduation rates have risen in recent years, considerable public pressure remains for school districts to continue to improve these rates, and interest in using online credit recovery to address the issue is growing.

This study examined the North Carolina Virtual Public School's (NCVPS) credit recovery program (which was added to NCVPS's extensive list of high school course offerings in 2008) and other common credit recovery options available to students in the state (such as summer school and traditional school-year course repetition, as well as online credit recovery provided by third-party vendors). It also compared short- and longer-term academic outcome data across the credit recovery options. Finally, the study calculated correlations between the academic outcomes and characteristics of students enrolled in the various credit recovery options to lay the groundwork for future research on the efficacy of credit recovery programs.

Key findings include:

- NCVPS credit recovery students were less likely than other credit recovery students to be economically disadvantaged, and a greater proportion entered high school proficient in math and reading.
- There was little difference in the short-term success rates (such as end-of-course exam scores) between NCVPS credit recovery students and other credit recovery students.
- On measures of longer-term success (such as graduation rates), NCVPS credit recovery students were less likely than other credit recovery students to graduate, but those who did graduate were more likely to stay on track to graduate (by succeeding in subsequent related coursework) and to graduate on time (that is, within four years).
- Black NCVPS credit recovery students were less likely than students of other racial/ethnic groups to reach proficiency in the recovered course (as measured by test scores) but were more likely to succeed in subsequent coursework in the same subject area after completion of the credit recovery course.

Given the study's design, the results of the analyses described in this report cannot be used to draw direct conclusions about the quality of online credit recovery courses or of their overall efficacy in improving student academic outcomes.

Contents

Why this study?

This report complements earlier work conducted by Regional Educational Laboratory (REL) Southeast on Florida Virtual School credit recovery (Hughes, Zhou, & Petscher, 2015) by extending that report's discussion about the expanding role of online education in the REL Southeast Region to North Carolina.

As is true across much of the REL Southeast Region, there is growing interest in North Carolina in strengthening the presence of online learning in all public schools. For example, in 2013 the North Carolina General Assembly directed the state to transition to digital learning tools by 2017 (North Carolina General Assembly, 2013), and the state is developing a longer-term comprehensive plan for incorporating digital learning into every school setting. This study expands understanding of two aspects of digital learning that helped inspire the state's transition—the extent to which online learning already plays a role in providing digitally enhanced options for students at risk of dropping out, and the range and scope of un- or under-addressed needs of students in these online credit recovery programs. Previous research on this topic is limited (box 1).

This study expands understanding of two aspects of digital learning in North Carolina—the extent to which online learning already plays a role in providing digitally enhanced options for students at risk of dropping out, and the range and scope of un- or under-addressed needs of students in these online credit recovery programs

Two stakeholder audiences for this study are the North Carolina Virtual Public School (NCVPS), North Carolina's provider of online courses, and the North Carolina Department of Public Instruction, the state's education agency. To date, these organizations have analyzed only enrollment data related to student participation in NCVPS credit recovery; neither has conducted an in-depth analysis of student outcomes. This study was developed to respond to the need for such an analysis. In addition to expanding understanding of participation in and outcomes related to online credit recovery, this study also demonstrates the range of North Carolina online credit recovery data available for future analyses and how the data can be used.

Viable credit recovery options are also of great interest to district-level personnel, who are directly responsible for deciding what academic options to make available to students. Though North Carolina dropout rates have declined and graduation rates have risen in recent years (see box 1), considerable public pressure remains for school districts to continue to improve these rates. In addition to the state-provided online credit recovery option offered through NCVPS, school districts use traditional options such as school-year and summer school course repetition in a face-to-face classroom setting, as well as third-party online credit recovery programs, to improve graduation rates. This report addresses the need for better understanding of the similarities and differences across these programs (box 2).

The analyses used in this study limit its ability to provide definitive conclusions about whether participation in online credit recovery leads directly to the short- and longer-term student outcomes examined—which include measures of student persistence in school and of student academic success. However, the results can focus future efforts on uncovering whether such causal relationships exist and, if so, how to maximize their potential.

Box 1. What other research has reported about student dropout and online credit recovery

A decade after the No Child Left Behind law mandated efforts to reduce the achievement gap, nationwide about 87 percent of Asian and 84 percent of White students, but only 71 percent of Hispanic, 67 percent of Black, and 72 percent of economically disadvantaged students graduate from high school (Stetser & Stillwell, 2014). Increasing graduation rates for all populations is important when considering the negative outcomes associated with the dropout population. The Center for Labor Market Studies (2009) estimates that each adult with a high school diploma has the potential to contribute at least $250,000 more than high school dropouts as a result of combined lifetime fiscal benefits (via taxes), and to lower the social costs associated with incarceration, welfare, and healthcare.

Despite sharply increased graduation rates in recent years, North Carolina's graduation rate has only recently climbed to the national average: four-year cohort graduation rates rose from 68.3 percent in 2006 to 83.9 percent in 2014 (North Carolina Department of Public Instruction, 2015a), surpassing the national average of 82 percent that year. And despite 2014's highest graduation rate on record for the state, the total number of high school dropouts (10,404) also remained high (North Carolina Department of Public Instruction, 2015b). This means that student dropout and its associated costs remain an important issue in North Carolina.

There is growing consensus among researchers that dropping out of school is not a static or isolated event but is instead the final event in a long-term process of disengagement from school that often involves multiple factors, many of which may have originated as early as elementary school. This theorized cumulative process of disengagement from school suggests that if the appropriate resources are implemented at the right time, students can be re-engaged and get back on track to graduate (Alexander, Entwisle, & Horsey, 1997; Ensminger & Slusarcick, 1992; Fine, 1991; Finn, 1993; McNeal, 1997; Rumberger, 2001; U.S. General Accounting Office, 2002; Vitaro, Brendgen, & Tremblay, 1999).

Online credit recovery programs are one way in which states have attempted to help students stay on track. Benefits of virtual courses are well documented for general and honors students in addressing issues such as access, student achievement, and twenty-first-century learning skills (Cavanaugh, Gillan, Kromrey, Hess, & Blomeyer, 2004; Means, Toyama, Murphy, Bakia, & Jones, 2009); however, there is little rigorous research about the experience and performance of low-achieving students in online learning environments (Cavanaugh, Barbour, & Clark, 2009). There is growing qualitative evidence that credit recovery programs (face to face as well as virtual) may improve graduation rates (Christian, 2003; Watson & Gemin, 2008; Dessoff, 2009; Menzer & Hampel, 2009), but few empirical studies support these findings (Zehr, 2010). Of the few quantitative studies that have examined credit recovery programs and short-term outcomes (such as pass rates and course grades), results are mixed, with some studies (such as Hughes et al., 2015) suggesting that online credit recovery courses may help students earn better grades than those earned by students taking the same recovery courses face to face. Others (such as Heppen et al., 2013) offer evidence that face-to-face credit recovery courses may benefit students more than online courses in terms of higher grades and pass rates.

Box 2. Credit recovery options in North Carolina

Credit recovery. Retaking a previously failed course required for graduation. For example, a student who needs English I to graduate, but fails the course, may retake English I at a later date to "recover" that credit.

North Carolina Virtual Public School credit recovery program. The state-provided online credit recovery option for students who fail high school courses required for graduation.

Third-party credit recovery programs. Another online credit recovery option in North Carolina. Several school districts enroll students in online credit recovery programs offered by third-party vendors. Third-party credit recovery program vendors operating in North Carolina for the years covered in this study were Ed Options, NovaNET, Novel Stars, Odyssey Ware, Plato, SAS Curriculum Pathways, and Study Island.

Traditional credit recovery options. Courses retaken in a traditional, face-to-face classroom setting. This study examined student enrollment in two types of traditional credit recovery options:

- School-year course repetition refers to courses retaken in a traditional classroom setting during the fall or spring semester.
- Summer school course repetition refers to courses retaken in a traditional classroom setting during the summer.

What the study examined

This study addressed three primary research questions.

1. What are the features of and enrollment in NCVPS credit recovery courses and the other credit recovery programs available to students in North Carolina, and what are the characteristics of students who enroll in NCVPS and other credit recovery options?

2. How do short-term success rates (as measured by scores on end-of-course exam retests) for students who complete NCVPS credit recovery courses compare with success rates for students who repeat a course through other credit recovery options?

3. After completing an NCVPS credit recovery course, how do mid- to longer-term success rates (such as staying on track and graduating) compare with success rates for students who repeat a course through any other credit recovery option?

As an extension to research questions 2 and 3, the study also analyzed outcomes for student subgroups within the NCVPS credit recovery sample:

4. To what extent, if any, do success rates in subsequent exams, courses, dropout rates, and graduation rates for NCVPS credit recovery students vary by student subgroup?

For this extension the study team examined whether any correlations exist between the student outcomes highlighted in research questions 2 and 3 and three observable

characteristics of NCVPS credit recovery students: whether a student is economically disadvantaged (as proxied by eligibility for the federal school lunch program), a student's race/ethnicity, and the number of end-of-course exams a student failed in the academic year of her or his initial course failure. Box 3 summarizes the data and analyses used; appendix A provides more details.

The report includes a descriptive inventory of the credit recovery options available to high school students from fall 2008 through summer 2012 in North Carolina.[1] In addition to NCVPS credit recovery, other credit recovery options detailed in this report include courses retaken in a traditional, face-to-face classroom setting (either during the school year or in summer school) and online programs provided by third-party credit recovery program vendors. The report summarizes characteristics of students enrolled in NCVPS credit recovery and the two main traditional credit recovery options for which reliable

Box 3. Data, methods, and interpretation

Data. This study used data from North Carolina Virtual Public School (NCVPS), the North Carolina Department of Public Instruction, and third-party credit recovery programs. NCVPS provided credit recovery program and student enrollment data, the North Carolina Department of Public Instruction provided student records that included individual demographic and academic variables, and the seven third-party credit recovery program vendors in operation in the state provided descriptions of their programs.

The study included students who took credit recovery courses offered by NCVPS between 2008/09—the first full academic year of NCVPS's program—and 2011/12, as well as all identifiable students whose credit recovery involved re-enrolling in a course during the regular school year (traditional face-to-face credit recovery), during summer school, or as part of some other credit recovery program (see appendix A for details about the data and methods used, and box A1 for details about efforts to identify participants in other credit recovery options).

Methods. Each section of this report leads with simple descriptive statistics (unadjusted summaries of outcomes for different student subgroups). The study also used regression analyses, which partially factor out the combined influence of multiple variables on an outcome of interest to provide a clearer sense of the relationship between the outcome and each variable independent of all other variables. The study relies on two types of regression analyses: analyses of outcomes with many potential values and analyses of outcomes with only two potential values.

Interpretations of results.

- *Interpreting effect sizes.* When the results of a regression analysis with many potential outcomes are statistically significant (that is, not likely to have happened by chance), there is a temptation to assume that the results are meaningful. What is often more important is the size of the predicted result. The effect size helps put into context how meaningful a statistically significant result is. This study considers effect sizes between 0.2 and 0.5 to be small, effect sizes from 0.5 to 0.8 to be medium, and effect sizes of 0.8 and above to be large (Cohen, 1988).
- *Interpreting likelihood.* When there are only two possible outcomes of a regression analysis (0 or 1, yes or no), likelihood is used instead of effect sizes to estimate the feasibility of an outcome for student subgroups. In this study the odds of an event happening for one group is calculated relative to the odds of the event happening for a comparison group.

student demographic data were available (school-year and summer school course repetition[2]), including grade level, race, gender, economic disadvantage status, special education status, grade 8 end-of-grade exam scores, and other measures.

The report compares short-term education outcomes for NCVPS credit recovery students with outcomes for students who participated in credit recovery through providers other than NCVPS. These short-term outcomes included students' standardized state end-of-course exam scores and proficiency levels following credit recovery. The report examines four longer-term education outcomes: whether a student re-enrolled in school the following year, reached proficiency in the next course in the course series, graduated from high school, and graduated from high school on time (that is, within four years).

What the study found

Findings are reported for four broad categories of outcomes: information about online and face-to-face credit recovery options in North Carolina, comparisons of student characteristics by credit recovery option, measures of short- and longer-term outcomes for students by credit recovery option, and differences in outcomes for subgroups of NCVPS credit recovery students.

In the 2011/12 school year (the last year in the current study) the North Carolina Virtual Public School program served students in 101 (88 percent) of the state's 115 school districts, as well as students in charter schools and federal schools

Traditional, school-year course repetition remains the most common credit recovery option in North Carolina, but online and summer school credit recovery enrollments are growing fast

This section provides detailed information about each of the credit recovery options available in North Carolina, as well as historical information about enrollment in each.

