Impact Evaluation of *ACCESS: A Culture Creating Effective Systems for Success*

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ACCESS
Final Impact Evaluation Report

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ABSTRACT

ACCESS, A Culture Creating Effective Systems for Success, was a three-year Investing in Innovation (i3) development grant funded by the Office of Innovation and Improvement, U.S. Department of Education. The *ACCESS* grant led the way for a districtwide redesign of educational practices based on the novel approach of embedding a culture of technology-based education (tech culture) within rural schools and the broader community, with an intentional effort to record, evaluate, refine, and disseminate an effective model for implementation across the state and nation. The impact evaluation included two studies that examined the effect of *ACCESS* on the academic achievement of students in grades 5 – 10 as measured by NC standardized End-of-Grade assessments and the American College Testing (ACT) standardized test. The middle grades study (Study1) used a comparative short interrupted time series (CSITS) design to assess the impact of the intervention on mathematics and reading achievement in grades 5 through 8 after two years of program exposure. The high school study (Study 2) used a quasi-experimental design (QED) to assess the impact of *ACCESS* on ACT composite scores taken in grade 10 after two years of program exposure. For both studies, we compared the outcomes of *ACCESS* participants with matched samples of non-participants in other NC school districts. Propensity score matching (PSM) was used to match *ACCESS* samples with comparison students at baseline; baseline equivalence was established all pre-test assessment measures. Both studies met What Works Clearinghouse (WWC) Group Design Standards with Reservations. The results indicated no statistically significant differences in achievement between the *ACCESS* treatment group and the business-as-usual comparison groups as measured by the ACT composite scores taken in grade 10 or NC End-of-Grades 5-8 standardized reading and mathematics exams. To contextualize the findings, researchers considered the duration of students' exposure to *ACCESS*, alignment between technology integration and NC standardized assessments, and contextual factors that may have narrowed the divide between MCS and other school districts from which comparison schools/samples were drawn. The report concludes with suggestions for future research and implications for education policy.

1. INTRODUCTION

ACCESS, A Culture Creating Effective Systems for Success, was a three-year Investing in Innovation (i3) development grant awarded to Montgomery County Schools (MCS) by the U.S. Department of Education (U.S. ED). The grant directly addressed U.S. ED's Priority 6: Serving Rural Communities and Priority 5: Effective Use of Technology (Subpart B). *ACCESS* supported a districtwide redesign of educational practices based on the novel approach of embedding a culture of technology-based education (tech culture) within schools and the community so that students could learn anytime and anywhere in MCS.

MCS is a rural, hilly, heavily forested area located amid the Uwharrie National Forest and Mountain Range, covering 491 square miles with many bus routes for students lasting up to two hours. The district qualified under the U.S. Department of Education's Rural and Low-Income School program and serves 4,141 students of whom 74% are economically disadvantaged. Additionally, the district has been designated as "low wealth" by the state with 21.8% of families living below the federal poverty level (compared to 12.4% statewide). The rural location of MCS and its physical geography (heavy forestation, mountainous terrain) presented challenges with access to wireless networks and consistency in digital connectivity. Additionally, the district experienced challenges recruiting and retaining highly-qualified instructors and providing opportunities for rigorous and advanced classes. As a districtwide initiative, *ACCESS* served all MCS students and teachers in grades K–12 with an intention to record, evaluate, refine, and disseminate an effective model for promoting student outcomes in rural locales across the state and nation.

1.1 Program Description

ACCESS was a novel approach compared with what had been attempted and studied nationally. Earlier initiatives implemented within rural schools included 1:1 device access (Butrymowicz, 2012; Kessler, 2011; Morell, 2012), blended and distance learning (Alliance for Excellent Education, 2013; Staker & Trotter, 2011), digital learning and assessment systems (NCDPI, 2014), mobile study halls (Dillon, 2010), and enhanced networking capabilities (Ardery, 2008; Slack, 2013). While these strategies were thoughtful solutions that worked to close the gaps in access common to many rural school districts, none of the initiatives were designed to redefine the way students learn and how educators teach to achieve long-term impact on the field of rural education. The *ACCESS* model (Figure 1) was a systematic attempt to provide solutions to address equity and access to resources for the broadest range of students, including those with diverse learning needs, within rural and under-resourced school districts (Best & Cohen, 2014; Hannum, Irvin, Banks, & Farmer, 2009; Jimerson, 2006).

Figure 1. The *ACCESS* Logic Model

KEY COMPONENTS	INDICATORS	INTERMEDIATE OUTCOMES
RESOURCES FOR SUPPORTING HIGH-QUALITY TEACHING AND LEARNING		**Enhanced Student Engagement:**
• Provide instruction anywhere, anytime via 1:1 Wi-Fi-based student devices	Number and percent of: • students with 1:1 devices • households acquiring discounted home Internet service • school buses offering internet access • new Wi-Fi "hotspots" added	• Increase personal, cognitive, and behavioral engagement • Decrease in students chronically absent (11-20 days) • Decreases in office disciplinary referrals • Decreases in suspensions and expulsions
EXPAND LONG-DISTANCE TEACHING AND LEARNING		**Enhanced Teacher Efficacy:**
• Expand the opportunities for students to be taught by effective teachers through distance learning; • Expand participation in rigorous college courses via the College and Career Promise Program; • Expand teacher participation in virtual PLCs; • Provide professional development to designated ACCESS Ambassador teachers on technology integration in the classroom; • Provide on-site coaching and integration support via Technology Facilitators.	Number and percent of: • distance learning courses offered at MCS high schools; • distance learning courses offered at MCS middle schools; • Senior students earning at least one college credit through the College and Career Promise Program; • teachers participating in virtual PLCs; • ACCESS Ambassador teachers participating in PD; • Training provided by on-site Technology Facilitators.	• Increase in the percentage of teachers meeting the International Society for Technology in Education standards • Increase in teachers' self-efficacy at using technology in the classroom • Increase teacher expectations of students' use and application of technology • Increased levels of communication and collaboration among educators
REAL-TIME ASSESSMENT DATA		**LONG-TERM OUTCOMES**
• Expand the use of the Learning Management System (LMS) to coordinate document transmission, feeds, sharing of lesson plans, student work, and access to assessment data in real time; • Students review their portfolio on-line 1:1 with a core course teacher.	Number and percent of: • teachers utilizing CANVAS LMS system; • students reviewing grades on-line with a core teacher at least twice per semester.	**Improved Student Achievement:** Significant improvement in student achievement as evidenced in C-SITS (with ES and MS students) and QED (with HS students) impact evaluations

ACCESS integrated three core components to demonstrate the impact of integrating high-quality blended learning technology and training on academic achievement and student engagement for rural students in grades K-12. Three core components were implemented districtwide:

1. Distribution and implementation of tech resources;
2. Expansion of long-distance teaching and learning; and
3. Expansion of the use of real-time assessment data.

The following describes the three key components and associated strategies that were implemented and evaluated in this study.

1.1.1 Distribution and implementation of tech resources.

ACCESS was designed to increased availability and use of educational technology, while simultaneously upgrading the density of our wireless network to support that technology within and beyond schools.

