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Technical Report

A comparison study of Connections Academy Schools to matched brick and mortar and virtual schools, examining the types of students who attend K–12 virtual school and the effects on performance of a highly mobile student body

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Executive Summary

In the United States, full-time virtual schools that serve students in grades K-12 are an increasingly popular and accepted alternative to local bricks-and-mortar schools. The ability of the virtual school to adapt to the unique needs of students, and their families, is one of the virtual school's most desirable attributes. These needs may include more challenge for students who are academically advanced; help for those who are struggling; flexibility for students with health concerns, accessibility issues, a demanding sport or artistic pursuit, or a more controlled environment for students who feel unsafe or otherwise dissatisfied with their local bricks-and-mortar school. Online schools may, therefore, prove to be a logical investment of education funds if they can provide quality education for those who are not served well by the traditional education system.

Connections Academy-supported virtual schools are state-funded and regulated public schools that provide a tuition-free, full-time online education to students in grades K-12. Most Connections Academy schools are also accredited. Connections Academy schools offer a personalized learning experience accessible anywhere students have access to the internet (as permitted by school and state regulations). Students have access to a certified online teacher, interactive learning technologies (e.g., LiveLesson), assessment and reporting tools, credit recovery options, social events and academic resources. Connections Academy provides students and their adult Learning Coaches (typically a parent) with orientations and a help desk/hotline to help them understand the online learning environment.

Currently, there is a paucity of peer-reviewed research on the effectiveness of virtual schools and the students who select them. The current literature does not seem to offer a comprehensive, research-based description of the complex needs of students and families seeking virtual schools, or the types of students who are likely to succeed in virtual schools. This study aims to first determine which types of students are most likely to seek out the Connections Academy virtual school option and then, after accounting for those specific factors, determine if the Connections Academy virtual school option can serve these students as well as, or better than, other public school options.

To improve our understanding of the students who select virtual schools and how effective these schools are at serving them, this research was conducted in two phases. Phase One was designed to gain a clear understanding of the most frequent types of students who attend Connections Academy schools. This was achieved by first merging multiple 2015-16 data files into one comprehensive database that included student demographic information, information collected via the Connections Academy Student and Family Information Forms (SIF and FIF), grading and attendance information, student mobility (defined as any time a student changed schools for reasons other than grade

promotion) and state test data. Then, a careful examination of this data was conducted, which revealed seven distinct profiles for students choosing a Connections Academy virtual school.

In Phase Two, the research team examined the effectiveness of Connections Academy schools as measured by proficiency on state tests, accounting for student qualities that emerged from Phase One. To do this, the research team collected school and district state Math and Reading achievement data (percentage of students scoring proficient on state assessments) from Departments of Education in 19 states, at grades 3 to 8, for 2014, 2015 and 2016. States were included if they had a Connections Academy school that had operated for three or more years.

The research team collected district-level student mobility data and school and district demographic data from the National Center for Education Statistics (NCES) for all public schools in each state, including the Connections Academy schools. In Phase One, student mobility emerged as a common characteristic of virtual school students and was directly related to many of the reasons students opted for virtual schools.

The research team used sophisticated matching formulae to identify districts and schools (bricks-and-mortar as well as virtual) with the student populations most similar to each of the Connections Academy schools' student populations. Given the significance of mobility in the Connections Academy student population, as revealed in Phase One, and its known impact on student achievement, and the importance of academic achievement in evaluating any educational program's success, mobility rate and prior student achievement were the primary factors in finding matching student cohorts for each Connections Academy school.

To ensure that the matched student cohorts were always compared on the same state assessments, Connections Academy schools were always matched only with a school in the same state. Within each Connections Academy School, a separate 'best' match was selected for each grade (e.g., 3rd to 8th) and within each subject area (i.e., Reading and Math) to ensure the most precise comparisons possible (i.e., school-grade-subject area student cohorts) This meant that 3rd graders at a Connections Academy may have been matched to 3rd graders at a different bricks-and-mortar school from the 4th graders at the Connections Academy. Further, 3rd grade Math performance may have been compared to a different school than 3rd grade Reading performance. The bricks-and-mortar matches were limited to non-charter schools, because charters vary greatly in their focus and curriculum. (See section detailing matching techniques).

Analysis of the data described above showed that student cohorts from Connections Academy schools performed as well in Reading and Math as student cohorts from bricks-and-mortar schools serving similar student populations. Further, there is substantial evidence suggesting Connections Academy students outperform other virtual school students in Reading, and perform as well in Math. These

results provide evidence that Connections Academy students can receive the same quality of education as that offered at their local public school, while simultaneously taking advantage of the benefits offered to them by a virtual school.

It should be noted that the same student cohorts matched on prior year characteristics were statistically compared on the subsequent years' state test achievement. Both the Connections Academy and comparison groups where always matched on data from the same prior year and compared on data from the same subsequent years.

The key finding for Phase One:

Connections Academy schools serve highly mobile students with complex needs known to have an effect on academic performance. These students' needs include health concerns, bullying and safety, looking to be challenged, trying to catch up and flexible scheduling. These characteristics create a unique student population that differs from traditional brick and mortar schools.

The key findings for Phase Two:

There was no statistical difference in percentage scoring proficient in Math and Reading between student cohorts in Connections Academy schools and cohorts in bricks-and-mortar schools that were matched on prior achievement, and after adjusting for district-mean student mobility, school-mean student SES and other demographic factors.