NCVPS credit recovery. NCVPS was established by the North Carolina E-Learning Commission in 2005 and began operations in 2007. NCVPS grew quickly; by 2015 it offered more than 150 courses and enrolled more than 52,000 students in courses ranging from Advanced Placement and other college credit courses to honors and general courses in English, math, science, social studies, world languages, arts, career and technical education, and healthful living. NCVPS also offers test preparation and career planning services. Course offerings are available to middle and high school students.

In January 2008 NCVPS introduced online credit recovery courses for students who failed high school courses required for graduation. Since its inception, NCVPS credit recovery has grown into a fully developed program. In the 2011/12 school year (the last year in the current study) the program served students in 101 (88 percent) of the state's 115 school districts, as well as students in charter schools and federal schools.

- *Courses offered.* The credit recovery courses in which students enrolled between 2008/09 and 2011/12 included English I, II, III, and IV; Algebra I, Algebra II, and Geometry; Physical Science and Biology; and Civics and Economics, U.S. History, and World History.
- *Coverage.* All NCVPS credit recovery courses align to state curriculum standards; use a self-paced, mastery-learning model; are written and taught by highly qualified North Carolina teachers trained to teach online; contain all instructional materials needed for the student and require no modifications by local school districts; and are available to all high school students enrolled in participating

North Carolina public schools, charter schools, Department of Defense schools, and schools operated by the Bureau of Indian Affairs.

- *Length of student participation.* Most students completed the courses during one semester of the school year or during an eight-week summer session.
- *Student autonomy.* NCVPS credit recovery courses are designed to be student centered. Once a student masters an assignment, the student can move on to the next assignment. Once all course units are mastered, NCVPS notifies the student's school of his or her completion of the course.
- *Format.* NCVPS courses use an online learning management system that relies on interactive whiteboards, wikis, virtual environments, and online discussion tools. While the exact setting can vary by school district, a typical student who enrolled in a NCVPS credit recovery course during the study period attended a physical class at his or her school in a computer lab with other students who were taking other NCVPS courses—not all of which were credit recovery courses. In addition to the online course instructor provided by NCVPS, a teacher or teacher assistant typically was present to supervise the lab. The course format supported synchronous and asynchronous communication. Students had weekly contact with their teacher in a synchronous environment, as well as daily asynchronous contact through the messaging system.

Overall, enrollment in traditional, school-year credit recovery courses declined slightly over the four years of the study, with grade 9 enrollment showing the largest drop from nearly 15,500 in 2008/09 to just over 11,500 in 2011/12. In contrast, summer school enrollment in nearly all courses increased slightly over the four years covered in the study

Traditional credit recovery options: school-year and summer school course repetition. Courses retaken in a traditional, face-to-face classroom setting (either during the school year or in summer school) are the most common credit recovery options available to North Carolina public school students. Implementation of these options (such as which courses are offered, how long students must participate to earn credit, cost per student, and so on) varies across school districts and across school years, but in almost all cases the courses are not mastery based, and completion is based at least in part on seat time. Overall, enrollment in traditional, school-year credit recovery courses declined slightly over the four years of the study, with grade 9 enrollment showing the largest drop from nearly 15,500 in 2008/09 to just over 11,500 in 2011/12. In contrast, summer school enrollment in nearly all courses increased slightly over the four years covered in the study.

While traditional, school-year course repetition continues to be the most frequently used credit recovery option in North Carolina, both traditional summer school and NCVPS credit recovery options have made enrollment gains in recent years (tables 1–3).

Other online credit recovery options in North Carolina. As noted above, NCVPS credit recovery is not the only online credit recovery option in North Carolina. Several school districts also enroll students in online credit recovery programs offered by third-party vendors. Because the choice to use third-party programs predated the availability of NCVPS credit recovery courses, some school districts retain relationships with those programs. Also, a change in the NCVPS funding formula that shifted more costs to the district starting in the 2011/12 school year has reduced the likelihood that NCVPS enrollment will overtake all other online options.

- *Courses offered.* The third-party vendors offered a variety of online content that ranged from supplemental resources (such as web-based lessons and interactive tools) to full courses. Use of most third-party products was not restricted to credit recovery, and many third-party vendors indicated that each school district established guidelines for how a vendor's products could be used.[3] As a result of this

Table 1. Student enrollment in North Carolina credit recovery courses, by grade level and credit recovery option, 2008/09–2011/12

Grade level and credit recovery option	2008/09	2009/10	2010/11	2011/12
Grade 9				
NCVPS credit recovery	420	787	904	654
Traditional, school-year course repetition	15,457	13,216	11,879	11,543
Traditional, summer school course repetition	1,728	1,949	2,171	2,621
Grade 10				
NCVPS credit recovery	653	1071	1172	985
Traditional, school-year course repetition	18,065	17,529	15,031	15,606
Traditional, summer school course repetition	1,837	2,283	2,659	3,138
Grade 11				
NCVPS credit recovery	663	1056	1104	1077
Traditional, school-year course repetition	15,794	16,132	13,391	14,041
Traditional, summer school course repetition	1,950	2,214	2,272	2,928
Grade 12				
NCVPS credit recovery	187	505	509	491
Traditional, school-year course repetition	11,349	13,421	10,531	10,542
Traditional, summer school course repetition	495	531	518	460

NCVPS is North Carolina Virtual Public School.

Note: Because of missing data or errors in the administrative data related to students' grade level, enrollment totals in tables 1, 2, and 3 do not match. Traditional school year and summer school credit recovery courses refer to face-to-face courses.

Source: Authors' analysis of transcript data provided by the North Carolina Virtual Public School and the Education Research Data Center.

variability in how districts used their products, most vendors had limited ability to track or differentiate exactly how their content was being used by a teacher or student (such as whether it was used for credit recovery or for some other purpose). Though unable to count credit recovery students precisely, vendors indicated that many schools or districts that contracted with them did so specifically for the purpose of online credit recovery. Also, some vendors offered specially designed versions of their courses for credit recovery that included pretest assessments to customize lessons for individual students. All vendors noted that the most commonly subscribed courses or materials were for English and math. See box A1 in appendix A for a detailed explanation of how third-party credit recovery courses were included in this study's analyses.

- *Length of student participation.* Across all third-party vendors, online courses were typically designed to be completed within a summer, semester, or yearlong timeframe. Due to the nature of many of these courses (self-paced, asynchronous, and the like) students often had flexibility to complete a given course in a shorter timeframe if they desired. Course durations could also be extended beyond the standard timeframe for a student, pending district approval. Most third-party vendors noted that each district set its own rules for credit recovery course completion requirements.
- *Student autonomy.* All available courses across vendors were designed to be student driven. While students could advance at their own pace, it was typical for a face-to-face teacher to assist students when necessary. No third-party vendor provided online teachers. All vendor representatives emphasized that districts decide how

Across all third-party vendors, online courses were typically designed to be completed within a summer, semester, or yearlong timeframe, and students often had flexibility to complete a given course in a shorter timeframe

Table 2. Student enrollment in North Carolina credit recovery courses with an end-of-course exam, by course and credit recovery option, 2008/09–2011/12

Course and credit recovery option	2008/09	2009/10	2010/11	2011/12
English I				
NCVPS credit recovery	**272**	**450**	**409**	**278**
Traditional, school-year course repetition	**8,912**	**7,506**	**6,929**	**7,116**
Traditional, summer school course repetition	**705**	**744**	**708**	**888**
Algebra I				
NCVPS credit recovery	**361**	**484**	**435**	**435**
Traditional, school-year course repetition	**18,518**	**15,853**	**14,931**	**13,306**
Traditional, summer school course repetition	**990**	**976**	**1,123**	**1,284**
Algebra II				
NCVPS credit recovery	**212**	**373**	**374**	483
Traditional, school-year course repetition	**5,101**	**3,601**	**3,458**	5,879
Traditional, summer school course repetition	**436**	**419**	**662**	1,194
Geometry				
NCVPS credit recovery	**213**	**320**	482	556
Traditional, school-year course repetition	**4,372**	**3,890**	4,475	7,994
Traditional, summer school course repetition	**480**	**611**	1,012	1,490
Physical Science				
NCVPS credit recovery	**127**	**212**	**167**	132
Traditional, school-year course repetition	**3,330**	**3,255**	**3,004**	3,099
Traditional, summer school course repetition	**258**	**323**	**284**	366
Biology				
NCVPS credit recovery	**0**	**138**	**333**	**217**
Traditional, school-year course repetition	**6,875**	**6,941**	**6,332**	**6,004**
Traditional, summer school course repetition	**501**	**711**	**629**	**554**
Civics and Economics				
NCVPS credit recovery	**241**	**442**	**363**	324
Traditional, school-year course repetition	**6,680**	**6,764**	**6,612**	6,171
Traditional, summer school course repetition	**479**	**605**	**477**	731
U.S. History				
NCVPS credit recovery	**187**	**273**	**304**	279
Traditional, school-year course repetition	**4,776**	**4,152**	**4,190**	3,825
Traditional, summer school course repetition	**508**	**471**	**484**	719

NCVPS is North Carolina Virtual Public School.

Note: Bolding indicates courses and years in which North Carolina end-of-course exams were administered; end-of-course exams were discontinued for some courses during the study period. Because of missing data or errors in the administrative data related to students' grade level, enrollment totals in tables 1, 2, and 3 do not match. Traditional school year and summer school credit recovery courses refer to face-to-face courses.

Source: Authors' analysis of transcript data provided by the North Carolina Virtual Public School and the Education Research Data Center.

Table 3. Student enrollment in North Carolina credit recovery courses without an end-of-course exam, by course and credit recovery option, 2008/09–2011/12

Course and credit recovery option	2008/09	2009/10	2010/11	2011/12
English II				
NCVPS credit recovery	282	547	556	433
Traditional, school-year course repetition	9,243	8,881	6,432	6,691
Traditional, summer school course repetition	788	1,015	1,137	1,273
English III				
NCVPS credit recovery	288	524	543	397
Traditional, school-year course repetition	7,617	7,351	5,260	5,402
Traditional, summer school course repetition	926	1,014	948	894
English IV				
NCVPS credit recovery	85	131	160	111
Traditional, school-year course repetition	4,747	4,207	1,987	2,064
Traditional, summer school course repetition	270	297	329	277
World History				
NCVPS credit recovery	0	230	513	230
Traditional, school-year course repetition	13,027	12,845	10,054	9,198
Traditional, summer school course repetition	615	716	787	841

NCVPS is North Carolina Virtual Public School.

Note: Because of missing data or errors in the administrative data related to students' grade level, enrollment totals in tables 1, 2, and 3 do not match. Traditional school year and summer school credit recovery courses refer to face-to-face courses.

Source: Authors' analysis of transcript data provided by the North Carolina Virtual Public School and the Education Research Data Center.

the content was delivered to students; thus, it was possible for courses to be entirely student-driven and completed online or to be delivered or administered by a face-to-face teacher.

- *Format.* Across vendors, course content or supplemental resources were designed primarily to be completed asynchronously; however, many courses included elements that supported synchronous communication or activities (that is, message boards, group activities, and the like).
- *Coverage.* Of the seven third-party vendors contacted, only one was willing and able to share the names of the districts with which it contracted and the number of students in each district who used the company's product during the time period of this study. The other vendors cited individual district contracts that prohibited them from sharing this type of information, or an inability to share detailed coverage data due to limitations in data-tracking and management processes. Based on the data available at the time, third-party credit recovery program vendors appeared to have operated in at least 100 of North Carolina's 115 districts between 2008/09 and 2011/12.

Across vendors, course content or supplemental resources were designed primarily to be completed asynchronously; however, many courses included elements that supported synchronous communication or activities

Some districts periodically have offered locally developed programs, but these are not clearly identified and are not considered separately in this study.

North Carolina Virtual Public School students were less likely than their peers in traditional credit recovery programs to be economically disadvantaged, and a greater proportion entered high school proficient in math and reading

Another important consideration when comparing credit recovery options is whether student populations are similar. While NCVPS credit recovery students were similar to other credit recovery students in many ways, there were some notable differences across student groups.

Gender. Across all four years of the study and across credit recovery options, enrollment by gender for each credit recovery option remained fairly constant, with a higher proportion of male students (56–64 percent) than female students (37–44 percent) enrolled in courses. Overall, female student enrollment across credit recovery options declined slightly, while male student enrollment increased slightly. Differences in enrollment by gender across credit recovery options were negligible, but female student enrollment was typically highest for NCVPS credit recovery and typically lowest for summer school.