Reduced the student to digital learning device ratio. *ACCESS* enabled MCS to provide students with laptops at a 1:1 ratio by increasing the inventory of educational technology for grades K-12 (via laptops or tablets). For the duration of the three-year grant, 98% or more of eligible MCS students were assigned a laptop or tablet. Exceptions were made for students attending MCS alternative school due to the transient nature of the population. During Year 1, all students in grades K-12 were assigned a personal 1:1 device the district procured with Lenovo. Students in grades 3-12 were able to take their devices home to use; our K-2 students used their 1:1 tablet exclusively in the classroom. During the remaining years of the grant, all students in grades K-12 continued using the personal 1:1 device that was assigned to them by the district. In some of our schools, particularly older schools, the bandwidth was below the recommended levels of 10–25 Mbps per 100 concurrent users and the number of wireless access points was insufficient to support school-wide connectivity. MCS assessed each school's bandwidth capacity to support upgrades with sufficient access points before distributing devices.

Community hot-spots. *ACCESS* advanced the installation of free-use wireless (Wi-Fi) "hot-spots" throughout Montgomery County. Through partnerships with local businesses, MCS established 10 Wi-Fi hot-spots at local restaurants throughout our county which allowed rural students and families to have internet access during non-school hours.

Affordable home-based internet service. MCS leveraged a partnership with a high-speed internet service provider to offer qualified MCS families (based on income or homebound circumstances) the opportunity to receive home-based internet service at a reduced monthly rate; the rate was a substantial reduction from their standard price of

$19.95 per month. By the end of 2015, over 60 MCS households exercised this option. By the end of 2016, over 70 households were exercising this option. Free home wireless access was made available to pregnant or parenting teens for limited time periods via "air cards," sponsored by a host of local businesses.

Wireless internet service on school buses. *ACCESS* supported the installation of Wi-Fi on select MCS buses with routes longer than 45 minutes and on special education buses to enable mobile learning. Through the grant, the district equipped 12 buses with Wi-Fi. Eight bus routes within the district had durations of two hours or more. MCS equipped these buses, along with four others that serve exceptional children, with Wi-Fi. Wi-Fi on buses allowed students online access to complete homework assignments, work on class projects, and monitor their grades while in route.

1.1.2 Expansion of long-distance teaching and learning

ACCESS expanded opportunities for students to be taught by effective teachers through distance learning and facilitated a districtwide redesign of instructional practice to integrate work in elementary specialization and multi-classroom leadership with new distance learning strategies, allowing MCS access to highly effective teachers via technology.

Participation in rigorous college courses. *ACCESS* expanded participation in rigorous course work via the College and Career Promise program. The instructional redesign facilitated through *ACCESS* provided every MCS student with the opportunity to take courses typically unavailable in rural schools, such as remediation; rigorous and advanced classes (Latin, NC Governor's School for Science and Math); non-traditional subjects and opportunities of special interest to our diverse student body (AP Spanish Language and Culture); and additional postsecondary courses from a broader range of colleges and universities via the Career and College Promise program.

On-site coaching and integration support. Four digital learning coaches (DLCs; originally referred to as instructional technology specialists), were hired and assigned to schools in Year 1, one for each middle and high school. Also, our district leveraged Title I funding to hire three additional DLCs to support our six elementary schools, each serving two elementary schools. In the final year of the grant, four DLCs supported the district, each serving an increased number of schools.

DLCs were certified teachers with instructional technology expertise. Drawing on learning adult and student learning theories, they led professional learning development and extended that professional development with coaching that included content-specific lesson planning focused on effective use of technology, in-class demonstrations of technology, and occasional technology troubleshooting. DLCs were able to advance equity in technology use within schools and across the district by supporting professional learning communities.

DLCs received extensive professional development provided by Microsoft, Canvas, Nearpod, and The Friday Institute. Each DLC reported growing through the experience, amassing valuable expertise and experience that they used to build the capacity of teachers, schools, and the district. Throughout the grant, their roles changed from serving as a technician to serving as a learning coach in response to professional development, experience, and the evolving needs of teachers. A compilation of advice and best practices collected through interviews with DLCs in the final year of the grant appear in Appendix A.

Technology technicians (one for our middle schools and one for our high schools) were hired to provide ongoing assistance with the installation of hardware, diagnosis and repair, and maintaining technology to ensure proper functioning in support of student learning and teacher professional learning.

Professional development for *ACCESS* ambassadors, diplomats, and teachers. Cohorts of teachers within each school were designated as *ACCESS* ambassadors and diplomats. *ACCESS* ambassadors were charged with championing technology integration. Through a partnership with The Friday Institute for Educational Innovation (The Friday Institute), located within North Carolina State University, a total of 145 teachers from schools across the district were recruited and trained to be *ACCESS* ambassadors. The Friday Institute provided four full days of professional development in the use of technology in the classroom. A total of 24 teachers completed the diplomat's course, a supplemental training to the ambassador's program, that was self-paced and focused on a deeper dive into the integration of technology into the classroom curriculum. The Friday Institute also provided 30 hours of professional development for all district administrators.

Virtual professional learning communities (PLCs) and professional development for all teachers. Virtual PLCs were aimed at expanding the effectiveness of high-quality teachers across the district. Teachers convened monthly to learn together in support of vertical and horizontal alignment across the district. Teachers received technology professional development that focused on pedagogy as well as modeling tools that teachers could use with their students. Multiple approaches and mechanisms were tried that included real-time meetings using videoconferencing technology (limited by varying schedules across schools), structured asynchronous discussions, self-paced lessons, and asynchronous discussions facilitated by guided practice. By setting up Polycom units for each school, teachers collaborated across schools through PLCs. DLCs provided a minimum of 10 hours annually of local staff development.

Additionally, all teachers participated in two Learning Walks each year. Learning Walks allowed teachers to visit other classrooms in their school to observe and gather ideas to use in their classrooms. The learning walks ranged from general observations to focused observations. In the secondary grades, walks occurred during planning time. Between observations, led by DLCs, the group debriefed in the hallway. After walks teachers submitted reflections to DLCs and often sought each other out to learn more about what they observed. MCS also held a summer camp for teachers each year of the grant performance period. The summer camp allowed teachers to receive additional training on technology and best practices for technology integration.

Routine observations and walkthroughs provided data regarding the use of technology and pedagogy in the classroom. MCS developed a Technology Integration Walkthrough Tool to be used by DLCs and other administrators (see Appendix B). During the time that this was implemented within our schools, The Substitution, Augmentation, Modification, and Redefinition (SAMR) Model (Puentedura, 2003) level of implementation within classrooms increased from substitution and augmentation (within the domain of enhancement) to modification and redefinition (within the domain of transformation). In 2016-17, Modification and Redefinition were seen in 2.5% of walkthroughs. During 2017-18, this percentage increased to 5.5%.

1.1.3 Expand use of real-time assessment data

Learning Management Systems (LMS) provides teaching and learning opportunities that are highly flexible. Through the use of online platforms students can participate in classes and complete coursework at their own pace, offering blended, personalized learning during the regular school day or outside of a traditional setting and timeframe. The use of an LMS has shown a positive impact on student performance in both national and international studies (Martin & Tutty, 2008; Cavus, Uzunbiylu, & Ibrahim, 2006).

Expand the use of the LMS. *ACCESS* championed MCS' Canvas, to coordinate document transmission, feeds, sharing of lesson plans, student work, and support real-time teacher and student access to assessment data. *ACCESS* led to meaningful data to continuously improve instruction, develop necessary interventions and enrichments, and monitors progress in meeting college- and career-ready standards. Portfolios are personalized based on student outcome data from district-based assessments provided via a real-time, digital platform through Home Base, which in addition to offering instructional content, captures assessment information through PowerSchool's student e-portfolios.