Student cohorts in Connections Academy schools statistically outperformed (by 7.9 percentage points) cohorts in other virtual schools (matched on prior achievement) in terms of the percentage scoring proficient in Reading on state assessments.

There was no statistical difference in percentage scoring proficient in Math between student cohorts in Connections Academy schools and cohorts in other virtual schools that were matched on prior achievement.

Recommendations

Continued research into understanding the reasons students choose virtual schools could prove beneficial for the schools, students and their families. A focus on refining the Connections Academy core instructional model to best address those reasons may help improve students' academic and personal outcomes.

Next Steps

Given the importance of mobility among virtual school students, future research could focus on states with reliable, parsed out, data on student mobility (e.g., Indiana, Minnesota) and link achievement data with rich contextual information on curricula, educational environment and student and teacher attitudes to define efficacy for different groups of students under more specific conditions. These findings could inform future programs of research around state accountability systems and the measures that are most effective in evaluating virtual schools.

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Introduction

In the United States, full-time virtual schools serving students in grades K-12, are an increasingly popular, accepted alternative to bricks-and-mortar schools. Online education provides an individualized approach to education offering a flexible, student-centered approach that traditional public schools often don't have the ability to offer. Virtual schools' ability to adapt to atypical students is one of their most desirable attributes. Customizing the learning experience for students by providing a flexible, portable education has the potential to benefit all students, but especially those unique students who feel online schools are a better fit. Online schools may, therefore, prove to be a logical investment of education funds if they can provide quality education to those who are not served well by the current education system.

There is a paucity of peer-reviewed research on the academic effectiveness of virtual schools (DiPietro, Ferdig, Black and Preston, 2008), and existing studies have not adequately captured the characteristics of students who enroll in virtual schools. This study seeks to understand and document the needs of students who seek a virtual school education and determine the effectiveness of virtual schools in serving these student populations.

Without reliable information on virtual school performance, policy-makers, school officials and families risk limiting the future learning and career opportunities of students. Also, those providing virtual educational options may not have the data and information they need to make improvements to their programs. This study, while it looks only at the performance of Connections Academy schools compared to matched bricks-and-mortar schools and virtual schools, presents a comprehensive research methodology that could be replicated for other virtual schools or groups of virtual schools.

Background

Virtual schools in the U.S. have shown consistent growth since their origination in the late 1990s. In 2014, more than 440 virtual schools were in operation in 33 states (Miron and Gulosino, 2016) serving more than 262,000 full-time students who attended courses completely online (Gemin et al., 2015). Virtual schools are K-12 schools and are defined as being fully online with no common, physical location for students. Instruction is provided online via computers or other telecommunications technologies in synchronous or asynchronous format (Glander, 2016).

In the United States, virtual schools address a myriad of educational problems that bricks-and-mortar schools face. Traditional schools are plagued with overcrowding, challenged with addressing the individual needs of the learner (i.e., remedial and accelerated learners, pace of learning, etc.), and struggle with attracting qualified teachers (Cavanaugh and Clark, 2007). Given these facts, it is easy to

see why the presence of online learning options have skyrocketed in the K-12 market (Setzer and Lewis, 2005).

Virtual charter schools make up the majority of virtual school enrollment (Huerta, Shafer, Barbour, Miron and Gulosino, 2015). These schools differ from similar homeschooling options in that the services they offer are state-funded, government- regulated, meet accountability requirements and are funded by the state government or other jurisdictions (Torre, 2013). On the other hand, virtual public schools share a defining characteristic with other homeschooling options. Parental involvement plays a key role (i.e., teaching/coaching) in the student's education, especially for lower grades, when students need more direction. This is an obvious departure from a traditional bricks-and-mortar school.

Researchers at the Center for Research on Educational Outcomes (CREDO) at Stanford University (Woodworth, Raymond, Chirbas, Gonzalez, Negassi, Snow and Van Donge, 2015) and the Thomas B. Fordham Foundation (Ahn, 2016) both published reports indicating that virtual schools have higher dropout rates and lower performance levels than traditional bricks-and-mortar schools. It is important to note that neither of these studies placed an emphasis on mobility (i.e., neither included mobility as a matching variable nor in a statistical model), and yet high mobility is frequently a key characteristic of students who attend virtual schools. Equally important are the reasons students seek out virtual schools – these are likely the very factors that drive the mobility. Understanding this information will allow virtual schools to better serve these students. Aside from speculation, the literature does not offer a clear description of the complex needs of students and families seeking virtual schools, or even the types of students who are likely to succeed in virtual schools.

Description of Connections Academy Schools

Connections Academies are public schools that provide a tuition-free, online, full-time education to K-12 students. Connections Academy schools serve a variety of students, including those looking to be challenged, trying to catch up, with health concerns, with accessibility issues, those being bullied and students otherwise dissatisfied with local bricks-and-mortar offerings. All schools are state-funded and regulated, and almost all are accredited.

The 21 Connections Academy schools selected for inclusion in this study have consistently and reliably employed their model for Math and Reading for three or more years. Students are offered a personalized learning experience tailored to their individual needs via a virtual (online) system that is accessible anywhere with internet access (Connections Academy, 2016). Students connect with their teachers online, are provided access to computer software, interactive learning technologies (e.g., LiveLesson), assessment and reporting tools, digital curriculum materials, credit recovery options, multimedia curriculum tools, games and social events. Students and their Learning Coaches (parent/guardian or other legally designated caring adult) also receive support from teachers and other

school educators working in the virtual school environment. Connections Academy teachers are certified and receive ongoing professional development on best practice in education and online learning.