Across all four years of the study and across credit recovery options, enrollment by gender for each credit recovery option remained fairly constant, with a higher proportion of male students (56–64 percent) than female students (37–44 percent) enrolled

Race/ethnicity. Across credit recovery options and across years, Black students accounted for a disproportionately large proportion of enrollment (41–50 percent; table 4). The proportion of Black students across the state between 2008/09 and 2011/12 was about 28 percent (North Carolina Department of Public Instruction, n.d. b.). However, it is outside the scope of the study to speculate about reasons for this discrepancy. Though most differences in enrollment across credit recovery options were not large within racial/

Table 4. Student race/ethnicity in North Carolina, by credit recovery option, 2008/09–2011/12 (percent)

Race/ethnicity and credit recovery option	2008/09	2009/10	2010/11	2011/12
Black				
NCVPS credit recovery	45.3	44.1	42.3	41.6
Traditional, school-year course repetition	40.6	43.0	43.6	42.0
Traditional, summer school course repetition	48.3	49.7	50.1	48.3
Hispanic				
NCVPS credit recovery	6.0	8.6	11.2	13.7
Traditional, school-year course repetition	9.8	10.9	12.7	13.9
Traditional, summer school course repetition	7.5	7.3	10.3	12.3
Other				
NCVPS credit recovery	4.2	4.3	4.5	6.1
Traditional, school-year course repetition	5.5	5.4	6.2	6.4
Traditional, summer school course repetition	4.2	5.1	5.4	5.5
White				
NCVPS credit recovery	44.5	43.1	40.1	38.1
Traditional, school-year course repetition	44.0	40.7	37.6	37.7
Traditional, summer school course repetition	39.8	38.0	34.2	33.9

NCVPS is North Carolina Virtual Public School.

Note: Black includes African American. Hispanic includes Latino. Other includes Asian, American Indian/Alaskan Native, Hawaiian Native/Pacific Islander, and multiracial. Traditional school year and summer school credit recovery courses refer to face-to-face courses.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

ethnic groups, among White students summer school typically had the lowest enrollment proportion and NCVPS credit recovery the highest enrollment proportion.

Economic disadvantage status. Matching a statewide trend, the proportion of credit recovery students who were economically disadvantaged increased steadily over the four years of the study; however, among credit recovery options the proportion was lower for NCVPS than for traditional schools and summer school in every year after 2008/09 (table 5).

Students receiving special education services. The proportion of students receiving special education services was similar across credit recovery options. Traditional school-year and NCVPS enrollment of students receiving these services ranged from 14 percent to 18 percent across years, and summer school enrollment ranged from 16 percent to 17 percent.

The proportion of credit recovery students who were economically disadvantaged increased steadily over the four years of the study

Grade 8 end-of-grade exam proficiency. Changes in performance on state-administered end-of-grade exams across years are not surprising in North Carolina, as end-of-grade scores typically track upward until the exam form is changed. More important are differences across credit recovery options in a given year, and for the three most recent years in math and the two most recent years in reading, NCVPS credit recovery students tended to earn higher average proficiency ratings than did traditional credit recovery students (table 6).

Table 5. Economically disadvantaged students in North Carolina, by credit recovery option, 2008/09–2011/12 (percent)

Credit recovery option	2008/09	2009/10	2010/11	2011/12
NCVPS credit recovery	47.6	51.9	52.1	55.9
Traditional, school year course repetition	47.3	56.7	64.0	67.5
Traditional, summer school course repetition	50.0	57.0	60.3	63.9

NCVPS is North Carolina Virtual Public School.

Note: Traditional school year and summer school credit recovery courses refer to face-to-face courses.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table 6. Grade 8 North Carolina end-of-grade exam proficiency of students, by content area and credit recovery option, 2008/09–2011/12 (percent)

Content area and credit recovery option	2008/09	2009/10	2010/11	2011/12
Math				
NCVPS credit recovery	48.0	53.3	58.0	64.1
Traditional, school-year course repetition	53.2	47.8	49.0	57.7
Traditional, summer school course repetition	45.2	48.5	57.9	63.7
Reading				
NCVPS credit recovery	77.6	66.6	52.7	49.2
Traditional, school-year course repetition	80.2	70.5	47.6	41.0
Traditional, summer school course repetition	69.9	55.5	43.3	45.1

NCVPS is North Carolina Virtual Public School.

Note: Traditional school year and summer school credit recovery courses refer to face-to-face courses.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

North Carolina Virtual Public School students scored lower on state end-of-course exam retests after credit recovery than did traditional credit recovery students, but the differences were small once differences between student subgroups were taken into account

This part of the study compared two short-term academic outcomes for NCVPS credit recovery students—scaled scores and achievement levels on standardized North Carolina end-of-course exams retaken after completion of credit recovery—to outcomes for all other credit recovery students (traditional face-to-face students, summer school students, and other identifiable credit recovery students, such as those who participated in third-party credit recovery options; see appendix A).

The study team examined end-of-course exam retests because students took them after completing their credit recovery courses. At the individual course level and across all courses, the NCVPS credit recovery students in the sample years reached proficiency on their end-of-course exam retests at lower rates (0.3–19.6 percentage points) and scored lower on their end-of-course exam retests after credit recovery (0.1–2.6 points) than did other credit recovery students (table 7).

At the individual course level and across all courses, the NCVPS credit recovery students in the sample years reached proficiency on their end-of-course exam retests at lower rates (0.3–19.6 percentage points) and scored lower on their end-of-course exam retests after credit recovery (0.1–2.6 points) than did other credit recovery students

Even after the analysis adjusted for other possible influences that might be related to these differences in retest scores (such as credit recovery option, student demographics, and prior scores on the same exam; see appendix A for full regression equations), NCVPS credit recovery students still appeared to be less likely to score as high as or to reach proficiency

Table 7. Performance on North Carolina end-of-course exam retest after completing credit recovery, 2008/09–2011/12

Outcome and course	NCVPS credit recovery students	All other credit recovery students	Difference in percent proficient
Students demonstrating proficiency on end-of-course exam retest (percent)			
English I	34.6	34.9	–0.3
Algebra I	29.5	36.1	–5.6
Algebra II	45.5	55.6	–10.1
Geometry	29.9	49.5	–19.6
Physical Science	30.8	45.0	–14.2
Biology	26.9	41.2	–14.3
Civics and Economics	27.1	36.0	–8.9
U.S. History	31.7	43.1	–11.4
Average scaled score on end-of-course exam retest			
English I	142.8	142.9	–0.1
Algebra I	143.3	144.7	–1.4
Algebra II	145.1	146.9	–1.8
Geometry	144.2	146.8	–2.6
Physical Science	144.3	146.8	–2.5
Biology	142.3	144.6	–2.3
Civics and Economics	144.0	145.3	–1.3
U.S. History	145.7	147.0	–1.3

NCVPS is North Carolina Virtual Public School.

Note: Traditional school year and summer school credit recovery courses refer to face-to-face courses.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

as often as other credit recovery students after completing their credit recovery course (see table B1 in appendix B and appendix C for more detailed results).

The differences revealed by these more complex, exploratory analyses were statistically significant, but because the effect sizes were very small (all well below 0.2), the differences were not particularly meaningful (see table B1 in appendix B and box 3 for an explanation of effect size).[4] In other words, while there was no indication that participation in NCVPS credit recovery might have been more beneficial to credit recovery students in terms of shorter-term outcomes than participation in other credit recovery options, there also was no definitive indication, based on the differences in the statistically adjusted changes in scaled scores before and after credit recovery, that participation might have been notably detrimental. As noted elsewhere in this report, it is not possible to make definitive inferences of causality based on these analyses, because the differences in outcomes may reflect differences between the pre-existing characteristics of participants in NCVPS and other credit recovery programs rather than the effects of the credit recovery programs themselves.

Between 2008/09 and 2011/12, NCVPS credit recovery students re-enrolled at a rate of 91.7 percent, 2.7 percentage points higher than other credit recovery students

Longer-term outcomes for North Carolina Virtual Public School credit recovery students were mixed relative to outcomes for other credit recovery students

Next, the study compared four longer-term binary (yes/no) education outcomes for NCVPS credit recovery students and for other credit recovery students:

- Student re-enrolled in school the following year.
- Student reached proficiency in the subsequent course in the course series—an indicator derived by stringing together the sequence of students' courses in their longitudinal records.
- Student graduated from high school.
- Student graduated from high school on time (that is, within four years).

Re-enrollment and subsequent-course proficiency. A critical first step in the graduation process for students who fail a class is successfully getting back on track for graduation, first through re-enrollment in school and then through success in courses immediately after re-enrollment. Between 2008/09 and 2011/12, NCVPS credit recovery students re-enrolled at a rate of 91.7 percent, 2.7 percentage points higher than other credit recovery students. NCVPS credit recovery students' academic success rates in the next course in each sequence (for example, passing English II after taking English I credit recovery), relative to students who completed other credit recovery options, varied between 3.9 percentage points lower and 2.4 percentage points higher (table 8).

Regression analysis was then applied to determine whether these results would hold up after adjusting for other possible explanatory factors (such as differences in special education status and school attendance rates; see box 3). NCVPS credit recovery students still appeared to be more likely than their peers to re-enroll in school the year following their credit recovery coursework (see table B2 in appendix B and table C26 in appendix C), but the adjustments did eliminate the two positive results for English course sequences reported in table 8 (see table B2 in appendix B and tables C21–C25 in appendix C for specific results).

Table 8. Longer-term in-school outcomes in North Carolina after completing credit recovery, 2008/09–2011/12 (percent)

Outcome	NCVPS credit recovery students	All other credit recovery students	Difference in percent achieving
Student re-enrolls following year	91.7	89.0	+2.7
Student passes next course in sequence			
English II after English I credit recovery	67.1	68.0	–0.9
English III after English II credit recovery	73.6	71.2	+2.4
English IV after English III credit recovery	88.4	86.9	+1.5
Algebra II or Geometry, after Algebra I credit recovery	60.8	64.7	–3.9

NCVPS is North Carolina Virtual Public School.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

NCVPS credit recovery students in the sample years graduated at a lower rate (76.0 percent) than did other credit recovery students (77.7 percent); however, among those who did graduate, they were more likely than their peers to graduate on time

Graduation. On the ultimate measure of secondary school-level longer-term outcomes—graduation—NCVPS credit recovery students in the sample years graduated at a lower rate (76.0 percent) than did other credit recovery students (77.7 percent; table 9).

Even after the analysis controlled for several variables through regression analyses (see box 3), NCVPS credit recovery students still appeared to be less likely than their credit recovery peers to graduate, a difference that was statistically significant. However, among those who did graduate, they were more likely than their peers to graduate on time (that is, within four years of entering high school; see table B3 in appendix B and tables C27 and C28 in appendix C).

Taken together, these findings suggest potentially useful areas for further research. In particular, there appears to be value in exploring further not only whether the flexibility of the state's online credit recovery option—which may be easier to schedule not only during the regular school day but also potentially outside of it, and which can more readily allow for rapid make-up of coursework—may be an effective tool for helping some students stay enrolled and on track for on-time graduation, but also whether those possible gains are offset by other apparent losses in academic performance and completion. However, because of the nature of the current study and because the comparison group includes a small number of third-party online credit recovery students, these analyses only allowed the study team to speculate, not to confirm, without the benefit of a more rigorous and controlled study. It may be just as likely that there are other factors that are systematically similar about NCVPS credit recovery students that increases their likelihood to exhibit some characteristics of academic persistence but that the demographics data used in these analyses cannot uncover.

Table 9. Longer-term graduation outcomes in North Carolina after completing credit recovery, 2008/09–2011/12 (percent)

Outcome	NCVPS credit recovery students	All other credit recovery students	Difference in percent achieving
Student graduates	76.0	77.7	–1.7
If student graduates, graduates on time (within four years)	31.5	24.3	+7.2

NCVPS is North Carolina Virtual Public School.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Among North Carolina Virtual Public School credit recovery students, Black students were less likely to reach proficiency but more likely to succeed in later coursework

Finally, this study examined the outcomes for research questions 2 and 3 within the population of NCVPS credit recovery students only, by considering both raw outcomes and outcomes analyzed through regression (see box 3) to estimate whether the outcomes differ after controlling for other possible explanatory variables. The goals were first to note differences between outcomes for different student subgroups and then to identify possible correlations between these outcomes and three key student characteristics:

- A student's race/ethnicity.
- Whether a student was economically disadvantaged.
- The number of end-of-course exams a student failed in the academic year in which she or he first failed a course (a more nuanced indicator than the raw number of courses failed of differences in the level of academic challenge that a given student faces after failing for the first time).