1.2 *ACCESS* Fidelity Study

ACCESS was evaluated on the fidelity of implementation and fidelity of intervention. Fidelity of implementation is the extent to which actual project implementation aligned with proposed project implementation. Fidelity of intervention advances our understanding of quantifiable differences between MCS and business-as-usual conditions in two rural school districts from which the Study 2 comparison sample was drawn.

1.2.1 Fidelity of Implementation

The *ACCESS* Annual Fidelity Index, presented in Appendix C, was used to measure fidelity of implementation. The index was designed in the first year of implementation. The index is comprised of three components (aligned to the three core components), and 11 indicators.

The numbers of indicators within each component ranged from two to five and leveraged survey data, administrative records, and attendance logs.

A fidelity score was calculated for each indicator and each construct. The evaluation team consulted with the MCS project director and other MCS administrators to distinguish key components of the program and the associated activities linked to each component; set ambitious, yet achievable, annual thresholds that defined the adequate implementation of each activity; and identified suitable data sources to track our progress. The *ACCESS* lead team utilized annual thresholds as benchmarks to assess progress toward their long-term program goals and to make course corrections throughout the grant.

Fidelity data were collected for two school years, SY 2015-16 and SY 2016-17. In SY 2015-16, the first year of implementation, two of three *ACCESS* components were implemented at the expected level of fidelity. In Year 2, fidelity of implementation increased, with all three *ACCESS* components being implemented with fidelity. Within Component 2— Expand Long Distance Teaching and Learning, access to distance learning courses in MCS middle schools (FI 2.2) was a challenge, particularly in Year 2. Within Component 3— Use of Real-time Assessment Data, students reporting that they review their progress online with a teacher reached the level of implementation expected in Year 2 at one school only. Further study of these two components would be helpful to guide future program implementation.

1.2.2 Fidelity of Intervention

The NC Digital Learning Progress Rubrics (Friday Institute for Educational Innovation, 2016) was used to quantify the differences between MCS and the districts from which the Study 2 comparison cases were drawn. (Section 4.1 explains how comparison districts were selected.) The NC Digital Learning Progress Rubric V2.0 measured district's implementation in five domains: Leadership, Professional Learning, Content and Instruction, Technology and Infrastructure, and Data and Assessment. MCS scored highest in all five digital learning domains, particularly in the domain of professional learning. However, the differences between MCS and comparison district were not as large as expected, particularly in the domain of Content and Instruction. See Appendix C for detailed findings.

2. STUDY 1: IMPACT STUDY DESIGN

Study 1 used a comparative short interrupted time series (CSITS) design. The eight elementary and middle treatment schools were matched to comparison schools at a 1:5 ratio.

Schools' Grades 5-8 reading and math achievement scores were tracked throughout the time series, starting five years before the start of the *ACCESS* intervention and ending two years after the start of the intervention.

2.1 Samples

The treatment schools consisted of eight rural elementary and middle schools in MCS. There were two sets of matched comparison schools (one set for the math analysis and one set for the reading analysis). Both sets of comparison schools (math and reading) were drawn from two other rural school districts in NC, with five comparison schools matched to each treatment school. One set included school-level math achievement scores as a pretest covariate, and the other set included school-level reading achievement scores as a pretest covariate. Scaled Euclidean distance matching was based on pretreatment school characteristics, including percent economically disadvantaged, percent minority students, AYP status, baseline standardized test scores, and enrollment. See Appendix D for detailed sample demographics.

The achievement outcomes in this study were grade-within-school test score means. These means were derived from test scores from students in Grades 5-8 during the duration of the time series.

2.2 Study 1 Question

What is the effect of *ACCESS* on math and reading achievement for *ACCESS* students after three program years compared to the math and reading achievement of students in the business as usual condition?

2.3 Analysis and Results

2.3.1 Baseline Analytic Model

$$Z_{iGj} = \beta_0 + \beta_1 (T_j) + \sum_{m=1}^{M-1} \beta_{(1+m)} (MatchingBlock_m) + \mu_j^{Schs} + r_{Gj}^{Grades}$$

Note that the coefficient β_1 represented the difference between the baseline mean scores of treatment and comparison schools. Standardization of the baseline differences was the same as described above.

2.3.2 Baseline Analytic Model Specifics

Using standardized outcomes from the school's last pre-treatment year only, the following model was fit to the combined data set with the standardized outcomes. The model was a two-level model with multiple grade-level outcomes (level-1) nested within schools (level-2).

2.3.3 Confirmatory Analytic Model

$$Z_{iGj} = \beta_0 + \beta_1(T_j) + \beta_2(TrtYr_{ij}) + \beta_3(T_j * TrtYr_{ij}) + \sum_{m=1}^{M-1}\beta_{(3+m)}(MatchingBlock_m) + \mu_j^{Schs} + r_{Gj}^{Grades} + \varepsilon_{iGj}^{Years}$$

where,

Z_{iGj}	=	the standardized mean reading/math score from the i[th] time point in the G[th] grade in the j[th] school, (calculation of z-scores is described subsequently)
T_j	=	1 if school j is an intervention (treatment) school
	=	0 if comparison school
$TrtYr_{ij}$	=	1 if year is a treatment year
	=	0 if a pre-treatment year
$MatchingBlock_m$	=	An indicator variable that takes the value 1 if school was in the m[th] of M matching blocks, and 0 otherwise. (Note that there are eight matching blocks, each with one treatment school and five comparison schools, so there will be seven indicator variables for matching blocks).
β_0	=	the intercept, which was the comparison school mean score in pre-treatment years for schools in the omitted matching block.
β_1	=	the average difference between treatment and comparison schools during pre-treatment years;
β_2	=	the average difference between pre-treatment years and post-treatment years for comparison schools. (Comparison schools were never treated, but the "post-treatment years" were the years with the treatment schools that they were matched to were being treated.)
β_3	=	The treatment effect. This was the difference-in-difference estimator. It was the difference between treatment and

		comparison schools in their differences between pre-treatment and treatment years.
$\beta_{(3+m)}$	=	was the mth coefficient for the mth matching block dummy variable
μ_j	=	the school-specific random intercept
r_{Gj}	=	the grade-specific random intercept

2.3.4 Analytic Model and Sample Specifics

The C-SITS design used five years of pre-treatment data and two years of post-treatment data. *ACCESS* was a three-year program, ending 12/31/17. Scores for SY2017-18 were not expected to be available until September 2018, or nine months after the end of the project. This limited the availability of post-intervention data to two years.

The impact model was a three-level model with repeated observations over years (level-1) nested within grades (level-2), and multiple grades nested in schools (level-3).[1] The subscripts *i, G,* and *j* represented the i^{th} time point for the G^{th} grade, in the j^{th} school. The dependent variable was the standardized mean achievement score for reading or math at the i^{th} time point for the Gth grade, in the j^{th} school (standardization discussed below). The model included random intercepts for schools (denoted as μ_j^{Schs}), random intercepts for grades (denoted as r_{Gj}^{Grades}), a residual error term (denoted as $\varepsilon_{iGj}^{Years}$), fixed effects dummy variables for matching blocks, and indicator variables for treatment school, treatment years, and a treatment school-by-treatment year interaction term. The random terms were each assumed to be distributed normally with mean zero and variances σ^2_{Schs}, σ^2_{Grades}, and σ^2_{Years}, respectively, and were assumed to be independent of one another. The other model terms were as described below. The impact model included an adjustment for potential autocorrelation among repeated observations within grades within schools over time.