Learning technologies include a comprehensive education management system and LiveLesson, a teaching tool which allows teachers to lead real-time interactive and adaptive classes online. The online curriculum and instructional design provide students with many opportunities to interact with teachers and classmates, including LiveLesson sessions, discussion boards, online student groups such as book and robotics clubs, field trips and other organized events.

The Present Study

The purpose of this research was to gain a deeper, clearer understanding of the types of students and the reasons students and families choose a virtual school. This improved understanding will greatly enhance the ability of the Connections Academy leadership to effectively refine, re-design, and/or add to the Connections Academy instructional model to best meet each student's individual needs.

In Phase Two, Gatti Evaluation Inc. was contracted by Pearson to compare the state assessment performance of Connections Academy schools with that of non-charter bricks-and-mortar schools with student populations similar to those at the Connections Academy school in the same state. Non-charter schools were selected due to the wide variability among charter schools in terms of focus and curriculum. Connections Academy schools were also compared to other virtual schools with similar student populations.

The research team collected school and district state achievement data from the Departments of Education in 19 states, grades 3 to 8, for 2014, 2015 and 2016. States were included if they had a Connections Academy school that had implemented the education model for at least three school years. District level student mobility data was also collected from each state along with school and district demographic data from the National Center for Education Statistics (NCES).

Matched comparison groups (i.e., school-grade-subject area student cohorts) of both non-charter bricks-and-mortar schools and other full-time, fully online virtual schools were then created using several district- and school-level characteristics. Given the significance of mobility in the Connections Academy student population, the methods for matching Connections Academy schools with similar bricks-and-mortar schools focused on prior student achievement and mobility rates. (See section detailing matching techniques)

In Phase One of this study, the research question examined was:

1. **What are the key characteristics of students who enroll at Connections Academy schools, and in what patterns do we see certain characteristics or profiles cluster?**

Phase Two examined two research questions:

2. **How do Connections Academy schools perform compared to matched non-charter bricks-and-mortar schools in Math and Reading state assessments?**
3. **How do Connections Academy schools perform compared to matched virtual schools on Math and Reading state assessments?**

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Method

The purpose of Phase One was to gain a clearer understanding of the types of students who attend Connections Academy schools. To do this, the research team first merged 2015-16 school year data files containing student demographic information, Connections Academy Student and Family Information Forms (SIF and FIF) information, grading and attendance information, student mobility and state test data. Seven clusters, or profiles, of students who enrolled in Connections Academy schools resulted from this two-step cluster analysis.

In Phase Two, a quasi-experimental, matched pairs research design was used to address two research questions:

1. How do Connections Academy schools' student cohorts compare on Math and Reading achievement to cohorts from non-charter bricks-and-mortar schools serving similar student populations
2. How do Connections Academy schools' student cohorts compare on Math and Reading achievement to student cohorts from other virtual schools serving similar student populations?

The research team collected school and district state achievement data (defined as the percentage of students scoring 'Proficient' or above in state tests) from the Departments of Education in 19 states, at grades 3 to 8, for 2014, 2015 and 2016. States were included if they had a Connections Academy school that had implemented the education model for at least three school years. District level student mobility data was also collected from each state along with school and district demographic data from the National Center for Education Statistics.

A weighted nearest-neighbor matching technique was used to match 21 Connections Academy schools to non-charter bricks-and-mortar schools, and other virtual schools, on several 2014 or 2015 district and school-level variables. (See the section detailing the matching techniques used) Given the significance of mobility in the Connections Academy schools' student population, matching methods focused heavily on mobility rates as well as prior student achievement. Matched pairs were created, always selecting within the same state as the Connections Academy, with a separate best match for each grade (i.e., 3rd to 8th) and subject area. These measures ensured matched pairs were always compared on the same state assessment.

The matched group of student cohorts were statistically compared to the Connections Academy student cohorts on 2015 and/or 2016 percentage of students 'Proficient' in math and reading on state tests. Schools that needed to be matched on 2015 due to the lack of available 2014 data were compared solely on 2016 student proficiency. The same student cohorts matched on prior year characteristics were statistically compared on the subsequent years' state test achievement. Both the Connections

Academy and comparison groups were always matched on data from the same prior year and compared on data from the same subsequent years.

Participants

In Phase One of the study, the researchers collected data on all students who attended Connections Academy schools in the 2015-16 school year (n = 77,541), and on their families.

For Phase Two, the Connections Academy team provided a list of all full partner schools that were in operation in the 2013-14 to 2015-16 school years. These Connections Academy schools are all intended to be college-preparatory schools, use the same 'standard' public school curriculum and instructional model and share a similar mission/focus, and so are a consistent group of schools. Connections Academies from Arizona, California, Colorado, Florida, Georgia, Idaho, Indiana, Kansas, Michigan, Minnesota, New Mexico, Nevada, Ohio, Oklahoma, Oregon, South Carolina, Texas and Utah were selected for this study. All states had one Connections Academy with the exception of California, which had three schools (California Connections Academy @Central, @Capistrano and @Ripon).

Only non-charter bricks-and-mortar schools were selected for comparison due to the variability among charters in terms of focus and curriculum. NCES provides a designation for charter schools. The research team, however, took the extra step of searching school names for specific identifying words (ex., charter, technical, STEM, etc.). The research team also looked at each matched school's webpages to confirm they were still in operation and not a charter school. Virtual schools were also independently confirmed by the research team to ensure they were K-12, fully online (no physical structure) and operational in the 2013-14 to 2015-16 school years.