White NCVPS credit recovery students re-enrolled 85.1 percent of the time, compared with 89.4 percent of the time for Black NCVPS credit recovery students and 89.5 percent of the time for Hispanic NCVPS credit recovery students

Race/ethnicity. Racial/ethnic minority NCVPS credit recovery students frequently had higher success rates than White students, not only in terms of re-enrolling the year following credit recovery, but also in terms of graduating and graduating on time. For example, White NCVPS credit recovery students re-enrolled 85.1 percent of the time, compared with 89.4 percent of the time for Black NCVPS credit recovery students and 89.5 percent of the time for Hispanic NCVPS credit recovery students. White NCVPS credit recovery students graduated 73.5 percent of the time, compared with 78.8 percent of the time for Black NCVPS credit recovery students and 83.7 percent for Asian NCVPS students (table 10).

After analyses controlled for the influence of other explanatory variables (such as differences in special education status and school attendance rates) through regression, racial/ethnic minority NCVPS credit recovery students still appear to have been more likely than White NCVPS credit recovery students to succeed on all three longer-term outcome measures (see tables C29–C31 in appendix C for detailed results). However, there were few statistically significant and meaningful patterns across races/ethnicities for improvements in exam scores after credit recovery.

Table 10. Short- and longer-term outcomes after completing North Carolina Virtual Public School credit recovery, by race/ethnicity, 2008/09–2011/12 (percent)

Outcome	Asian	Black	Hispanic	White
Short-term outcome				
Student demonstrates proficiency, all courses combined	44.4	25.9	33.8	38.7
Longer-term outcome				
Student re-enrolls following year	[a]	89.4	89.5	85.1
Student passes next course in sequence (all courses combined)	64.9	65.4	60.9	64.6
Student graduates	83.7	78.8	72.3	73.5
If student graduates, graduates on time (within four years)	36.1	30.6	37.1	30.1

Note: Black includes African American; Hispanic includes Latino.

a. Percentage omitted because there were fewer than five students in this subgroup for this item.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

One intriguing pattern that may merit additional investigation was among Black NCVPS credit recovery students. Even after outcomes were statistically adjusted, Black NCVPS credit recovery students were less likely than White NCVPS credit recovery students to demonstrate proficiency following credit recovery (as measured by achievement level) but more likely to re-enroll, to succeed in subsequent coursework (as measured by earning course credit), to graduate, and to graduate on time (see table B4 in appendix B).

Economic disadvantage status. Patterns for NCVPS credit recovery students who were economically disadvantaged paralleled those for the larger population of students who were not economically disadvantaged. For example, NCVPS credit recovery students who were economically disadvantaged had a lower average baseline proficiency rate (28.4 percent) than NCVPS credit recovery students who were not economically disadvantaged (35.8 percent) and a lower graduation rate after credit recovery (73.1 percent versus 79.2 percent; table 11).

Even after regression analysis controlled for other possible explanatory factors, these students still appeared to be less likely to graduate and to re-enroll. Their predicted performance typically was lower on subsequent end-of-course proficiency (that is, whether a student's exam score indicates that she or he is performing at grade level) and achievement (that is, her or his actual scaled score) measures (though only statistically significantly so on the measure of achievement, and even then with only a small effect size). It is again worth noting, however, that, as was the case with racial/ethnic minority students, after statistical adjustment, students in this sample who were economically disadvantaged were more likely to graduate on time than students who were not economically disadvantaged (see table B5 in appendix B and tables C10, C20, C25, and C29–C31 in appendix C).

Initial rate of failure. Finally, examinations through regression analysis of differences in outcomes for students with higher rates of end-of-course exam failure in the first year in which they failed one or more courses (that is, students who ended their year farther behind academically than their peers the first time they failed one or more high school courses) were inconclusive. Differences in shorter-term outcomes were not significant, and differences in longer-term outcomes, though almost all statistically significant, were difficult to interpret without additional information (see tables C10, C20, C25, and C29–C31 in appendix C). Such inconclusive results do not mean that important differences for these

Table 11. Short- and longer-term outcomes after completing North Carolina Virtual Public School credit recovery, by economic disadvantage status, 2008/09–2011/12 (percent)

Outcome	Economically disadvantaged	Not economically disadvantaged	Difference in outcome (percent)
Short-term outcome			
Student demonstrates proficiency, all courses combined	28.4	35.8	–7.4
Longer-term outcome			
Student re-enrolls following year	91.1	92.3	–1.2
Student passes next course in sequence (all courses combined)	65.8	63.7	+2.1
Student graduates	73.1	79.2	–6.1
If student graduates, graduates on time (within four years)	33.6	29.3	+4.3

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

students do not exist when it comes to their participation in online credit recovery, but it may require more careful qualitative work to uncover those differences.

Implications of the study findings

While there were almost no clear and strong positive associations between participation in NCVPS credit recovery and the short- and longer-term academic outcomes examined relative to participation in other credit recovery options, there also were few meaningfully negative associations. Also, while the results for different student subgroups within the NCVPS credit recovery group are preliminary at best, they do offer possibilities for follow-up studies about whether it is beneficial to prioritize participation in online credit recovery for certain student populations—especially for Black students.

North Carolina has demonstrated a persistent and growing interest in continuing to expand the use of online and digital instruction statewide. As programs like NCVPS continue to grow (NCVPS is now the second-largest online school in the nation, after Florida's; Hughes et al., 2015) and the state continues to emphasize the importance of transitioning to digital learning, it will become increasingly important to expand understanding of how to best support that transition. These analyses suggest that at least one group of online learners—credit recovery students—differs in potentially important ways from credit recovery students in traditional face-to-face programs (for example, in terms of academic preparedness and socioeconomic background) and as a result may require supports that are different from those provided for traditional students.

The analyses suggest that at least one group of online learners—credit recovery students—differs in potentially important ways from credit recovery students in traditional face-to-face programs (for example, in terms of academic preparedness and socioeconomic background) and may require supports that are different from those provided for traditional students

More evidence and more rigorous and controlled studies will be needed to give strength to the preliminary findings in this study that there may be a few detriments and, in some scenarios (for instance, efforts to keep students on track for on-time graduation), some benefits to participation in online credit recovery. This study's analyses suggest that online credit recovery may offer a promising option for a population of students for whom finding the right academic experience is critical to their academic success—and often a challenge.

Limitations of the study

This study has five main limitations:

- One of the key advantages of a large, rich, longitudinal dataset like the one used for this study's analyses is that the high number of cases examined helps reduce the chances that the analyses have been affected in some way by unusual results from a single year or by too few observations to generate useful results. The size and richness of the dataset still do not allow drawing conclusions about what caused some results revealed by the study's analyses. But it does help contribute to an understanding of where future research should focus to explore the costs and benefits of online credit recovery for high school students.
- The analyses cannot be used to draw any direct conclusions about the quality of online credit recovery courses or of their overall efficacy in improving student academic outcomes. However, these analyses do provide the kind of information necessary to understand how much and what kind of data are available on the topic, as well as some of the causal research questions the available data may allow future studies to consider.

- The state funding formula for NCVPS credit recovery changed in the 2011/12 school year. The study's analytical design was not affected by this funding change, as the credit recovery student sample were all enrolled before the funding change. However, participation, and thus the correlations, might change under the new funding regime.
- End-of-course exams in North Carolina do not cover all subjects; the tested subjects have changed over time and the exams themselves have recently changed. Anticipating future results based on past testing scenarios is not always practicable.
- The samples used to conduct the analyses are not necessarily representative of all online credit recovery programs or participants. First, most online courses in these analyses were NCVPS credit recovery courses; therefore, the results may not be applicable to other online settings. Also, the administrative data did not explicitly identify credit recovery courses, and the processes used to identify those courses could have introduced errors or omissions. All students who participated in third-party online credit recovery programs could not be identified (though interactions with third-party vendors did indicate that this population is not large). And the decision to pool all non-NCVPS credit recovery courses into a single subgroup for comparison to outcomes from NCVPS credit recovery courses could have masked important differences in course and student outcomes for subpopulations of that larger group (for example, outcomes for summer school versus traditional school-year face-to-face credit recovery students versus outcomes for students who participated in third-party credit recovery programs).

Appendix A. Data and methodology

This appendix includes detailed information about the data used for this report, as well as the methods used to complete the analyses.

Data

This section outlines the sources of the data used for this report and details about the student data sample.

Data sources. The data for this study came from three primary sources: North Carolina Virtual Public School (NCVPS), which provided a description of its credit recovery program and student enrollment data that could be matched to state administrative data; longitudinal, administrative student records provided by North Carolina Department of Public Instruction and hosted and maintained by the Education Research Data Center at Duke University; and the seven third-party credit recovery program vendors in operation in the state, who provided descriptions of their programs. Information for the description of third-party credit recovery options was gathered through telephone interviews with representatives of those vendors (see appendix D).

Administrative records provided student-level data and included many individual demographic variables—for example, age, race, economic disadvantage status (as proxied by eligibility for the federal school lunch program)—and academic variables—for example, performance on standardized state end-of-course exams, course enrollment.

Sample. The sample included all identifiable students who took credit recovery courses offered by NCVPS between 2008/09—the first full academic year of NCVPS's program—and 2011/12, as well as all identifiable students whose credit recovery involved re-enrolling in a course during the regular school year (traditional face-to-face credit recovery), during summer school, or, when possible, as part of some other credit recovery program, such as participation in a program provided by a third-party vendor (see box A1 for efforts to identify participants in other credit recovery options). For some research questions, student records from the preceding year (2007/08) were included to provide baseline (pre-participation) measures for some students.

Because students can fail more than one course and can, therefore, choose more than one type of credit recovery, for most analyses data were organized by instances of course enrollment instead of by student. Thus, a single student could have separate records in the data for credit recovery courses taken online or face to face, as well as separate records for courses taken in different years. The sample of all credit recovery students included about 14,900 instances of NCVPS credit recovery enrollment between fall 2008 and spring 2012, about 329,900 instances of face-to-face traditional credit recovery enrollment, and about 33,900 instances of summer school credit recovery enrollment (see tables 1 through 3 in the main text). Courses included in the analyses were limited to the 12 offered by NCVPS as part of its credit recovery program—English I through IV, Algebra I and II, Geometry, Physical Science, Biology, Civics and Economics, U.S. History, and World History.

Box A1. Participation in third-party and other credit recovery options

As noted in the main text, several North Carolina school districts have employed third-party credit recovery services in addition to North Carolina Virtual Public School (NCVPS) credit recovery and traditional, school-year and summer school course repetition. The first step in collecting information about these programs was to contact each third-party vendor believed to be in operation in North Carolina between 2008/09 and 2011/12, based on initial information provided by NCVPS. In most cases the initial point of contact was a vendor's marketing office. The next step was to contact regional representatives to learn more about the company and its products. Following each conversation, a vendor representative validated meeting notes and supplemented information that was not addressed during the interview.

In the end, information derived from contact with these vendors was incomplete, in most cases limited to overall enrollment numbers or overall numbers of subscribing districts. Also, it became apparent during preparation of the data for this report that the responsibility for developing procedures for recording transcript data falls to each school district (there were 115 traditional school districts and, during the time period covered by this study, up to 100 charter schools), resulting in inconsistencies across student records in the ways in which credit recovery courses are identified. In particular, some districts do not include credit recovery courses from third-party vendors on a formal transcript. As a result, it was not possible to determine accurate estimates of third-party credit recovery program participants.

However, it was possible to identify a group of students who experienced some form of otherwise unaccounted-for credit recovery (for example, students who failed a required course in a given sequence without evidence of subsequent credit recovery, but who were on record as taking the next course in the sequence). These students were identified as "other credit recovery" students in the data and likely include some of the third-party credit recovery population. For the analyses described below, this subset of course instances (only about 2.2 percent of the total number of course instances—about 7,700 in all) were included as part of the non-NCVPS credit recovery records (because they were clearly identifiable as non-NCVPS credit recovery courses) but were not broken out separately from the other non-NCVPS credit recovery courses (because variations in course-recording procedures across districts do not allow for definitive conclusions about what type of non-NCVPS credit recovery these students accessed).

The sample used for analyses of differences among NCVPS credit recovery students included only the 12,900 students for whom complete administrative data could be matched to evidence of participation in NCVPS credit recovery.

In some cases a subset of students was excluded for some research questions, because they had not been enrolled long enough to experience some of the mid- or longer-term outcomes of interest. In other cases students were excluded if their records could not be matched to demographic information required for analysis. However, rates of matching students to the demographic and transcript data necessary for many of the analyses were very high (for example, 93 percent of all NCVPS credit recovery students were identifiable in the official state administrative dataset).

Quantitative analysis methodology

This section outlines the strategies used to determine categorization of each record of enrollment in a credit recovery course, and details about the regression analyses conducted after completion of this categorization.