In the notation specified above, the betas were model parameters. In the text that follows, betas with "hats" are the parameter estimates that were obtained from fitting the model to the data. For example, β_0 was the intercept parameter, and $\hat{\beta}_0$ was the parameter estimate.

Because this model was used to estimate and test across-grade impact of *ACCESS* on reading and math achievement (i.e., the combined impact across grades 5-8), we standardized achievement test scores so that all grades' scores were measured via a common metric.

[1] The description of the impact model, and subsequent discussions of standardization and effect sizes, are based on Price, C. (February 25, 2015). Example study design plan for a comparative short interrupted time series (C-SITS) design: An i3 technical assistance guidance document.

During standardization, we used our sample-wide grade-specific school-level means and standard deviations from our study sample for each of the school years covered in our study. We chose this method to account for our unique sample of rural and high-need target schools. We had little or no missing data, as the outcomes were standardized versions of schools' grade-level mean achievement test scores and were publicly available at the North Carolina Department of Education website. These mean achievement test scores should have only been missing if a school closed or merged with another school. In such circumstances, we removed the school from the analysis sample.

2.3.5 Results for Study 1

Results indicated no statistically significant difference between the *ACCESS* treatment group and the business-as-usual comparison group on the math achievement outcome (t (1165) = -0.275, p = 0.783) or reading achievement outcome (t (1193) = 0.245, p = 0.210).

The math impact model found baseline scores (t (1165) = 12.246, $p < 0.001$) and economic disadvantage status (EDS, t (1165) = -4.997, $p < 0.001$) had significant main effects. Specifically, higher baseline math scores predicted higher outcome math scores. Moreover, EDS qualifying students reported lower outcome scores than students who did not qualify for EDS.

The reading impact model found baseline scores (t (1193) = 9.022, $p < 0.001$), EDS (t (1193) = -7.170, $p < 0.001$), and minority status (t (1193) = 2.460, p = 0.014) had significant main effects. Specifically, higher baseline reading scores were associated with higher outcome reading scores. Conversely, FPRL and minority statuses were associated with lower outcome reading scores.

3. STUDY 2: IMPACT STUDY DESIGN

Study 2 was a quasi-experimental design (QED), focusing on 10^{th} graders in the two rural MCS high schools and 10^{th} graders in business-as-usual rural high schools in two comparable rural school districts. Comparison 10^{th} graders were matched to treatment 10^{th} graders through a 1:1 ratio using scaled Euclidean distance matching. The cohort of 10^{th} graders was followed over two years of the *ACCESS* program, with the confirmatory outcome of ACT composite scores assessed in the spring of 2017.

3.1 Samples

The treatment schools were the two rural high schools in MCS, and all 10^{th} graders during SY2015-16 were included in the study. Comparison schools were drawn from two other rural school districts in NC. Because of the unique characteristics of the treatment district, comparison districts were selected based on key demographic variables (percent EDS, percent minority, Rural and Low-Income School designation) and in consultation with the project team and the district's assistant superintendent of accountability. A subset of comparison districts' 10^{th} graders in SY2015-16 were matched to treatment 10^{th} graders. Nearest neighbor 1:1 propensity score matching was used to match 399 comparison students to 224 treatment students. Matching considered pretreatment student characteristics of minority status, sex, and baseline math scores. All treatment students in Grade 10 were included, as well as comparison students matched to them. See Appendix D for detailed sample demographics.

3.2 Study 2 Questions

What was the effect of *ACCESS* on high school students' ACT composite score for *ACCESS* students after two program years compared to the ACT composite scores of high school students in the "business as usual" condition?

3.3 Analysis and Results

3.3.1 Baseline Analytic Model and Specifics

All baseline equivalence testing was done on the analysis sample, i.e., a student with both pre- and post-test data. No outcome data and no pre-test data was imputed. Baseline equivalence was assessed for *ACCESS* students and comparison students on 9th-grade math achievement. The following model was used to estimate the baseline mean difference between the intervention and comparison groups.

$$\mathrm{BaselineMathScore}_{ij} = \beta_0 + \mathrm{Treatment}_j\beta_1 + \mu_j + e_{ij}$$

Where,

$Baseline_{ij}$ was the continuous outcome (Baseline Math Scores);

β_0 was intercept;

β_1 was the difference in baseline math scores for students in the treatment group compared to students in the comparison group;

$Treatment_j$ is 1 = treatment group and 0 = comparison group;

μ_j was a school-specific random intercept; and

e_{ij} was a student-level error term.

We calculated the standardized baseline mean difference between the *ACCESS* intervention group and the comparison group by dividing the baseline treatment-comparison difference (β_1 in the level-2 equation) by the student-level pooled standard deviation of pre-test mathematics test scores. Given that we included students' ninth grade baseline mathematics score in our impact analysis model, we considered baseline equivalence to be established if the standardized mean difference between treatment and comparison on pre-test math scores was less than 0.25.

3.3.2 Analytic Model and Sample Specifics

Consistent with WWC standards, the analysis sample was defined as cases with non-missing outcome and non-missing pre-test data.

3.3.3 Confirmatory Analytic Model

Let *i* index students and *j* index schools. The following two-level model was used for the impact analysis.

$$\begin{aligned} \mathrm{Y_{ij}} = \beta_0 + \mathrm{Treatment_j}\beta_1 + \mathrm{BaselineMathScore_{ij}}\beta_2 + \mathrm{Age_{ij}}\beta_3 + \mathrm{Gender_{ij}}\beta_4 \\ + \mathrm{MinorityStatus_{ij}}\beta_5 + \epsilon_j + \mathrm{e_{ij}} \end{aligned}$$

Where:

Y_{ij} was the continuous outcome (ACT Composite Score);

β_0 was intercept;

$Treatment_j$ is 1 = treatment student and 0 = comparison student;

β_1 was the covariate adjusted impact of *ACCESS* (the mean difference in ACT composite scores for students in the treatment group compared to students in the comparison group);

$BaselineMathScore_{ij}$ is the baseline math score for each student *i*;

β_2 is the parameter estimate for the effect of student baseline math scores;

Age_{ij} is the age for each student *i*;

β_3 is the parameter estimate for the effect of student age;

$Gender_{ij}$ is 1 = female and 0 = male;

β_4 is the parameter estimate for the effect of student gender;

$MinorityStatus_{ij}$ is 1 = minority and 0 = not minority;

β_5 is the parameter estimate for the effect of student minority status;

ε_j was a school level error term; and

e_{ij} was a student-level error term.

3.3.4 Results for Study 2

Results indicated no statistically significant difference between the *ACCESS* treatment group and the business-as-usual comparison group on the ACT composite score outcome. However, baseline math achievement significantly predicted higher ACT composite score outcomes. Minority students scored significantly lower on the ACT than non-minority students. Table 1 includes our regression model output.