There were 171 possible Connections Academy pairings across years in grades 3 to 8 in each subject area. After omitting pairings with redacted or missing achievement data, 161 bricks-and-mortar pairings were available for Math and 167 for Reading. Likewise, of the 165 possible pairings for virtual schools, 142 pairings were available for Math and 138 for Reading.

Data Collection

Data used in Phase One of the study was provided by the Connections Academy team. This data included student demographic and mobility information, grading and attendance information and state assessment data. Please see **Tables** 1 and 2 for details on variables and their value labels.

Table 3 shows the availability of necessary data for the Connections Academy schools under study in Phase Two. Necessary data points were school-level mobility rate and percentage of students proficient in Math and Reading.

Demographic and Expenditure Data

A member of the research team contacted NCES for training and guidance on how to download the necessary data from their website. Specific demographic and instructional expenditures were selected and a comprehensive file was downloaded from the NCES website. It is important to note that the most recent expenditure data available at the time was from 2012-13.

State Achievement Data

The research team visited each state's Department of Education (DoE) website to access state achievement files. When available, achievement data was downloaded directly from the DoE website. In some instances, the achievement data was not available, in which case the research team directly contacted the appropriate state DoE to request the data. Further, when necessary, the DoE was contacted to gain clarity on data labels, data format, unique identification numbers, data organization and so on.

Student Mobility Data

District student mobility rates were collected from each state's DoE. Mobility data was collected online, if possible. When not available online, the research team contacted the DoE directly to request this data. The type of mobility data collected depended on what states made publicly available. Some states are required to define, collect and post student mobility rate (Category 1). For states not required to do this, the research team requested data to independently calculate mobility (Category 2). This proxy designated a student as 'mobile' if one or more of the following about the student was true:

- They were absent 20% or more of the school year.
- They enrolled after the enrollment cut-off date.
- They withdrew and did not complete state testing.

If the state did not have a definition, and could not provide information to calculate mobility (Category 3), the research team used truancy or absenteeism information (i.e., 20%). Below is a description of which states fell into each category.

Category 1: Colorado, Florida, Georgia, Michigan, Minnesota, Ohio, Oregon, Texas, Utah

Category 2: Iowa, Idaho, Indiana, Kansas, New Mexico, Oklahoma

Category 3: Arizona, California, Nevada, South Carolina

Outcome Measures

Matched schools were statistically compared to the Connections Academy schools on the percentage of

students scoring 'Proficient' in state Math and Reading tests. The groups were compared on both 2015 and 2016 percentage 'Proficient' when schools were matched in 2014. Schools that needed to be matched in 2015 were compared solely on 2016, as the 2015 data was not available. Without exception, this data was collected from each DoE for grades 3 to 8. It should be noted that matched pairs were created always selecting within the same state as the Connections Academy school to ensure comparisons were made using the same state assessment. Further, the same student cohorts that were matched on prior year characteristics were statistically compared on the subsequent years' state test achievement. Both the Connections Academy and comparison groups were always matched on data from the same prior year and compared on data from the same subsequent years.

To ensure the highest level of precision possible, separate school matches were selected for each grade-level and subject area within the Connections Academy school. For example, 3rd graders at a Connections Academy might be matched to 3rd graders at a different bricks-and-mortar school than the 4th graders at the Connections Academy. Further, 3rd grade Math performance may have been compared to students at a different school than 3rd grade Reading performance. The goal was to find a sample of students that was the best match for each group of Connections Academy students within each school by grade and subject area. (See details below on matching techniques)

Connections Academy Family and Student Information Forms

Each Connections Academy student and their family fill out questionnaires prior to enrollment each school year. The majority of the questions on these questionnaires are required information.

The Family Information Form includes questions about:

- contact information,
- household living accommodation
- migratory information
- household income
- technology information

The Student Information Form includes questions regarding:

- general student information
- residency and custody information
- basic schooling information and background
- academic history
- special education history
- primary learning coach information
- reasons for attending Connections Academy

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Connection Academy to Brick-and-Mortar School Matching Techniques

Connections Academy schools were matched to non-charter, non-virtual bricks-and-mortar schools on several district- and school-level variables. Possible matches came from a pool of all the bricks-and-mortar, non-charter and non-virtual districts in each Connection Academy's state. Matched pairs were created always selecting within the same state as the Connections Academy school, with a separate best match for each grade (i.e., 3rd to 8th) and subject area. This ensures matched pairs are always compared on the same state assessment.

Again, it should be noted that the same student cohorts that were matched on prior year characteristics, were statistically compared on the subsequent years' state test achievement. Both the Connections Academy and comparison groups were always matched on data from the same prior year and compared on data from the same subsequent years.

Nine of the states had from 100 to 500 bricks-and-mortar schools at each grade to choose from for matching purposes. Six states had fewer than 100 schools to select from: Nevada (16), Idaho (41), Utah (42), Florida (72), South Carolina (85) and New Mexico (91). Four states had more than 500 schools from which to choose matches: Michigan (513), Ohio (609), California (798), and Texas (1,012).

A two-tier nearest-neighbor model was employed, matching at the district-level and then school-level. Connections Academies are statewide virtual schools, and often have characteristics of both a district and a school in that students come from a wide geographic area, but they are still operated as a school with a single administration, faculty, and staff, and a single core instruction model. Given these characteristics, we matched at both district- and school-level. It is important to note that, based on the data available at the district- and school-level, matching characteristics are different at each level. Please see the two matching formulae below which identify each matching characteristic at the district- and school-level.