Identifying NCVPS online credit recovery courses. Because the North Carolina Department of Public Instruction administrative database does not contain an online course identifier, and because (as noted in box A1) individual districts are responsible for encoding student enrollment, the process of identifying the various instances of credit recovery required several steps. The first step was to match NCVPS's records to the state records, resulting in a very high match rate (93 percent).

Identifying traditional school-year and summer school credit recovery courses. Next, records of all other courses for the years of interest were selected, then reduced to include only those that matched the 12 NCVPS credit recovery courses. Despite differences in the course titles and in course coding schemes across districts, all districts do include a universal initial four-digit course code that identifies the discipline (first two numbers) and the course (second two numbers). By identifying instances of targeted courses that were repeated (and for which initial enrollment included an indication of no credit earned), the study team could deduce (from information about the semester in which the repeated courses were taken) whether those courses were traditional repetitions (that is, taken in the fall or spring semester) or summer school repetitions. Because credit recovery requires repeating courses and because the transcript data begin in 2007/08, the credit recovery course analyses are limited to 2008/09–2011/12.

Overview of quantitative analyses. All research questions were intended either to provide descriptive information or to generate correlations related to participation in various credit recovery programs. Because this study was not experimental or quasi-experimental, causal inferences could not be made. For all components of research questions 2 and 3, the study team used multivariate ordinary least squares regression models for continuous outcomes (for example, scaled exam scores) and multivariate logistic regression models for binary outcomes (for example, whether a student graduated). Definitions of the outcome variables are included in box A2, more details explanations of the regression analyses are included in box A3, and examples of these models are included in each analysis section below.

This study is both exploratory and preliminary in nature in that it is a first attempt to understand better the place of NCVPS credit recovery in the landscape of credit recovery in North Carolina. It is not an attempt to draw definitive conclusions about outcomes for various specific credit recovery pathways. Therefore, all regression analyses compared two populations: students who took a NCVPS credit recovery course and credit recovery students who did not. Limiting the analyses for research questions 2 and 3 to comparisons and contrasts for these two groups (rather than for all four groups—NCVPS, traditional school-year, summer school, and third-party credit recovery—separately) significantly reduced reporting complexity and also reduced the possibility that study results might be misinterpreted as identifying causal impacts of one specific credit recovery option over another.

Box A2. Definitions of outcome variables

Achievement levels and scaled scores. Outcomes on North Carolina end-of-grade (elementary and middle school) and end-of-course (high school) exams for the years included in this study are measured in two ways: whether those outcomes indicate that a student has reached a certain level of proficiency (four-point scale, with a 3 or 4 indicating proficiency); and a scaled score result, the scale of which is common across exam subjects. For cases in which students retook an exam in the same testing period (for example, before student enrollment in or completion of credit recovery), the study team followed the state's procedure of using the higher of the two exam scores as the official first score of record.

Re-enrollment. A student was identified as having re-enrolled if there was evidence that she or he enrolled in any courses in the year following the year of interest and that she or he had not officially graduated the previous year.

Success in subsequent courses. A student's success in a later course was determined by identifying students in the sample who were enrolled in and earned credit for a credit recovery course of interest and later enrolled in the next course in the subject sequence. Because some science and history courses can be taken out of sequence, only math and English courses were included in these analyses.

Graduation. A student was identified as having graduated based solely on the presence of a graduation flag in the administrative data.

On-time graduation. A student was identified as having graduated on time if her or his first year of enrollment in grade 9 could be identified, and her or his graduation year was within four years of that first matriculation year.

Box A3. Regression methods

Regression analysis for outcomes with many potential values. One type of regression analysis used in this study is ordinary least squares regression, which is used when the outcome of interest has many possible values—such as an exam score. For example, students in one school district might appear to be less likely to graduate on time than students in other districts based on their graduation rates alone, but when other aspects of their schooling that may have influenced their chances for graduation (such as family income level) are factored out mathematically, it may turn out that going to school in a certain district did not really affect graduation rates at all.

Regression analysis for outcome variables with only two potential values. Another type of regression analysis, logistic regression, was used when the outcome of interest had only two possible values—such as yes or no. This type of analysis generates predicted odds for whether the outcome occurred for students with certain characteristics, all else being equal. For example, if the outcome of interest is whether or not a student graduates on time, this kind of regression can generate the adjusted odds that different types of students (for example, English learner students, racial/ethnic minority students, students who live in rural communities) experienced that outcome by factoring out the influence of other characteristics.

Given that credit recovery takes place within definable clusters—such as individual districts and specific implementation years—the study team extended the analyses to investigate whether multilevel modeling options were required, but did not find evidence for the need for multilevel modeling techniques (for example, intraclass correlations were very low at <0.03 in most cases, as was the amount of variance, typically <1 percent, explained by three non-student-level grouping variables: grade, district, and year). Consequently, all results are reported for single-level ordinary least squares and logistic regressions.

Achievement outcomes and outcomes related to success in subsequent courses were analyzed independently by course, and also pooled across courses to increase statistical power. Because of the variety of course combinations students could take across their high school careers, other academic outcomes (such as graduation on time) were analyzed across all courses and not by specific credit recovery course.

Analyses of short-term outcomes. The student population for these analyses included all students who retook a state standardized end-of-course exam after completion of credit recovery. The population was limited by two factors. First, students who failed a course but initially passed the mandatory end-of-course exam did not have to retake the exam after completion of the credit recovery course. Second, end-of-course exams were limited to only a subset of the courses offered for credit recovery by NCVPS, and in some cases were limited to a subset of years (table A1).

The study team used a multivariate ordinary least squares regression to predict students' course-specific normalized end-of-course exam scores following NCVPS credit recovery participation. Also, multivariate logistic regressions predict one related binary dependent variable following students' participation in NCVPS credit recovery: whether the student subsequently reached proficiency in the same course's end-of-course exam. During the years of interest for this study, proficiency was designated by a 3 or 4 (on a four-point scale).

Because the scale and achievement level designations are the same across exams, these two dependent variables were modeled not only independently by course but also in aggregate.

Table A1. North Carolina Virtual Public School credit recovery courses with end-of-course exams, 2008/09–2011/12

Course	2008/09	2009/10	2010/11	2011/12
English I	✔	✔	✔	✔
Algebra I	✔	✔	✔	✔
Algebra II	✔	✔	✔	
Geometry	✔	✔		
Physical Science	✔	✔	✔	
Biology	[a]	✔	✔	✔
Civics and Economics	✔	✔	✔	
U.S. History	✔	✔	✔	

a. North Carolina administered Biology end-of-course exams in 2008/09, but North Carolina Virtual Public School did not offer a Biology credit recovery option that year.

Source: North Carolina Department of Public Instruction, n.d. a.

Short-term outcomes model example

End-of-Course Scaled Score: English I Retest =

$$\beta_0 + \beta_1 * \textit{Enroll in NCVPS Credit Recovery} + \beta_2 * \textit{Initial English I End-of-Course Scaled Score} + \beta_3 * \textit{English Learner} + \beta_4 * \textit{Economically Disadvantaged} + \beta_5 * \textit{Black} + \beta_6 * \textit{Hispanic} + \beta_7 * \textit{Asian} + \beta_8 * \textit{American Indian/Alaska Native} + \beta_9 * \textit{Hawaiian Native/Pacific Islander} + \beta_{10} * \textit{Multiracial} + \beta_{11} * \textit{Special Education Status} + \beta_{12} * \textit{Rural} + \beta_{13} * \textit{Female} + \beta_{14} * \textit{Grade in School} + \beta_{15} * \textit{Days in Attendance This School Year} + \beta_{16} * \textit{School Year} + \textit{error}.$$

Student Demonstrates Proficiency on End-of-Course English I Retest =

$$\textit{Log}\ \frac{\textit{Student Demonstrates Proficiency}}{1 - \textit{Student Demonstrates Proficiency}} = \beta_0 + \beta_1 * \textit{Enroll in NCVPS Credit Recovery} + \beta_2 * \textit{Initial English I End-of-Course Scaled Score} + \beta_3 * \textit{English Learner} + \beta_4 * \textit{Economically Disadvantaged} + \beta_5 * \textit{Black} + \beta_6 * \textit{Hispanic} + \beta_7 * \textit{Asian} + \beta_8 * \textit{American Indian/Alaska Native} + \beta_9 * \textit{Hawaiian Native/Pacific Islander} + \beta_{10} * \textit{Multiracial} + \beta_{11} * \textit{Special Education Status} + \beta_{12} * \textit{Rural} + \beta_{13} * \textit{Female} + \beta_{14} * \textit{Grade in School} + \beta_{15} * \textit{Days in Attendance This School Year} + \beta_{16} * \textit{School Year} + \textit{error}.$$

Analyses of mid- and longer-term outcomes. The population for these analyses included all students for whom dropout data or re-enrollment data were available after taking a credit recovery course. As with the previous research question, this population was limited by two factors.

First, because data for this study extend only through the 2011/12 school year, the analyses of multiyear outcomes such as eventual graduation were limited to those students for whom the study team had the longitudinal records necessary to answer each part of this research question. For example, a student who re-took an English I course during the 2011/12 school year does not have matching data about her or his success in 2012/13; similarly, a student who enters the dataset during grade 9 in the 2010/11 school year does not have subsequent graduation data.

Second, analysis of success in subsequent courses in a sequence is limited by the number of courses that are mandatory for high school graduation in North Carolina. For example, students who take Algebra I may complete their math requirements for graduation with that course, and therefore have no subsequent math course data. Analyses related to success in subsequent courses were limited to the Algebra I → Algebra II/Geometry sequence and the English I → English II → English III → English IV sequence.

All analyses for the components of this research question employed multivariate logistic regressions.

Mid- to longer-term outcomes model example

Student Graduates =

$$Log\ \frac{Student\ Graduates}{1 - Student\ Graduates} = \beta_0 + \beta_1 * Enroll\ in\ NCVPS\ Credit\ Recovery +$$
$$\beta_2 * English\ Learner + \beta_3 * Economically\ Disadvantaged + \beta_4 * Black + \beta_5 * Hispanic +$$
$$\beta_6 * Asian + \beta_7 * American\ Indian/Alaska\ Native + \beta_8 * Hawaiian\ Native/Pacific\ Islander +$$
$$\beta_9 * Multiracial + \beta_{10} * Special\ Education\ Status + \beta_{11} * Rural + \beta_{12} * Female +$$
$$\beta_{13} * Grade\ in\ School + \beta_{14} * Days\ in\ Attendance\ This\ School\ Year +$$
$$\beta_{15} * School\ Year + error.$$

Student Succeeds in English II after Completion of English I Credit Recovery =

$$Log\ \frac{Student\ Graduates}{1 - Student\ Graduates} = \beta_0 + \beta_1 * Enroll\ in\ NCVPS\ Credit\ Recovery +$$
$$\beta_2 * English\ Learner + \beta_3 * English\ I\ End\text{-}of\text{-}Course\ Retake\ Scaled\ Score +$$
$$\beta_4 * Economically\ Disadvantaged + \beta_5 * Black + \beta_6 * Hispanic + \beta_7 * Asian +$$
$$\beta_8 * American\ Indian/Alaska\ Native + \beta_9 * Hawaiian\ Native/Pacific\ Islander +$$
$$\beta_{10} * Multiracial + \beta_{11} * Special\ Education\ Status + \beta_{12} * Rural + \beta_{13} * Female +$$
$$\beta_{14} * Grade\ in\ School + \beta_{15} * Days\ in\ Attendance\ This\ School\ Year +$$
$$\beta_{16} * School\ Year + error.$$

Appendix B. Regression results referenced in the main text

This appendix includes results of selected regression analyses referenced in the main report. The raw analyses from which these tables were generated can be found in appendix C.