Table 1. ACCESS ACT Model

Variable	Estimate	Standard Error	*t*-value	*p*-value
Intercept	22.91	4.46	5.14	< 0.001
Mean Centered Baseline Math Score	0.29	0.02	16.71	< 0.001
Treatment	-0.19	0.61	-0.32	0.770
Sex	0.10	0.27	0.37	0.7134
Minority Status	-1.57	0.30	-5.22	< 0.001
Age	-0.33	0.25	-1.31	0.191

4. DISCUSSION

ACCESS supported a districtwide redesign of educational practices based on the novel approach of embedding a culture of technology-based education (tech culture) within rural schools and the community, to close gaps in educational access and promote student achievement. The results indicated no statistically significant differences in achievement between the *ACCESS* treatment group and the business-as-usual comparison groups as measured by the ACT composite scores taken in Grade 10 or NC End-of-Grades 5-8 standardized reading and mathematics exams. To contextualize the findings researchers considered the duration of students' exposure to *ACCESS*, alignment between technology integration and NC standardized assessments, and contextual factors that may have narrowed the divide between MCS and other school districts from which comparison schools/samples were drawn.

Instructional redesign of the breadth and scope undertaken by MCS required a substantial upfront investment of time in establishing infrastructure, strategically selecting and securing technology, staff professional development, and job-embedded coaching based on trusting professional relationships. The first year of the grant was foundational with the first half of the academic year spent securing and rolling out technology and the second half of the year familiarizing teachers and students with new processes, support personnel, curricular opportunities, and equipment. By Year 2, high fidelity of implementation study findings provided evidence that *ACCESS* was underway with developing and implementing a high-quality redesign of educational practices embedded in a culture of technology integration. In Year 3 of the three-year grant, the benefits of the initiative were likely just beginning to take hold. Prior research suggests that three to five years may be needed to see the effects of major system changes (Borman, Hughes, Overman, and Brown, 2003). Therefore, a longer period of time may be needed to detect an effect.

Furthermore, while the standardized NC state and ACT exams appeared to be well-aligned measures to detect the impact of technology integration within the NC standards-based curriculum, proximal indicators of teacher and student growth may have been better suited to detect shorter-term impacts (less than two years). For example, formative assessments, classroom observations (such as the Technology Integration Walkthrough Tool piloted by MCS), and indicators of student technology use within and beyond classrooms and schools are more sensitive as early indicators of impact. Additionally, implementation and formative evaluation were critical to documenting and detecting shorter-term indicators of impact that occur in the early stages of major instructional redesign studies.

Lastly, another important caveat to consider in interpreting the study findings relates to the degree to which the neighboring rural school systems narrowed the divide regarding technology-integrated instruction. During the grant period, the NC State Board of Education published the NC Digital Learning Plan (September 2015) that emphasized advancing education through innovation in digital-age teaching, learning, and leadership. While Montgomery County Schools scored higher on the NC Digital Learning Progress Rubric overall, and in areas that aligned to the grant, the comparison school districts were not far behind (see Appendix C).

There were several important lessons that MCS learned through the implementation of *ACCESS* that have both practice and policy implications.

Plan for device distribution and management. A lesson learned that we implemented as we progressed through implementation was to stagger the distribution of devices to students and the delivery of professional development to teachers. Before devices are distributed to students, teachers require training on basic device management practices, including simple troubleshooting techniques, as well as how to develop meaningful content-specific curriculum lessons that transform from using technology for technology sake to technology for learning sake. An optimal approach would be to provide professional development for a period of time before distributing devices to students. Early on some teachers were apprehensive about instruction supplemented through laptops and tablets. This may have eased the transition by providing teachers time to better prepared and gain comfort with the technology.

In addition to providing training on technology use, pedagogy, and content integration, teachers required strategies and tools for 1:1 classroom behavior management. Repeat modeling by digital learning coaches of classroom practices proved to be beneficial to our teachers. Coaches collected feedback from staff following every training and found that professional development delivered by teachers for teachers was beneficial for teacher development and morale. Coaches found co-teaching early, often, and with a purpose was beneficial to teachers.

Close attention to distribution, device management, and device maintenance needs to be provided to parents and students. Clear and on-going communication for all parties around device management practices and procedures are necessary to safeguard and maximize the technology investment. A subset of MCS parents worked irregular shift hours, particularly those working in the lumber industry, our region's main employer. The work hours of parents made it difficult to gain written permission acknowledging the children's possession of devices and to ensure parents' support of the proper use of the device. MCS' solution was to schedule several pickup times at each school during different time slots so parents that who work different shifts could still come and get their child's device.

Community engagement supports technology integration. MCS found that when implementing a 1:1 initiative, especially in a rural community, educator, parent, student, and community buy-in (or lack) thereof greatly contribute to the adoption of a technology culture. Developing and maintaining a trusting and responsive relationships with all stakeholder groups - teachers, parents, students, and community members - was essential to moving an innovative program forward. All stakeholders needed a good foundational understanding of the importance of a culture shift towards technology use, at the onset of implementing an innovative program.

MCS found success by engaging all stakeholders before receiving funding for *ACCESS*. Despite having early support of stakeholders, district leaders found that continuous surveying and communications were essential to obtaining feedback from to monitor progress and refine practices. MCS used social media often, utilized the expertise of students, educators, and community leaders, as well as reached out to obtain support from other districts with expertise in technology integration.

Before offering professional development opportunities, digital learning coaches found that it was essential to conduct a needs assessment of all staff. Coaches reported that being intentional about engaging building administrators and curriculum specialists ensured technology integration was well aligned with the school's broader strategic goals. Administrative support for technology integration and modeling by school administrators encouraged a faster uptake among classroom teachers.

Some parents and community members expressed concerns about students' online safety with 24/7 internet access. Parent education was required on multiple levels. An extensive media campaign was used to raise awareness in the community about what it meant to enable students to learn "anytime, anywhere." MCS publicized *ACCESS* through the weekly newspaper; issued call-outs to families through our Blackboard Connect system; and used MCS social media platforms to answer questions and concerns about the program. This included demonstrating how to monitor student devices, the benefits of a 1:1 initiative for student education, and ways parents can best support students. Parents and students need to be empowered with knowledge of good digital citizenship practices. Parents wanted to and need to know, upon student's receiving devices, how to check their child's browsing history and to be supported and encouraged for setting rules for technology use at home.

Technology integration changes school and classroom climate. MCS teacher-student relationships were transformed. DLC and teachers reported that they learned a great deal about the abilities of students, even at the kindergarten level. The biggest shifts appeared in teachers empowering student self-directed learning and collaboration aided by technology. DLCs observed a natural progression in teachers. Instead of business-as-usual lectures, MCS teachers were using the technology to facilitate meaningful collaboration (student-student and teacher-student), inquiry-based learning, responsible digital citizenship, and meaningful feedback using Google tools, Canvas, and other technology. Some teachers even transformed their physical classroom spaces. Additionally, teacher collaboration was on the rise. Learning walks literally and figuratively opened up classrooms and fostered meaningful exchanges. A DLC summarized the journey this way, "*ACCESS* has given students and teachers a great opportunity to learn and not be behind the curve…Has everything been perfect? No…but that's all part of growing pains and learning…if something doesn't work, let's fail forward and …fix it next time."

Sustainability planning beyond grant-funding was critical. MCS worked hard to develop a plan to sustain *ACCESS*. The district reallocated local funds and expanded partnerships with the private sector. All students in Grades 3 – 12 continued to receive 1:1 devices, although only students in Grades 6 – 12 could take devices home. Due to local budget constraints, MCS scaled back to having devices available exclusively in each K–2 classroom. In a climate of teacher turnover and evolving technology, MCS recognized that DLCs played a critical role in pushing the growth curve for teachers, and therefore for students. The district was able to locally fund two DLC positions, as well as a fully staffed district technology department. The DLC roles solely focus on delivering and fostering professional development within the schools, including facilitating learning walks and virtual PLCs. An additional 50 teachers were provided *ACCESS* ambassador training to build capacity within schools. MCS planned to increase the number of hotspots available for students to checkout to support the needs of rural, high-need students. One of the most important factors influencing sustainability was ensuring the continual engagement of teachers, parents, students, and community leaders. MCS continued to educate all stakeholders on the necessity for sustaining a 1:1 initiative. District and school leaders, as well as digital learning coaches, planned to continue engaging stakeholders to keep everyone abreast of programming and emerging technologies that advance student development.