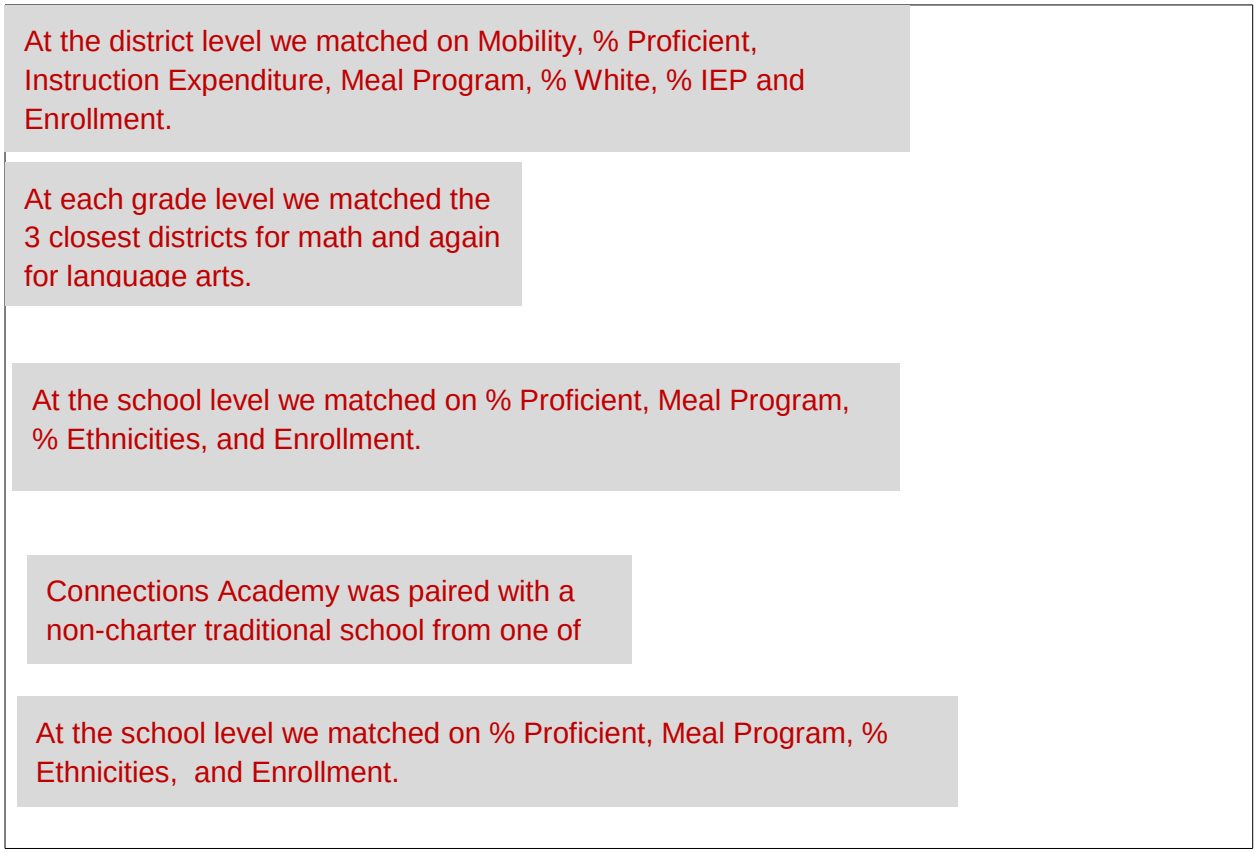
Matching Process

The two-tier nearest-neighbor (i.e., closest match) process may best be explained as a two-step process. Again, the rationale for this is the fact that Connections Academy schools are statewide virtual schools with characteristics of both a school district and a local school. The two-step process allows for the inclusion of both district and school characteristics in a well-ordered process that can be applied to all states.

Step 1 (matching by district): Within each state, the research team first identified the three closest-matching districts to the Connections Academy at each grade for Math. This process was repeated for Reading. It is important to note that the matching process was done for each grade and each subject area separately (i.e., six grades by two subject areas = 12 student cohorts).

Step 2 (matching by school): For each of these 12 cohorts, the Connections Academy school was matched to the single best-matching school within the three districts identified in Step 1.

To illustrate: in Texas, the research team started with 3rd grade Reading and matched the Texas Connections Academy to the three closest districts using the district-level matching formula (Step 1). Within those districts, the researchers then identified all the non-charter bricks-and-mortar schools that teach 3rd grade. From these schools, the closest-matching school using the school-level matching formula was chosen (Step 2). This was then repeated for each grade for Language Arts, and then again for each grade for Math. This process was then repeated for each state in the study. This process thus defines the student cohorts used as the matching units and the units of comparison (i.e., cohorts → school-grade-subject within each state)



Matching Formula

In the matching process, variables were weighted according to how they distinguished Connections Academy student populations (i.e., mobility) as well as other critical variables (i.e., percentage 'Proficient' on previous state assessment). The coefficients preceding the variable indicate the weight assigned to that variable. The more unique a characteristic is considered to be to a Connections Academy school,

the greater the weight assigned. These are the characteristics the research team wanted to ensure were closely matched in the resulting pairs.