Table B1. Predicted success on North Carolina end-of-course exams after completing credit recovery, 2008/09–2011/12

Course	Odds ratio results Likelihood NCVPS credit recovery students demonstrated proficiency relative to other credit recovery students[a]
English I	Less likely
Algebra I	Less likely
Algebra II	Less likely
Geometry	Less likely
Physical Science	Less likely
Biology	Less likely
Civics and Economics	Less likely
U.S. History	Less likely
All courses combined	Less likely

	Predicted change in scaled scores	
	NCVPS credit recovery students relative to other credit recovery students[a]	Effect size for predicted change
English I	–0.7	0.0005
Algebra I	–1.6	0.0015
Algebra II	–2.1	0.0042
Geometry	–2.5	0.0048
Physical Science	–2.3	0.0036
Biology	–2.3	0.0027
Civics and Economics	–1.6	0.0024
U.S. History	–1.2	0.0009
All courses combined	–1.6	0.0018

NCVPS is North Carolina Virtual Public School.

a. All results are statistically significant. See appendix A for methodology details and appendix C for expanded results.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table B2. Predicted longer-term in-school outcomes after completing credit recovery in North Carolina, 2008/09–2011/12

Outcome	Statistically adjusted results: Likelihood NCVPS credit recovery students achieved longer term outcomes relative to other credit recovery students
Student re-enrolls following year	More likely[a]
Student passes next course in sequence:	
English II after English I credit recovery	Less likely
English III after English II credit recovery	Less likely
English IV after English III credit recovery	Less likely
Algebra II or Geometry, after Algebra I credit recovery	Less likely

NCVPS is North Carolina Virtual Public School.

a. Result is statistically significant. See appendix A for methodology details and appendix C for expanded results.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table B3. Predicted longer-term graduation outcomes after completing credit recovery in North Carolina, 2008/09–2011/12

Outcome	Statistically adjusted results: Likelihood NCVPS credit recovery students graduated relative to other credit recovery students
Student graduates	Less likely[a]
If student graduates, graduates on time (within four years)	More likely[a]

NCVPS is North Carolina Virtual Public School.

a. Result is statistically significant. See appendix A for methodology details and appendix C for expanded results.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table B4. Predicted short- and longer-term outcomes for Black students after completing North Carolina Virtual Public School credit recovery, 2008/09–2011/12

Outcome	Statistically adjusted results: Likelihood Black NCVPS credit recovery students achieved outcome relative to White NCVPS credit recovery students[a]
Short-term outcome	
Student demonstrates proficiency, all courses combined	Less likely
Longer-term outcome	
Student re-enrolls following year	More likely
Student passes next course in sequence (all courses combined)	More likely
Student graduates	More likely
If student graduates, graduates on time (within four years)	More likely

NCVPS is North Carolina Virtual Public School.

a. All results are statistically significant. See appendix A for methodology details and appendix C for expanded results.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table B5. Predicted short- and longer-term outcomes after completing North Carolina Virtual Public School credit recovery, by economic disadvantage status, 2008/09–2011/12

Outcome	Predicted change in scaled scores: NCVPS credit recovery students who were economically disadvantaged relative to other NCVPS credit recovery students	Effect size
Short-term continuous outcome		
All courses combined	–0.42[a]	0.0014

Outcome	Statistically adjusted results: Likelihood NCVPS credit recovery students who were economically disadvantaged achieved outcome relative to other NCVPS credit recovery students
Short-term binary outcome	
Student demonstrates proficiency, all courses combined	Less likely
Longer-term binary outcome	
Student re-enrolls following year	Less likely[a]
Student passes next course in sequence (all courses combined)	No difference
Student graduates	Less likely[a]
If student graduates, graduates on time (within four years)	More likely[a]

NCVPS is North Carolina Virtual Public School.

a. Result is statistically significant. See appendix A for methodology details and appendix C for expanded results.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Appendix C. Detailed results of all regression analyses

This appendix includes tables of the raw results from all ordinary least squares regression analyses (analyses for which the outcome of interest can have several different values) and logistic regression analyses (analyses for which the outcome of interest has only two possible values) completed for this report, as described in appendix A. The general outcome tables in this appendix include the data used to construct the tables in appendix B.

Results of analyses of short-term outcomes

Table C1. Demonstration of proficiency on North Carolina end-of-course exam retest, all courses combined, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery student	0.6119	0.0273	***
First exam scaled score	1.1920	0.0017	***
English learner student	0.4920	0.0170	***
Economically disadvantaged	0.8822	0.0125	***
Black	0.5568	0.0086	***
Hispanic	0.9944	0.0280	
Asian	0.9513	0.0634	
American Indian/Alaskan Native	0.6382	0.0433	***
Hawaiian Native/Pacific Islander	0.9499	0.4351	
Multiracial	0.8796	0.0363	**
Students receiving special education services	0.5455	0.0097	***
Rural	0.9559	0.0130	***
Female	0.9013	0.0120	***
Grade	1.0912	0.0068	***
Attendance	1.0058	0.0003	***
Year	0.9945	0.0060	

* significant at $p < .05$; ** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 125,560; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C2. Demonstration of proficiency on North Carolina end-of-course exam retest, English I, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery English I student	0.8452	0.0892	
First English I exam scaled score	1.2268	0.0047	***
English learner student	0.3402	0.0287	***
Economically disadvantaged	0.7986	0.0303	***
Black	0.5228	0.0208	***
Hispanic	1.0570	0.0781	
Asian	0.6444	0.1362	*
American Indian/Alaskan Native	0.4845	0.0764	***
Hawaiian Native/Pacific Islander	2.3714	2.2086	
Multiracial	0.9118	0.1011	
Students receiving special education services	0.4860	0.0194	***
Rural	0.8793	0.0307	***
Female	0.9629	0.0343	
Grade	1.0231	0.0301	
Attendance	1.0037	0.0007	***
Year	0.9590	0.0138	**

* significant at $p < .05$, ** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 21,959; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C3. Demonstration of proficiency on North Carolina end-of-course exam retest, Algebra I, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery Algebra I student	0.6493	0.0554	***
First Algebra I exam scaled score	1.1904	0.0031	***
English learner student	0.5633	0.0351	***
Economically disadvantaged	0.9119	0.0235	***
Black	0.5328	0.0149	***
Hispanic	0.9360	0.0473	
Asian	0.8948	0.1162	
American Indian/Alaskan Native	0.6394	0.0772	***
Hawaiian Native/Pacific Islander	0.5283	0.4615	
Multiracial	0.8164	0.0574	**
Students receiving special education services	0.5566	0.0177	***
Rural	1.0041	0.0247	
Female	0.9627	0.0232	
Grade	0.9127	0.0130	***
Attendance	1.0074	0.0006	***
Year	1.0200	0.0102	

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 39,355; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C4. Demonstration of proficiency on North Carolina end-of-course exam retest, Algebra II, 2008/09–2010/11

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery Algebra II student	0.5781	0.0766	***
First Algebra II exam scaled score	1.1358	0.0060	***
English learner student	0.7671	0.1206	
Economically disadvantaged	0.9071	0.0478	
Black	0.6497	0.0366	***
Hispanic	0.9530	0.0953	
Asian	1.0341	0.1881	
American Indian/Alaskan Native	0.9393	0.2642	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	0.8565	0.1212	
Students receiving special education services	0.6565	0.0703	***
Rural	1.1662	0.0577	**
Female	1.0672	0.0519	
Grade	0.9379	0.0353	
Attendance	1.0083	0.0014	***
Year	1.1300	0.0326	***

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 7,923; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C5. Demonstration of proficiency on North Carolina end-of-course exam retest, Geometry, 2008/09–2009/10

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery Geometry student	0.3750	0.0765	***
First Geometry exam scaled score	1.1957	0.0081	***
English learner student	0.8332	0.1527	
Economically disadvantaged	0.9382	0.0604	
Black	0.5781	0.0422	***
Hispanic	0.7705	0.0988	*
Asian	0.8333	0.2183	
American Indian/Alaskan Native	0.6738	0.2473	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	0.7005	0.1231	*
Students receiving special education services	0.5906	0.0740	***
Rural	0.9905	0.0610	
Female	0.9119	0.0553	
Grade	0.8128	0.0356	***
Attendance	1.0097	0.0019	***
Year	1.3700	0.0720	***

* significant at $p < .05$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 5,579; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C6. Demonstration of proficiency on North Carolina end-of-course exam retest, Physical Science, 2008/09–2010/11

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery Physical Science student	0.5065	0.0868	***
First Physical Science exam scaled score	1.1684	0.0062	***
English learner student	0.6928	0.1089	**
Economically disadvantaged	0.9987	0.0581	
Black	0.5646	0.0356	***
Hispanic	1.0941	0.1422	
Asian	1.0670	0.3031	
American Indian/Alaskan Native	0.9433	0.3249	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	1.2004	0.2495	
Students receiving special education services	0.5637	0.0412	***
Rural	0.9508	0.0558	
Female	1.0235	0.0567	
Grade	1.3040	0.0470	***
Attendance	1.0058	0.0011	***
Year	0.9720	0.0318	

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 7,002; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C7. Demonstration of proficiency on North Carolina end-of-course exam retest, Biology, 2009/10–2011/12

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery Biology student	0.4432	0.0615	***
First Biology exam scaled score	1.1830	0.0044	***
English learner student	0.4868	0.0409	***
Economically disadvantaged	0.9196	0.0331	**
Black	0.5579	0.0225	***
Hispanic	1.0224	0.0707	
Asian	1.0702	0.1916	
American Indian/Alaskan Native	0.5078	0.0951	***
Hawaiian Native/Pacific Islander	0.9995	0.9303	
Multiracial	0.8562	0.0912	
Students receiving special education services	0.6087	0.0269	***
Rural	1.0051	0.0341	
Female	0.8934	0.0297	***
Grade	1.1594	0.0242	***
Attendance	1.0046	0.0008	***
Year	1.0075	0.0150	

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 18,983; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino. North Carolina administered Biology end-of-course exams in 2008/09, but NCVPS did not offer a Biology credit recovery option that year.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C8. Demonstration of proficiency on North Carolina end-of-course exam retest, Civics and Economics, 2008/09–2010/11

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery Civics and Economics student	0.5594	0.0682	***
First Civics and Economics exam scaled score	1.2280	0.0056	***
English learner student	0.5140	0.0494	***
Economically disadvantaged	0.9271	0.0377	
Black	0.5071	0.0231	***
Hispanic	1.0067	0.0710	
Asian	0.7747	0.1368	
American Indian/Alaskan Native	0.7878	0.1398	
Hawaiian Native/Pacific Islander	0.2671	0.3674	
Multiracial	0.9632	0.1180	
Students receiving special education services	0.6452	0.0325	***
Rural	0.8512	0.0335	***
Female	0.7182	0.0272	***
Grade	1.1803	0.0298	***
Attendance	1.0051	0.0010	***
Year	0.9249	0.0197	***

*** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 16,152; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C9. Demonstration of proficiency on North Carolina end-of-course exam retest, U.S. History, 2008/09–2010/11

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery U.S. History student	0.6270	0.1121	**
First U.S. History exam scaled score	1.2148	0.0069	***
English learner student	0.6391	0.0996	**
Economically disadvantaged	0.9121	0.0485	
Black	0.7587	0.0442	***
Hispanic	1.0180	0.1221	
Asian	1.5476	0.3958	
American Indian/Alaskan Native	1.0146	0.2905	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	0.9106	0.1596	
Students receiving special education services	0.6588	0.0485	***
Rural	0.9541	0.0498	
Female	0.7030	0.0355	***
Grade	1.2519	0.0650	***
Attendance	1.0055	0.0011	***
Year	1.0828	0.0309	**

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 8,603; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C10. Demonstration of proficiency on North Carolina end-of-course exam retest, all courses combined, North Carolina Virtual Public School only, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
First exam scaled score	1.1670	0.0134	***
English learner student	0.4157	0.1256	**
Economically disadvantaged	0.9312	0.0968	
Black	0.7891	0.0922	*
Hispanic	1.2480	0.2661	
Asian	1.4619	0.9587	
American Indian/Alaskan Native	1.2210	0.7705	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	0.6726	0.1665	
Students receiving special education services	0.6855	0.0897	**
Rural	0.8765	0.0934	
Female	1.0328	0.1035	
Grade	0.8593	0.0407	***
Attendance	1.0089	0.0027	***
Number of end-of-course exams failed first year	0.8893	0.0662	
Number of end-of-course exams failed this year	0.3230	0.0205	***
Year	0.8003	0.0415	***

* significant at $p < .05$, ** significant at $p < .01$, *** significant at $p < .001$.