MCS fully implemented *ACCESS* districtwide and began to have a broader impact. Other districts in the state connected to explore adopting and adapting *ACCESS*. MCS is committed to continuing to disseminate the results of our project through media outlets, podcasts, websites (district, school, community), social media, publications, and conference presentations. MCS is committed to preparing their rural teachers and students to seize the opportunities of the next century by placing the world at their fingertips through technology. In turn, the district aims to contribute to national policy through continued study and dissemination of findings related to technology-based education that expands learning opportunities for students in rural locales.

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APPENDIX A

Advice and Best Practices Compiled from Interviews with DLCs

Coaching Teachers for Technology Integration

- Creating a DLC mission statement helped teachers understand the role of coaching.
- It may take a year for teachers to know your safe and not there for evaluative purposes.
- Create a schedule that is beneficial to teachers; find ways to integrate PD within existing meeting structures like regularly occurring staff meetings in partnership with building administrators.
- Need assessments aren't always fruitful; Developing good rapport and partnerships with Instructional Facilitators and Principals to plan professional development because they are looking at school data.
- Professional development is not enough; Teachers needed to get comfortable with technology and grow in their ability to discern when and when not to use devices to support higher levels of learning.
- Twitter and Facebook posts of classroom coaching help to peak interest among other teachers.

Capacity Building for Sustainable Technology Integration

- Work to create lessons that align with the curriculum, even two to four per area, to help teachers integrate and move to the next level.
- When customizing professional development to meet the needs of teachers and schools, schools might be all over the map. In hindsight, DLC might consider offering the same professional development with every school. That way everyone would have the same basic knowledge of tools and strategies.
- We should've created a repository for all of our old trainings so that when new teachers are hired, we do not have to go back and train something we've already done.
- It is important once you go 1:1 that you keep that ratio. We are now 2:1 environment in K-2 and it is hard for teachers to go back.
- We need to be thinking about maintenance. How do we keep this going when this grant is over? Teacher spent considerable time integrating and building around the technology that has been introduced.
- New teacher will conduct veteran teacher interviews as a virtual PLC activity. New teachers can learn from veteran teachers and vice versa.
- Consider creating a troubleshooting list for students and teachers to empower them to do some initial diagnosing of challenges (i.e., what to do when my device won't turn on?)

- As a district, MCS is trying to be more proactive with publishing our work. It is important for the district to have a hashtag that everyone can use. It is a great way to search published work on social media so other schools learn what's going on throughout the county.

Student and Parent Engagements

- Students also have to be involved in doing and creating. For example, students can create their own online flip cards questions for Kahoot. Sharing the responsible or handing off the responsibility to students can be good for teachers and students.
- Have each classroom designate a student as a "tech expert".
- We should flip our complaints about kids using technology (e.g., talk to text, Facebook, etc.) into a teaching strategy. If they are already using these things, how can we use them in the classroom?
- Parents need to know everything. Do parent meetings at the beginning of the project, each year, and maybe a refresher mid-year to remind parents that their child has a device and that they are jointly responsible.
- Do a good job informing parents. We get a lot of pushback from the community and parents about the dangers of technology and the internet. Schools need to raise awareness about the benefit of technology, as well as safeguards that can be enabled.

Device Management

- Devices chosen need to be durable with proper cases and teachers must have good procedures in place to support device management.
- It's very important to think about device management (e.g., are barcodes going to wear off or be pulled off).
- It is important for the district to offer insurance for devices because the parts can be extremely expensive.

APPENDIX B

Montgomery County Schools Technology Integration Walkthrough Tool

Montgomery County Schools (NC) developed this tool under an Investing in Innovation grant from the Department of Education

* Required

1. Observer *
Check all that apply.

2. Grade Level *
Mark only one oval.

3. Teacher *

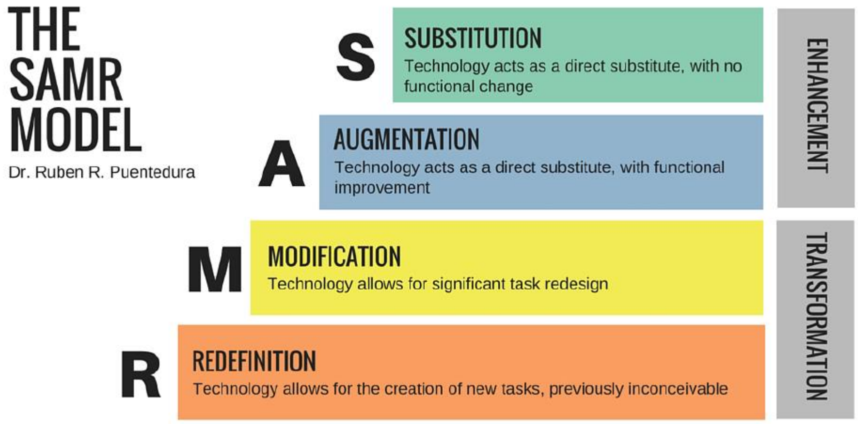
4. Teacher Email Address:

5. Student Groupings: (check all observed) *

- ☐ *Check all that apply.*
- ☐ Individual
- ☐ Student Pairs
- ☐ Small Groups
- ☐ Whole Class
- ☐ Other:

6. What was the Teacher role:(check all observed) *
Check all that apply.

- ☐ Lecturing
- ☐ Discussion
- ☐ Modeling
- ☐ Facilitating/Coaching
- ☐ Interactive Direction
- ☐ Other:



7. Which level of SAMR was evident in the classroom? *
Mark only one oval.

- ☐ Substitution
- ☐ Augmentation
- ☐ Modification
- ☐ Redefinition

8. Describe SAMR level observed: *

9. Do selected technology tools align with curriculum goals? *
Mark only one oval.

- ☐ yes
- ☐ no
- ☐ inappropriate
- ☐ N/A

10. Do selected technology tools support instructional strategies? *
Mark only one oval.

- ☐ yes
- ☐ no
- ☐ inappropriate
- ☐ N/A

11. Do selected technology tools support student led learning? *
Mark only one oval.

- ☐ yes
- ☐ no
- ☐ inappropriate
- ☐ N/A

12. Suggest Tools *

13. Are all students actively engaged in the lesson? Is the teacher monitoring to ensure they are on task? *
Mark only one oval.

☐ Yes

☐ No

☐ N/A

14. Is the instructional environment conducive to technology-based learning? *
Mark only one oval.

☐ Yes

☐ No

☐ N/A

15. Is the teacher facilitating learning by allowing student ownership and collaboration? *
Mark only one oval.

☐ Yes

☐ No

☐ N/A

16. Suggest Improvements *

17. Teacher uses a web-based platform to distribute materials and foster critical thinking skills? (LMS) *
Mark only one oval.

☐ Yes

☐ No

☐ N/A

18. Teacher communicates with students and colleagues to improve instructional practices? *
Mark only one oval.

☐ Yes

☐ No

☐ N/A

19. Teacher embraces technology, collaborates with colleagues and attends regular trainings to implement new tools? *
Mark only one oval.