Mobility is weighted the highest due to its prominence among virtual students, and previous year achievement is weighted second due to its importance in predicting subsequent year achievement. By way of demonstration, it should be pointed out here that Connections Academy schools (i.e., mean = 41%, SD = 22) had more than twice the mobility rate of unmatched non-charter bricks-and-mortar districts (i.e., mean = 17%, SD = 13). For 16 of the 19 Connections Academies, the mobility rate was above the 75th percentile, and in 10 states, the Connections Academy had the highest or second highest mobility rate.

At the district-level, mobility was weighted as a multiple of 12, percentage 'Proficient' was weighted as a multiple of 6, free/reduced lunch was weighted as a multiple of 3, and the remaining variables received no extra weighting. At the school-level, percentage 'proficient' was weighted as a multiple of 12, free and reduced lunch was 6, enrollment was 3, and all other variables received no additional weighting. Mobility rate was only widely available at the district-level and therefore was not used in the school-level formula. Grade-level enrollment becomes important at the school-level as bricks-and-mortar schools must deal with the realities of finite accommodation.

The matching formula for the district-level was,

$$12\,APR(A) + 6\,APR(B) + 3\,APR(C) + APR(D) + APR(E) + APR(F) + APR(G) \qquad (1)$$

Where:

A=student mobility rate

B=percentage of students 'Proficient' in Math or Reading for specific grade

C=percentage of students eligible for free or reduced priced lunch

D=percentage White students

E=instructional expenditure per pupil

F=percentage of students in individualized educational program

G=enrollment for specific grade

The matching formula for the school-level was,

$$12\,APR(B) + 6\,APR(C) + 3\,APR(G) + APR(D) + APR(H) + APR(I) + APR(J) + APR(K) \qquad (2)$$

Where:

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APR(-) is the absolute value of the percentile rank calculated across each cohort of districts or schools available for choosing the match (i.e., within each grade for each subject area within each state), and:

A = D_{C-i}(student mobility rate)

B = D_{C-i}(percentage of students proficient' in Math or Reading for specific grade)

C = D_{C-i}(percentage of students eligible for free or reduced priced lunch)

G = D_{C-i}(enrollment for specific grade)

D = D_{C-i}(percentage White students)

H = D_{C-i}(percentage Hispanic students)

I = D_{C-i}(percentage African American students)

J = D_{C-i}(percentage Asian students)

K = D_{C-i}(percentage multi-racial students)

Note that the values for A-K are the differences from the value for the corresponding Connections Academy school of the school or district (i) in the matching cohort (i.e., D_{C-i}(-)). Calculating the percentile rank of the difference scores puts each difference on the same scale from 0 to 100. This allows the weighting to be meaningful. Essentially, the weights were applied to the percentile rankings of the distances of each matching variable to the Connections Academy school value.

Some things to note here are that the variables represented by A-K are not directly comparable across segments because the percentile ranking depends on the number of potential matches in that segment. If an NCES data point was missing for a school or district, it was set to the median value for that matching cohort (i.e., 50 was imputed as the percentile rank). The exception was for percentage 'proficient' and mobility rate. If this data was missing, the corresponding school(s) was omitted from the matching pool. Furthermore, if the state did not report a variable, it was omitted from the formula. For example, Oklahoma and Oregon did not report on free and reduced meal status for the Connections Academy schools, so C was omitted from the matching formulae when finding matches for those Connections Academy schools.

Imputing the matching cohort median for a missing data point is a conservative approach because the expectation is that the imputation negates any advantage in the matching score for that characteristic. Such a district or school would only be chosen as a match if it could overcome the imputation with its closeness on the most important and heavily weighted factors (achievement, mobility) or all other factors. It is true that, when you impute an estimate of central tendency for a missing value, you bias a subsequent estimate to the center, because more scores were artificially set to the center of mass. But

since our goal was not to estimate a parameter, rather to choose best matches, the research team was not worried about estimator bias.

Lastly, when a matched pair was created, all the data available was included in the analytic sample for both the Connections Academy school and the matched schools separately. For example, if the percentage 'proficient' for a matched school was available for 2015 and not 2016, the 2015 information was included along with the 2015 and 2016 data for its Connections Academy school. Matched pairs were not entirely deleted if a portion of the outcome information was missing. If there was no available outcome information for a best matched school, then the next best matching school was used. It is still the case that the same student cohorts matched on prior year characteristics, were statistically compared on the subsequent years' state test achievement. Both the Connections Academy and comparison groups were always matched on data from the same prior year and compared on data from the same subsequent years.

Connection Academy to Other Virtual School Matching Techniques

Connections Academy schools were also matched to other similar virtual schools. Here, mobility rate was not included as a matching variable because both groups come from the wider virtual school population. Again, matched pairs were created always selecting within the same state as the Connections Academy school, with a separate best match for each grade (i.e., 3rd to 8th) and subject area. This ensures matched pairs were always compared on the same state assessment. The matching procedures and formula for the virtual school sample were the same as for that of the bricks-and-mortar sample. Across all states in the study and grades 3 to 8, there were 665 available virtual school matches. It is important to note, however, that several states (i.e., Indiana, Nevada, Oklahoma, Texas) had three or fewer, and in some cases only one (i.e., Georgia, New Mexico, Utah), virtual school available for matching.

Data Analysis Procedure

For Phase One data analyses, the research team merged 2015-16 data files containing student demographic information, Student and Family Information Forms, grading and attendance information, student mobility and state test data. The IBM SPSS statistical package was used to perform a two-step cluster analysis. This procedure is versatile in that it is efficient with very large data files and can handle categorical, ordinal and continuous variables. The first step is exploratory and creates a set of initial clusters. The second step determines the final number of clusters based on the default best-fit criteria.