Note: Number of course records = 2,924; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C11. Exam score retest coefficients for North Carolina end-of-course exam, all courses combined, 2008/09–2011/12

Variable	Coefficient	Standard error	Significance	Effect size
NCVPS credit recovery student	–1.5813	0.1084	***	0.0017
First exam scaled score	–0.4149	0.0031	***	0.1277
English learner student	–2.3696	0.0846	***	0.0064
Economically disadvantaged	–0.4153	0.0363	***	0.0011
Black	–1.7502	0.0399	***	0.0155
Hispanic	–0.0381	0.0726		0.0000
Asian	–0.0789	0.1646		0.0000
American Indian/Alaskan Native	–1.0875	0.1720	***	0.0003
Hawaiian Native/Pacific Islander	0.5978	1.1259		0.0000
Multiracial	–0.4033	0.1080	***	0.0001
Students receiving special education services	–1.9382	0.0421	***	0.0171
Rural	–0.1181	0.0342	***	0.0001
Female	–0.0721	0.0338	*	0.0000
Grade	0.5536	0.0157	***	0.0101
Attendance	0.0184	0.0008	***	0.0047
Year	–0.2469	0.0153	***	0.0021

* significant at $p < .05$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 121,802; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C12. Exam score retest coefficients for North Carolina end-of-course exam, English I, 2008/09–2011/12

Variable	Coefficient	Standard error	Significance	Effect size
NCVPS credit recovery English I student	–0.6914	0.2240	**	0.0005
First English I exam scaled score	0.5632	0.0066	***	0.2547
English learner student	–2.8471	0.1747	***	0.0124
Economically disadvantaged	–0.3885	0.0831	***	0.0010
Black	–1.6734	0.0873	***	0.0171
Hispanic	–0.0337	0.1622		0.0000
Asian	–1.2038	0.4010	**	0.0004
American Indian/Alaskan Native	–1.7592	0.3296	***	0.0014
Hawaiian Native/Pacific Islander	2.1655	2.3198		0.0000
Multiracial	–0.4628	0.2524		0.0002
Students receiving special education services	–2.1234	0.0809	***	0.0316
Rural	–0.3657	0.0745	***	0.0011
Female	0.2488	0.0773	***	0.0005
Grade	0.0905	0.0626		0.0001
Attendance	0.0124	0.0015	***	0.0033
Year	–0.2179	0.0312	***	0.0023

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 21,095; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C13. Exam score retest coefficients for North Carolina end-of-course exam, Algebra I, 2008/09–2011/12

Variable	Coefficient	Standard error	Significance	Effect size
NCVPS credit recovery Algebra I student	–1.5675	0.2094	***	0.0015
First Algebra I exam scaled score	0.5945	0.0057	***	0.2207
English learner student	–1.9409	0.1575	***	0.0039
Economically disadvantaged	–0.4483	0.0670	***	0.0012
Black	–1.8629	0.0735	***	0.0164
Hispanic	–0.1579	0.1344		0.0000
Asian	–0.0343	0.3271		0.0000
American Indian/Alaskan Native	–0.7375	0.3101	*	0.0001
Hawaiian Native/Pacific Islander	1.4281	2.1019		0.0000
Multiracial	–0.3806	0.1880	*	0.0001
Students receiving special education services	–1.9267	0.0760	***	0.0164
Rural	–0.0781	0.0631		0.0000
Female	0.1356	0.0622	*	0.0001
Grade	–0.1638	0.0360	***	0.0005
Attendance	0.0228	0.0015	***	0.0061
Year	–0.1696	0.0260	***	0.0011

* significant at $p < .05$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 38,435; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C14. Exam score retest coefficients for North Carolina end-of-course exam, Algebra II, 2008/09–2010/11

Variable	Coefficient	Standard error	Significance	Effect size
NCVPS credit recovery Algebra II student	–2.1185	0.3736	***	0.0042
First Algebra II exam scaled score	0.4699	0.0134	***	0.1375
English learner student	–0.5639	0.4484		0.0002
Economically disadvantaged	–0.2699	0.1477		0.0004
Black	–1.7126	0.1584	***	0.0149
Hispanic	0.0087	0.2798		0.0000
Asian	0.6118	0.4987		0.0002
American Indian/Alaskan Native	–1.1113	0.7615		0.0003
Hawaiian Native/Pacific Islander	6.7147	4.1671		0.0003
Multiracial	–0.7203	0.3956		0.0004
Students receiving special education services	–1.3584	0.2997	***	0.0027
Rural	0.5888	0.1380	***	0.0024
Female	0.2037	0.1360		0.0003
Grade	–0.3297	0.1040	**	0.0013
Attendance	0.0254	0.0037	***	0.0060
Year	0.1357	0.0806		0.0004

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 7,723; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C15. Exam score retest coefficients for North Carolina end-of-course exam, Geometry, 2008/09–2009/10

Variable	Coefficient	Standard error	Significance	Effect size
NCVPS credit recovery Geometry student	–2.5143	0.4906	***	0.0048
First Geometry exam scaled score	0.5531	0.0147	***	0.2061
English learner student	–1.0904	0.4674	**	0.0010
Economically disadvantaged	–0.3105	0.1634		0.0007
Black	–1.8786	0.1855	***	0.0184
Hispanic	–0.3075	0.3226		0.0002
Asian	0.1238	0.6478		0.0000
American Indian/Alaskan Native	–0.1430	0.9617		0.0000
Hawaiian Native/Pacific Islander	0.0000	(omitted)		
Multiracial	–1.4508	0.4521	***	0.0019
Students receiving special education services	–1.7553	0.3039	***	0.0061
Rural	–0.0063	0.1560		0.0000
Female	–0.4334	0.1538	**	0.0015
Grade	–0.7795	0.1106	***	0.0090
Attendance	0.0269	0.0046	***	0.0061
Year	0.7930	0.1325	***	0.0065

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 5,482; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C16. Exam score retest coefficients for North Carolina end-of-course exam, Physical Science, 2008/09–2010/11

Variable	Coefficient	Standard error	Significance	Effect size
NCVPS credit recovery Physical Science student	–2.2940	0.4747	***	0.0035
First Physical Science exam scaled score	0.5607	0.0141	***	0.1953
English learner student	–1.3324	0.4580	**	0.0013
Economically disadvantaged	0.2128	0.1682		0.0002
Black	–1.9462	0.1832	***	0.0169
Hispanic	–0.0039	0.3798		0.0000
Asian	0.7624	0.8312		0.0001
American Indian/Alaskan Native	1.5406	1.0414		0.0003
Hawaiian Native/Pacific Islander	0.0000	(omitted)		.
Multiracial	0.9745	0.5941		0.0004
Students receiving special education services	–1.8633	0.2029	***	0.0127
Rural	–0.0922	0.1686		0.0000
Female	–0.2689	0.1604		0.0004
Grade	0.9829	0.1018	***	0.0140
Attendance	0.0209	0.0032	***	0.0064
Year	–0.3099	0.0942	***	0.0016

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 6,577; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C17. Exam score retest coefficients for North Carolina end-of-course exam, Biology, 2009/10–2011/12

Variable	Coefficient	Standard error	Significance	Effect size
NCVPS credit recovery Biology student	–2.2981	0.3256	***	0.003
First Biology exam scaled score	0.5665	0.0084	***	0.199
English learner student	–2.5204	0.2105	***	0.008
Economically disadvantaged	–0.2367	0.0926	*	0.000
Black	–1.7734	0.1048	***	0.015
Hispanic	–0.0332	0.1796		0.000
Asian	–0.0512	0.4520		0.000
American Indian/Alaskan Native	–1.3790	0.4904	**	0.000
Hawaiian Native/Pacific Islander	0.8488	2.3265		0.000
Multiracial	–0.3020	0.2814		0.000
Students receiving special education services	–1.5127	0.1083	***	0.010
Rural	–0.0714	0.0866		0.000
Female	–0.2301	0.0852	**	0.000
Grade	0.4572	0.0527	***	0.004
Attendance	0.0170	0.0020	***	0.004
Year	–0.1139	0.0381	**	0.000

* significant at $p < .05$, ** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 18,444; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino. North Carolina administered Biology end-of-course exams in 2008/09, but NCVPS did not offer a Biology credit recovery option that year.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C18. Exam score retest coefficients for North Carolina end-of-course exam, Civics and Economics, 2008/09–2010/11

Variable	Coefficient	Standard error	Significance	Effect size
NCVPS credit recovery Civics and Economics student	–1.5980	0.2620	***	0.0024
First Civics and Economics exam scaled score	0.5973	0.0084	***	0.2416
English learner student	–2.0201	0.2124	***	0.0057
Economically disadvantaged	–0.4262	0.0942	***	0.0013
Black	–1.7772	0.1060	***	0.0175
Hispanic	0.0778	0.1864		0.0000
Asian	–1.3884	0.3855	***	0.0008
American Indian/Alaskan Native	–1.3732	0.4132	***	0.0007
Hawaiian Native/Pacific Islander	–5.7044	2.6668	*	0.0003
Multiracial	–0.7231	0.2936	*	0.0004
Students receiving special education services	–1.4141	0.1086	***	0.0106
Rural	–0.2882	0.0888	***	0.0007
Female	–0.6007	0.0862	***	0.0031
Grade	0.5911	0.0561	***	0.0070
Attendance	0.0176	0.0021	***	0.0043
Year	–0.4720	0.0485	***	0.0060

* significant at $p < .05$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 15,768; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C19. Exam score retest coefficients for North Carolina end-of-course exam, U.S. History, 2008/09–2010/11

Variable	Coefficient	Standard error	Significance	Effect size
NCVPS credit recovery U.S. History student	–1.1505	0.4301	**	0.0009
First U.S. History exam scaled score	0.6194	0.0116	***	0.2579
English learner student	–2.0739	0.3825	***	0.0035
Economically disadvantaged	–0.4058	0.1356	**	0.0011
Black	–1.1635	0.1497	***	0.0073
Hispanic	–0.0538	0.3024		0.0000
Asian	1.2477	0.6100	*	0.0005
American Indian/Alaskan Native	0.3617	0.7166		0.0000
Hawaiian Native/Pacific Islander	–0.8787	5.7135		0.0000
Multiracial	–0.2082	0.4420		0.0000
Students receiving special education services	–1.5188	0.1789	***	0.0087
Rural	–0.1445	0.1313		0.0001
Female	–0.8950	0.1280	***	0.0059
Grade	0.8250	0.1289	***	0.0049
Attendance	0.0160	0.0026	***	0.0044
Year	0.1485	0.0726	*	0.0005

* significant at $p < .05$, ** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of course records = 8,278; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C20. Exam score retest coefficients for North Carolina end-of-course exam, all courses combined, North Carolina Virtual Public School only, 2008/09–2011/12

Variable	Coefficient	Standard error	Significance	Effect size
First exam scaled score	–0.5385	0.0199	***	0.2040
English learner student	–1.5269	0.5401	**	0.0028
Economically disadvantaged	–0.4196	0.2092	*	0.0014
Black	–0.6321	0.2359	**	0.0025
Hispanic	0.4094	0.4335		0.0003
Asian	–0.5659	1.2925		0.0001
American Indian/Alaskan Native	–0.1070	1.1768		0.0000
Hawaiian Native/Pacific Islander	–5.8339	5.2131		0.0004
Multiracial	0.4605	0.5223		0.0003
Students receiving special education services	–1.2887	0.2436	***	0.0097
Rural	–0.0108	0.2089		0.0000
Female	0.0983	0.1988		0.0001
Grade	0.1748	0.0935		0.0012
Attendance	0.0202	0.0048	***	0.0063
Number of end-of-course exams failed first year	–0.2151	0.1380		0.0008
Number of end-of-course exams failed this year	–1.8040	0.0982	***	0.1056
Year	–0.7124	0.1036	***	0.0163

* significant at $p < .05$, ** significant at $p < .01$, *** significant at $p < .001$.