☐ Yes

☐ No

☐ N/A

20. Suggestions *

21. Communicated with Principal/IF *

22. PD Response Plan: *

APPENDIX C

ACCESS Annual Fidelity Index and Fidelity of Implementation Findings

ACCESS was evaluated, in part, on the fidelity of implementation, the extent to which actual project implementation aligns with proposed project implementation. The *ACCESS Annual Fidelity Index* was used to measure implementation fidelity. The index is comprised of three components and 12 indicators. Indicators, along with measures, targets, and threshold levels [Low (L), Moderate (M), and High(H)] for each indicator, were established based on baseline data and MCS administrators' recommendations. Additionally, used to

Component 1. Resources to Support High-Quality Teaching and Learning		
Fidelity Indicator & Measure	**Year 1 (SY 2015/16)**	**Year 2 (SY 2016/17)**
Indicator Target	Actual (A) / **Fidelity Score (Level)**	
1.1 MCS students with laptops/tablets; Measure: Purchase orders *Target: 95% of Students*	A: 100% ***2 (H)***	A: 98% **2 (H)**
1.2 Households acquiring internet service; Measure: Century Link Data Orders *Target: 75 Accounts*	A: 80 **2 (H)**	A: 70 **1 (M)**
1.3 School buses offering internet access; Measure: Administrative records *Target: 8 School Buses*	A: 12 **2 (H)**	A: 12 **2 (H)**
1.4 New Wi-fi hot spots; Measure: Administrative Records *Target: 8 School Buses*	A: 10 **2 (H)**	A: 10 **2 (H)**
Total Program Score	***8***	***8***
Program-Level Fidelity Threshold: Score of 6 or more on component score and no individual indicator score equals zero.		
Actual:	**8 of 8 (Met)**	**8 of 8 (Met)**

Component 2. Expand Long Distance Teaching and Learning											
Fidelity Indicator & Measure	**Year 1 (SY 2015/16)** Actual (A) / **Fidelity Score (Level)**										
	Elementary Schools							*Middle Schools*		*High Schools*	
Indicator Target	ES1	ES2	ES3	AS*	ES4	ES5	ES6	MS1	MS2	HS1	HS2
2.1 Distance Learning courses at MCS high schools (HS Only); Measure: Administrative Records *Target: 4 courses per HS*										**A: 4** **2 (H)**	**A: 4** **2 (H)**
2.2 Distance Learning courses at MCS middle schools (MS Only); Measure: Administrative Records *Target: 2 courses per MS*								A: 1 1 (M)	A: 1 1 (M)		
2.3 Seniors earning at least 1 college credit through the College and Career Program (CCP; HS Only); Measure: Administrative Records *Target: 50% per HS*										**A: 59** **2 (H)**	A: 35 0 (L)
2.4 Number of ACCESS Ambassadors (AA) by site that attend 4 days AA training; *Measure*: Sign-In Sheets; *Target: 4 AAs attend 4 days*								**A: 6/8** **2 (H)**	**A: 5/6** **2 (H)**	**A: 6/7** **2 (H)**	**A: 4/7** **2 (H)**
2.5 Core course teachers participating in monthly online PLC sessions											
2.6 Number of training sessions provided DLCs by site*; Measure:* DLC Logs *Target: 20 sessions at all 11 schools*	A: 12 0 (L)	A: 15 1 (M)	A: 19 1 (M)		A: 19 1 (M)	A: 16 1 (M)	A: 15 1 (M)	A: 12 1 (M)	A: 22 **2 (H)**	A: 15 1 (M)	A: 20 **2 (H)**
Total School Score	*0*	***1***	***1***	*0*	***1***	***1***	***1***	***4***	***5***	***7***	***6***

Program-Level Fidelity Threshold: 2 of 2 HSs have adequate fidelity (score of 5 or more) AND at least 2 of 2 MSs have adequate fidelity (score of 3 or more) AND at least 5 of 6 ESs have adequate fidelity (score of 1 or more); *Data for MLA are reported above, but not included in the final calculation of fidelity. **Actual: 2 of 2 HS; 2 of 2 MS**; **5 of 6 ES (Met)**

Fidelity Indicator & Measure *Indicator Target*	**Year 2 (SY 2016/17)** Actual (A) / **Fidelity Score (Level)**										
	Elementary Schools							*Middle*		*Elementary Schools*	
	ES1	ES2	ES3	AS*	ES4	ES5	ES6	MS1	MS2	HS1	HS2
2.1 Distance Learning courses at MCS high schools (HS Only); Measure: Administrative Records *Target: 4 courses per HS*										**A: 11 2 (H)**	**A: 11 2 (H)**
2.2 Distance Learning courses at MCS middle schools (MS Only); Measure: Administrative Records *Target: 2 courses per MS*								A: 0 0 (L)	A: 0 0 (L)		
2.3 Seniors earning at least 1 college credit through the College and Career Program (CCP; HS Only); Measure: Administrative Records *Target: 50% per HS*										**A: 52 2 (H)**	A: 43 1 (M)
2.4 Number of ACCESS Ambassadors (AA) by site that attend 4 days AA training; *Measure*: Sign-In Sheets; *Target: 4 AAs attend 4 days*	**A: 5/8 2 (H)**	**A: 4/9 2 (H)**	A: 2/5 0 (L)		A: 3/6 1 (M)	**A: 5/7 2 (H)**	**A: 4/5 2 (H)**				

2.5 Core course teachers in Grade 5 and up participating in monthly online PLC sessions *Target: 75% of teachers at all 10 schools*	A: 0 0 (L)	A: 33 0 (L)	**A: 100** **2 (H)**		**A: 80** **2 (H)**	A: 0 0 (L)		**A: 84** **2 (H)**	A: 50 1 (M)	**A: 76** **2 (H)**	A: 67 1 (M)
2.6 Number of training sessions provided DLCs by site *Target: 20 sessions at all 11 schools*	A: 27 **2 (H)**	A: 51 **2 (H)**	A: 42 **2 (H)**		A: 43 **2 (H)**	A: 27 **2 (H)**	A: 44 **2 (H)**	A: 55 **2 (H)**	A: 39 **2 (H)**	A: 53 **2 (H)**	A: 56 **2 (H)**
Total School Score	***4***	***4***	***4***	*3*	***5***	***4***	***4***	***4***	***3***	***8***	***6***

Program-Level Fidelity Threshold: 2 of 2 HSs have adequate fidelity (score of 5 or more) AND at least 2 of 2 MSs have adequate fidelity (score of 3 or more) AND at least 5 of 6 ESs have adequate fidelity (score of 4 or more); *Data for MLA are reported above, but not included in the final calculation of fidelity.