The Phase Two statistical analyses were performed on the 2015 and 2016 student cohort percentage of students proficient' on state Math and Reading standards. The Generalized Estimating Equations procedure provided in the IBM SPSS statistical package was used to statistically test the group mean

differences. While student cohorts were the unit of analysis, the states were the independent sampling units. An ordinary least squares fixed-effects model was employed along with a naïve covariance structure within a robust empirical standard error formulation (i.e., sandwich estimator with the traditional model-based estimator as the 'bread' in the sandwich). This procedure results in estimates that are unbiased and statistical hypothesis tests that are consistent despite the complex nested nature of the data (Liang and Zeger, 1986). This less restrictive covariance structure was used because Connections Academies are unique to states and were matched to various school-grade student cohorts from that state.

All statistical significance tests are two-tailed with a Type I error rate of 0.05. This means that, statistically significant group mean differences have no better than a one in 20 chance of occurrence when the groups are, in fact, equal. Statistical significance thus implies that the samples are likely drawn from two separate populations, or that the groups are unlikely to be the same in the population. Coupled with the rigorous study design controls (in this case, the matching procedure) we may then hold any statistically significant differences as evidence for one group outperforming the other.

Standardized effect-size estimates (i.e., effect-size = group mean difference/matched group sample score standard deviation) along with a percentile rank-based effect size measure are computed for each comparison. The latter effect-size measure indicates the percentile rank for the average Connections Academy school in relation to the matched group's distribution. For example, if the Connections Academy school group outperformed the matched group by 0.20 standard deviations the average/mean/median for the Connections Academy schools was larger than 58% of the matched group, thus the Connections Academy schools group outperformed the matched group by 8 percentile points.

It was not possible to match closely on mobility for all states, even after selecting the best matched bricks-and-mortar districts with a focus on mobility and giving it the largest weighting. It was also not possible to match within What Works Clearinghouse (WWC) standards on the percentage of bricks-and-mortar school students eligible for free or reduced priced lunches. It should further be noted, as with any matched comparison study design, the specific details of the matching technique used will select different matched pairs and thus can give different results. It is important to demonstrate how sensitive the techniques used are to the ultimate findings. In the current study, matches were selected based on a weighted formulation of several state and district-level variables. It is reasonable to question whether different weighting would produce substantively different results. For these reasons mobility rate, as well as all matching characteristics, and additional factors, were entered as controls into the statistical model (i.e., 'full' model).

Additional model factors included a fixed-state factor. State was modeled to account for differing state standards and test proficiency cut-off scores. A fixed factor (mobility category) was also included that

indicates the three general ways mobility was defined. The interaction between mobility category and mobility rate was further modeled to remove additional variation from any potential differential effect from the three definitions of mobility. This effectively fits a slope or correlation between mobility and the percentage of students 'Proficient' for each of the three mobility definitions.

Lastly, the full model included the matching variables as covariates. For the matching variables, district-only level covariates were included in addition to the school-level covariates. For example, the model did not include district percentages of students eligible for free or reduced priced lunch or district enrollment because these are included at the school-level. This eliminates redundancy and allows for adjusting at the finer final level of matching, while also including those variables only available at the district-level, such as mobility rate.

The full bricks-and-mortar model included the following fixed effects:

- Connections Academy versus best matched comparison
- State
- Percentage 'Proficient' matching year (actually grade)
- District level
    - Mobility category dummy variable
    - Mobility rate
    - Mobility category by mobility rate interactions
    - Instructional expenditure per pupil
    - Individualized Educational Program
- School level
    - Percentage 'Proficient' matching year
    - Grade enrollment
    - Free or reduced priced lunch
    - Ethnicity W, H, AfA, AsA, two or more races

Missing values were estimated using the standard expectation-maximization algorithm. In addition to the matching variables, state, year, subject area and grade were added to the EM model as predictors.

The full model investigates the sensitivity of the matching techniques used and the success of the execution by providing an adjusted estimate of the group comparisons that further statistically equates on the matching variables, as well as taking into account varying states proficiency standards and student mobility definitions. In other words, these analyses provided an estimate of the group comparisons with the effect of the matching variables and state differences on the percentage of students 'Proficient' set to 0.0, or otherwise being equal. This method preserves the original matching,

which incorporated the importance of prior achievement and mobility, additionally statistically adjusting for any remaining effect on the results from the sample not being perfectly matched. Such adjustments would also be required by WWC standards (WWC Procedures Handbook Version 4.0, p13).

The hierarchical nature of the data (i.e., students tested across years, nested within grades, nested within schools, nested within states) has the effect of reducing the amount of independent information available in the sample, therefore decreasing the precision of estimates and the power of hypothesis tests to find these estimates statistically significant (Donnar and Klar, 2000). It is estimated that this research study has the power to find a contrast of 0.31 (design effect = 1.0) to 0.37 (design effect = 1.5) standard deviations statistically significant 80% of the time.

Pearson

Results

Phase One of this study examined the key characteristics of students who enrolled at Connections Academy schools in the 2015-16 school year. Seven clusters resulted from a two-step cluster analysis, which were used to distinguish student profiles and gain a clear understanding of the types of students who attend Connections Academy schools.