Note: Number of course records = 2,876; students take a retest only if they do not reach proficiency on first exam. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C21. Success in English II after English I credit recovery in North Carolina, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery English I student	0.9524	0.0856	
Scaled score, English I	1.0194	0.0026	***
English learner student	1.3035	0.1102	**
Economically disadvantaged	0.9977	0.0382	
Black	1.0461	0.0421	
Hispanic	0.8941	0.0613	
Asian	2.0070	0.4441	**
American Indian/Alaskan Native	1.1632	0.1593	
Hawaiian Native/Pacific Islander	0.1719	0.2182	
Multiracial	1.0101	0.1082	
Students receiving special education services	1.1172	0.0463	**
Rural	1.1437	0.0404	***
Female	1.5293	0.0558	***
Grade	1.7563	0.0493	***
Attendance	1.0090	0.0006	***
Year	0.9600	0.0152	*

* significant at $p < .05$, ** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Success means that student earned credit for subsequent course. Number of students = 17,346. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C22. Success in English III after English II credit recovery in North Carolina, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery English II student	0.9399	0.0816	
Scaled score, English I	1.0184	0.0036	***
English learner student	1.1399	0.1496	
Economically disadvantaged	0.9985	0.0461	
Black	1.0568	0.0533	
Hispanic	0.9388	0.0756	
Asian	0.7388	0.1582	
American Indian/Alaskan Native	2.1235	0.3757	***
Hawaiian Native/Pacific Islander	0.5759	0.7119	
Multiracial	0.9019	0.1083	
Students receiving special education services	0.9397	0.0576	
Rural	0.9177	0.0411	
Female	1.3983	0.0630	***
Grade	1.6372	0.0495	***
Attendance	1.0100	0.0008	***
Year	0.9835	0.0245	

*** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Success means that student earned credit for subsequent course. Number of students = 11,845. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C23. Success in English IV after English III credit recovery in North Carolina, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery English III student	0.9049	0.1197	
Scaled score, English I	1.0045	0.0057	
English learner student	1.0170	0.2252	
Economically disadvantaged	0.8707	0.0659	
Black	1.2199	0.1038	*
Hispanic	1.1393	0.1494	
Asian	1.0382	0.3484	
American Indian/Alaskan Native	0.7427	0.1888	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	0.8460	0.1556	
Students receiving special education services	1.1138	0.1241	
Rural	1.1349	0.0831	
Female	1.3927	0.1057	***
Grade	1.3296	0.0429	***
Attendance	1.0081	0.0011	***
Year	1.1977	0.0690	**

* significant at $p < .05$, ** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Success means that student earned credit for subsequent course. Number of students = 7,840. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C24. Success in Algebra II or Geometry after Algebra I credit recovery in North Carolina, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery Algebra I student	0.8774	0.0863	
Scaled score, Algebra I	1.0460	0.0023	***
English learner student	1.0654	0.0875	
Economically disadvantaged	0.8922	0.0297	***
Black	0.9158	0.0337	*
Hispanic	0.9058	0.0535	
Asian	1.0985	0.1733	
American Indian/Alaskan Native	1.1183	0.1770	
Hawaiian Native/Pacific Islander	0.7115	0.6621	
Multiracial	0.8104	0.0685	*
Students receiving special education services	1.0055	0.0446	
Rural	1.0743	0.0335	*
Female	1.2970	0.0398	***
Grade	1.0073	0.0007	***
Attendance	1.3010	0.0262	***
Year	0.9885	0.0153	

* significant at $p < .05$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Success means that student earned credit for subsequent course. Number of students = 20,167. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C25. Success in subsequent course in sequence, all courses combined, North Carolina Virtual Public School only, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
Scaled score, English I or Algebra I	1.0185	0.0065	**
English learner student	0.9161	0.2113	
Economically disadvantaged	1.0015	0.0778	
Black	1.2598	0.1121	**
Hispanic	1.0077	0.1445	
Asian	0.8726	0.3552	
American Indian/Alaskan Native	0.6642	0.2221	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	1.2425	0.2479	
Students receiving special education services	0.9963	0.0975	
Rural	1.1299	0.0852	
Female	1.3878	0.1055	***
Grade	1.5086	0.0615	***
Attendance	1.0074	0.0015	***
Number of end-of-course exams failed first year	1.0054	0.0553	
Number of end-of-course exams failed this year	0.8350	0.0353	***
Year	0.9593	0.0423	

** significant at $p < .01$, *** significant at $p < .001$.

Note: Success means that student earned credit for subsequent course. Number of students = 3,571. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C26. Re-enrollment in school year following credit recovery in North Carolina, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery student	1.5909	0.0633337	***
English learner student	0.6758	0.0330	***
Economically disadvantaged	0.7196	0.0151	***
Black	1.3940	0.0311	***
Hispanic	1.3478	0.0535	***
Asian	1.5830	0.1507	***
American Indian/Alaskan Native	1.5079	0.1303	***
Hawaiian Native/Pacific Islander	1.4344	0.7492	
Multiracial	1.2413	0.0701	***
Students receiving special education services	0.7663	0.0189	***
Rural	1.0299	0.0203	
Female	1.1428	0.0225	***
Grade	0.7380	0.0079	***
Attendance	1.0408	0.0003	***
Year	0.4013	0.0043	***

*** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of students = 178,232. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C27. Graduation after completion of at least one credit recovery course in North Carolina

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery student	0.6704	0.0295	***
English learner student	0.6292	0.0359	***
Economically disadvantaged	0.6599	0.0147	***
Black	1.6172	0.0390	***
Hispanic	1.3160	0.0560	***
Asian	2.2554	0.2305	***
American Indian/Alaskan Native	1.3729	0.1307	***
Hawaiian Native/Pacific Islander	1.4244	0.7508	
Multiracial	1.0665	0.0666	
Students receiving special education services	0.6676	0.0188	***
Rural	0.8409	0.0179	***
Female	1.4214	0.0301	***
Grade	4.8377	0.0479	***
Attendance	1.0305	0.0003	***
Year	1.9207	0.0192	***

*** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: Number of students = 122,307. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C28. On-time graduation after completion of at least one credit recovery course in North Carolina

Variable	Odds ratio	Standard error	Significance
NCVPS credit recovery student	1.4033	0.0459	***
English learner student	0.4677	0.0241	***
Economically disadvantaged	1.2983	0.0217	***
Black	0.8633	0.0156	***
Hispanic	1.2528	0.0373	***
Asian	1.0278	0.0650	
American Indian/Alaskan Native	1.3406	0.0855	***
Hawaiian Native/Pacific Islander	1.7777	0.5589	
Multiracial	1.2168	0.0536	***
Students receiving special education services	0.9742	0.0232	
Rural	1.0553	0.0165	***
Female	1.0476	0.0161	**
Grade	0.7132	0.0069	***
Attendance	1.0065	0.0004	***

** significant at $p < .01$, *** significant at $p < .001$.

NCVPS is North Carolina Virtual Public School.

Note: On-time graduation means graduation within four years of entering high school as a grade 9 student. Year variable excluded because more than 95 percent of viable observations were for 2011/12. Number of students = 94,828. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C29. Re-enrollment in school year following credit recovery, North Carolina Virtual Public School only, 2008/09–2011/12

Variable	Odds ratio	Standard error	Significance
English learner student	0.7087	0.1658	
Economically disadvantaged	0.6999	0.0595	***
Black	1.4754	0.1406	***
Hispanic	1.7552	0.2915	***
Asian	1.1092	0.5087	
American Indian/Alaskan Native	1.3689	0.6858	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	1.6034	0.3591	*
Students receiving special education services	0.7855	0.0845	*
Rural	0.8330	0.0693	*
Female	1.0566	0.0870	
Grade	0.6181	0.0277	***
Attendance	1.0352	0.0013	***
Number of end-of-course exams failed first year	0.6301	0.0331	***
Number of end-of-course exams failed this year	1.5197	0.0764	***
Year	0.2233	0.0138	***

* significant at $p < .05$, *** significant at $p < .001$.

Note: Number of students = 12,854. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C30. Graduation after completion of at least one credit recovery course, North Carolina Virtual Public School only

Variable	Odds ratio	Standard error	Significance
English learner student	0.6986	0.1719	
Economically disadvantaged	0.7107	0.0594	***
Black	1.8740	0.1770	***
Hispanic	1.4122	0.2312	*
Asian	1.6038	0.8081	
American Indian/Alaskan Native	1.1095	0.6358	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	1.2953	0.2917	
Students receiving special education services	0.7770	0.0863	*
Rural	0.9959	0.0828	
Female	1.3003	0.1047	***
Grade	3.4822	0.1293	***
Attendance	1.0244	0.0011	***
Number of end-of-course exams failed first year	1.1504	0.0561	**
Number of end-of-course exams failed this year	0.6922	0.0330	***
Year	1.7785	0.0832	***

* significant at $p < .05$, ** significant at $p < .01$, *** significant at $p < .001$.

Note: Number of students = 6,421. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Table C31. On-time graduation after completion of at least one credit recovery course, North Carolina Virtual Public School only

Variable	Odds ratio	Standard error	Significance
English learner student	1.0599	0.2874	
Economically disadvantaged	1.3331	0.0968	***
Black	1.2523	0.1014	**
Hispanic	1.2906	0.1690	
Asian	1.1461	0.4253	
American Indian/Alaskan Native	1.4541	0.5608	
Hawaiian Native/Pacific Islander	1.0000	(omitted)	
Multiracial	1.6842	0.2968	**
Students receiving special education services	1.3446	0.1430	**
Rural	0.9095	0.0638	
Female	1.3005	0.0886	***
Grade	0.7808	0.0323	***
Attendance	1.0088	0.0014	***
Number of end-of-course exams failed first year	0.7651	0.0338	***
Number of end-of-course exams failed this year	0.2110	0.0205	***

** significant at $p < .01$, *** significant at $p < .001$.

Note: On-time graduation means graduation within four years of entering high school as a grade 9 student. Year variable excluded because more than 95 percent of viable observations were for 2011/12. Number of students = 4,744. Black includes African American; Hispanic includes Latino.

Source: Authors' analysis of administrative data provided by the Education Research Data Center.

Appendix D. Interview protocols for third-party vendors

This appendix includes the telephone interview protocol used to collect data for the descriptions of each of the seven third-party credit recovery vendor programs.

Consent to participate in interview and introduction

Good [MORNING/AFTERNOON]. My name is [NAME]. I am a [RESEARCH ASSOCIATE/RESEARCH SCHOLAR] at the Friday Institute for Educational Innovation at North Carolina State University.

We are conducting a study of the North Carolina Virtual Public School's online credit recovery program for high school students.

The reason we have asked you to talk to us today is because, according to our records, at least one North Carolina school district has enrolled students in courses offered by your organization as a means of helping them to recover credit for a course or courses they had failed. Consequently, we believe that you can help us understand more about the context of online credit recovery in North Carolina.

During this short interview, I will ask you to share with us some basic information about your organization and the services you currently provide or have provided in the recent past to North Carolina school districts.

Your participation in this study is voluntary. Because your name will not be associated with any of the information you provide, there is minimal risk to you as a result of participating in this study. In addition, whether you decide to participate or not will not affect your organization's right to offer services to North Carolina school districts.

The information in the study records will be kept confidential to the full extent allowed by law. Your responses will not be linked in any way to your name. In addition, no direct reference will be made in oral or written reports that could link you to the study.

Questions

1. Since the 2008/09 school year, how many North Carolina school districts have enrolled students in courses your organization offers, with the explicit intent of helping those students recover credit for courses they previously failed?

    a. [IF ABLE TO DISTINGUISH USE OF COURSES FOR CREDIT RECOVERY] Can you provide for us either an exact or estimated count per school district of the number of students enrolled in those courses for each school year from 2008/09 through 2011/12?

    b. [IF UNABLE TO DISTINGUISH USE OF COURSES FOR CREDIT RECOVERY] If you are willing to do so, can you estimate how many of those enrollments were for credit recovery, per school district, for each school year from 2008/09 through 2011/12?

2. In which of your courses did North Carolina students enroll between 2008/09 and 2011/12?

3. During the time period in question, did your organization's approach to online learning require student participation for an entire semester/year in order to earn credit, or was credit based on mastery, regardless of length of participation?

4. During the time period in question, were your courses student-driven or teacher-led? In other words, did students set their own learning pace, or did they follow a schedule set by an online teacher?

5. During the time period in question, were your course offerings synchronous, asynchronous, blended (i.e., a mix of synchronous and asynchronous), or some mix of some or all of these?

6. During the time period in question, what was your organization's typical per-student, per-course charge to a district for enrollment in your courses?

Notes

1. Before the 2011/12 school year, NCVPS courses were provided at no cost to districts. During the 2011/12 school year the NCVPS funding formula was changed to require school districts to return to the state part of their fiscal year allotments equivalent to the cost of educating each of their students enrolled in NCVPS courses (North Carolina General Assembly, 2011). Previously, student enrollment in NCVPS classes largely did not affect district funding. Because of this change, individual district responses in terms of students allowed to enroll in NCVPS courses (including credit recovery courses) varied, making student enrollment patterns in credit recovery in some districts after 2011/12 very different from enrollment in previous years. Because the full impact of the change on enrollment is not yet clear, the study limited data analysis to the years preceding the change. As a clearer understanding of the impact of the change across districts and student groups on credit recovery enrollment is developed, researchers can reconsider inclusion of data from later years.
2. Because of limitations in the ability to identify all third-party online credit recovery students (see box A1 in appendix A), the study does not report demographic information about those students, as the identifiable students may not be demographically representative of all third-party online credit recovery students. These students are, however, included in the analyses for research questions 2 and 3 (which combine data for all identifiable non-NCVPS credit recovery students), as they are clearly identifiable as participants in at least one of the non-NCVPS credit recovery programs.
3. Most third-party vendors do not enroll students in a program but rather offer full access to their products with limitations tied to individual students' scope of use. Schools typically have the option to purchase access either for a single student or for multiple students (that is, school-wide access), with those students then able to access a certain number of resources (up to four courses) at a given time. Some vendors allow full access to all their products without limitations.
4. Of the variables considered in these deeper analyses, the most reliable predictor of a student's achievement level or scaled score growth on the retest was her or his score the first time she or he took the exam (in other words, where she or he started academically before credit recovery)—not participation in a specific credit recovery option (see tables C11–C19 in appendix C).

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