Actual: 2 of 2 HS; 2 of 2 MS; 6 of 6 ES (Met)

Component 3. Use of Real-time Assessment Data All High Schools and Middle Schools ONLY								
Fidelity Indicator & Measure *Indicator Target*	**Year 1 (SY 2015/16)** Actual (A) / **Fidelity Score (Level)**				**Year 2 (SY 2015/16)** Actual (A) / **Fidelity Score (Level)**			
	Middle		*High*		*Middle*		*High*	
	MS1	MS2	HS1	HS2	MS1	MS2	HS1	HS2
3.1 Core course teachers using CANVAS at least once per month; Measure: ACCESS teacher survey *Target: 70% of core course teachers per school*	**A: 87 2 (H)**	**A: 84 2 (H)**	**A: 93 2 (H)**	**A: 85 2 (H)**	**A: 90 2 (H)**	**A: 87 2 (H)**	**A: 89 2 (H)**	**A: 77 2 (H)**
3.2 Students reporting that they review their progress online with a teacher at least twice per semester; Measure: Tech Talk Student Survey *Target: 60% of students per school*	A: 34 0 (L)	A: 43 1 (M)	A: 37 0 (L)	A: 37 0 (L)	A: 35 0 (L)	**A: 82 2 (H)**	A: 46 1 (M)	A: 40 1 (M)
Total School Score	**2**	**3**	**2**	**2**	**2**	**4**	**3**	**3**
Program-Level Fidelity Threshold: At least 3 of 4 schools have adequate fidelity (score of 3 or more).								
Actual:	1 of 4 Schools **(Not Met)**				**3 of 4 Schools (Met)**			

NC Digital Learning Progress Rubric 2.0 Score Comparison

Montgomery County Schools (MCS) and Two Comparison School Districts
(Friday Institute for Educational Innovation, 2016)

	District Rubric V2.0 Elements		MCS	Comparison District 1	*Comparison District 2*
LEADERSHIP	L1	Shared Vision	2	1	2
	L2	Personnel	2	1	2
	L3	Communication & Collaboration	**3**	2	2
	L4	Sustainability	2	2	2
	L5	Policy	2	2	2
	L6	Continuous Improvement	2	1	2
	L7	Procurement	**3**	2	2
	Overall Score		**16**	**11**	**14**
PROFESSIONAL LEARNING	P1	Professional Development Focus	**3**	1	2
	P2	Professional Development Format	**3**	2	2
	P3	Professional Development Participation	**3**	1	2
	Overall Score		**9**	**4**	**6**
CONTENT & INSTRUCTION	C1	Educator Role	2	1	2
	C2	Student-Centered Learning	2	2	2
	C3	Access to Digital Content	3	3	2
	C4	Learning Management System (LMS)	2	3	2
	C5	Curation & Development	2	1	2
	C6	Data-Informed Instruction	2	2	2
	Overall Score		**13**	**12**	**12**
TECHNOLOGY & INFRASTRUCTURE	T1	School Networks	3	3	3
	T2	End-User Devices	2	2	2

	District Rubric V2.0 Elements		MCS	Comparison District 1	Comparison District 2
	T3	Learning Environments	2	2	2
	T4	Technical Support	**3**	2	2
	T5	Network Services	**3**	2	2
	T6	Outside of School	**3**	2	2
	Overall Score		**16**	**13**	**13**
DATA & ASSESSMENT	D1	Data Systems	3	3	2
	D2	Learner Profiles	2	2	2
	D3	Multiple & Varied Assessments	2	2	2
	Overall Score		**7**	**7**	**6**
OVERALL RATINGS	Final Score		61	47	51
	Percent of Possible Points		61%	47%	51%
	Rank		Advanced	Developing	Advanced

Friday Institute Overall Rankings: EARLY (0-25); DEVELOPING (26-50); ADVANCED (51-75); TARGET (76-100)

APPENDIX D

Characteristics of the ACCESS Study Analytic Samples

Table 1. Pre-treatment Years and Treatment Years for Reading and Math Outcomes in Grades 5-8 for ACCESS and Comparison Schools

Type of School	Spring 2011	Spring 2012	Spring 2013	Spring 2014	Spring 2015	Spring 2016	Spring 2017	Number of Schools
ACCESS Schools	x	x	x	x	x	T	T	7
Comparison Schools	x	x	x	x	x	t	t	40
ntime coded as:	-4	-3	-2	-1	0	1	2	
TrtYr coded as:	0	0	0	0	0	1	1	

All reading scores come from assessments that were administered in the spring of the school year.
“x”: indicates a pre-treatment year when a school-level grade reading and math outcome score was obtained.
“T”: For Treatment schools, T indicates a treatment year.
“t”: For comparison schools, “t” indicates a year when the schools’ treatment group counterparts received treatment.

Table 2. Study 1 Baseline Analytics Sample Characteristics

	Average Daily Membership	% Minority	% Economic Disadvantaged
ACCESS Cluster (Math)	370.86	57.49	81.25
ACCESS Cluster (Reading)	370.86	57.49	81.28
Comparison Cluster (Math)	362.23	63.79	84.11
Comparison Cluster (Reading)	370.00	62.17	81.94

Table 3. Study 1 Average Grade-Level Achievement Scores by Group and Year

Grade by Year of Assessment	Reading ACCESS Sample	Reading Comparison Sample	Mathematics ACCESS Sample	Mathematics Comparison Sample
	Mean Z-Score			
Grade 5				
Spring 2011 (Baseline)	0.22	-0.04	0.33	-0.06
Spring 2016 (Year 1)	0.28	-0.05	0.26	-0.04
Spring 2017 (Year 2)	-0.14	0.02	0.05	-0.01
Grade 6				
Spring 2011 (Baseline)	0.21	-0.04	0.31	-0.05
Spring 2016 (Year 1)	0.26	-0.04	0.25	-0.04
Spring 2017 (Year 2)	-0.09	0.02	0.06	-0.01
Grade 7				
Spring 2011 (Baseline)	0.31	-0.05	0.37	-0.06
Spring 2016 (Year 1)	0.13	-0.02	0.20	-0.03
Spring 2017 (Year 2)	-0.06	0.01	0.05	-0.01
Grade 8				
Spring 2011 (Baseline)	0.10	-0.02	0.25	-0.04
Spring 2016 (Year 1)	-0.01	-0.00	0.21	-0.04
Spring 2017 (Year 2)	-0.20	0.03	0.11	-0.02

Table 4. Percent Representativeness of Study 1 Clusters

Year of Assessment	ACCESS Clusters	Comparison Clusters	Overall Analytic Sample
	Number (and Percentage) of Enrolled Individuals Contributing to Cluster Mean		
Study 1 (Elementary Reading)			
Spring 2011 (Baseline)	2,567 (99)	15,035 (97)	17,602 (97)
Spring 2016 (Year 1)	2,484 (99)	15,190 (98)	17,674 (98)
Spring 2017 (Year 2)	2,428 (93)	15,297 (99)	17,725 (98)
Study 1 (Elementary Mathematics)			
Spring 2011 (Baseline)	2,282 (88)	9,201 (64)	11,483 (67)
Spring 2016 (Year 1)	2,324 (94)	9,609 (68)	11,933 (71)
Spring 2017 (Year 2)	2,302 (95)	9,895 (70)	12,197 (73)

Table 5. Baseline Characteristics of the ACCESS Study 2 Sample			
Characteristics	ACCESS Sample	Comparison Sample	Standardized Difference[a]
Study 2 (Secondary Achievement):	*n* = 224	*n* = 224	
% Gender	68	63	0.13
% Minority	52	48	0.10
Standardized Sample Mean on the ACT (SD)[b]	252.09 (8.73)	250.07 (7.73)	0.24

NOTES:

[a]Hedges' *g* was used to calculate the standardized differences. Baseline equivalence was established if the standardized difference between treatment and comparison groups was less than 0.25. Statistical adjustment was included for all key variables.

[b]The standardized baseline mean difference between the ACCESS students and comparison/control group students were calculated by dividing the baseline treatment-comparison difference by the student-level pooled standard deviation of pre-test scores.