Below are the predominant characteristic(s) for each of these clusters:

1. Academically advanced students
2. New students who enrolled because they were struggling academically
3. Students who were experiencing health problems
4. New students who were experiencing bullying
5. Returning students who originally enrolled with various challenges, including bullying, struggling academically or health issues
6. New students who enrolled for reasons related to virtual school choice (greater flexibility, dissatisfaction with local school)
7. Returning students who originally enrolled for reasons related to virtual school choice (greater flexibility, dissatisfaction with local school)

Please see **Tables 4 to 8** for a description for each cluster, reasons for enrollment, student achievement information, ethnicity and enrollment category. Note that reasons for enrollment such as bullying might appear in more than one profile, but it is the combination of factors (e.g., demographics, course performance, enrollment status) that leads students to be assigned to one profile over another.

Phase Two of this study examined two similar research questions: how do Connections Academy schools compare to similar bricks-and-mortar schools and to other similar virtual schools? Schools were matched on either 2014 or 2015 demographic and state test data (i.e., percentage of students proficient' in Math and Reading). Matched pairs were created always selecting within the same state as the Connections Academy school with a separate best match for each grade (i.e., 3rd to 8th) and subject area, ensuring matched pairs were always compared on the same state assessment. The methods section describes, in detail, the process used to find matching schools. Matched schools were then compared post matching year, 2015 and/or 2016, on the percentage of students proficient' in each subject area.

Closeness of Bricks-and-Mortar School Matching

This section demonstrates how closely the research team was able to match the Connections Academy Schools to the comparison school group on the individual matching variables. **Tables 9** and **10** show the distributions of the district-level matching variables for Math and Reading. They include descriptive statistics (i.e., mean, standard deviation and median) comparing the Connections Academy schools to the matched bricks-and-mortar schools. Further, **Tables 11** and **12** show the distributions of the school-level matching variables for Math and Reading.

Additionally, T-test results and effect sizes may be found here. The standard deviations reported here and used in effect-size calculations are those for the entire population of corresponding districts or schools in the matching years. The lone exception being for the percentage of students proficient at school-grade-subject area cohort, the standard deviation used here was that of the matched comparison group.

Percentage of school students proficient' (i.e., the outcome variable) in the matching year was not found to be statistically significantly different, as compared to the matched schools, for Reading (0.01 SDs, 50th percentile) or Math (0.04 SDs, 48th percentile). These group differences are well within the WWC standards for baseline equivalence (What Works Clearinghouse Standards Handbook Version 4.0, p14).

Across all non-matched school districts (i.e., more than 36,000) the average percentage 'proficient' in Math was 47.31 (SD = 26), or 1.3% less than the Connections Academy schools, while the average percentage 'proficient' in Reading was 53.49 (SD = 24), a substantial 12% less than the Connections Academy schools. This finding highlights the importance of matching schools on student cohort prior achievement levels and separately for subject areas.

It was not possible to match closely on mobility for all states. Connections Academy schools (i.e., mean = 41%, SD = 22) had more than twice the mobility rate of unmatched non-charter bricks-and-mortar districts (i.e., mean = 17%, SD = 13). For 16 of the 19 Connections Academies, the mobility rate was above the 75th percentile and, in 10 states, the Connections Academy had the highest or second highest mobility rate. Even after selecting the best matched bricks-and-mortar districts (i.e., mean = 27%, SD = 16) with a focus on mobility and giving it the largest weighting, the mobility rate for Connections Academy schools was still 14% higher.

It should be clarified here that, though a large difference remained after matching, the direction of the difference is not in Connections Academy's favor. This would tend to mean that any effects may be seen as conservative in this regard.

For this reason, mobility rate, as well as all matching characteristics, was entered into the statistical model as a covariate (i.e., full model). This provided an adjusted estimate of the group comparisons that further statistically equated on the matching variables. In other words, these analyses provided an

estimate of the group comparisons with the effect of the matching variables on percentage of students proficient' set to 0.0, or otherwise being equal. This method preserves the original matching, which incorporated the importance of prior achievement and mobility, additionally statistically adjusting for any remaining effect on the results from the sample not being perfectly matched.

Instructional expenditure per pupil and Individualized Education Program (IEP) were statistically significantly different across the groups for both Math and Reading. While not a large difference in the number of students, IEP was 2% higher for the matched group (0.31 SDs, 62nd percentile). Instructional expenditure per pupil was also statistically higher for Connections Academy, as compared to their matched districts, by an average of $978 or 19% (0.36 SDs, 64th percentile). Although instructional expenditure for bricks-and-mortar districts may not include exactly the same services as those for virtual schools, it was seen as the best available metric in this category.

Free and reduced lunch status was, however, found to be statistically significantly higher for the matched bricks-and-mortar schools. This was an average difference of 9% with the matched pair group 22% larger (0.35 SDs, 64th percentile). In terms of ethnicity, the majority (i.e., 66%) of the Connections Academy schools' student population was White. The two or more races category was the only ethnicity to have a statistically significant difference, with Connections Academy schools being higher than bricks-and-mortar schools by 3%.

Closeness of Virtual School Matching

This section demonstrates how closely the research team was able to match the Connections virtual schools to the comparison virtual school group. **Tables** 13 and 14 show the descriptive statistics (i.e., mean, standard deviation and median) of the school-level matching variables for Math and Reading comparing the Connections Academy groups to the matched virtual school groups. Note that virtual schools were only matched at school-level and therefore they were not matched on mobility rate, expenditure per pupil nor IEP.

Again, the Connections and matched groups' percentage of students 'proficient' was found to be statistically equivalent for both Reading (0.18 SDs, 57th percentile) and Math (0.09 SDs, 54th percentile). These group differences are well within the WWC standards for baseline equivalence (What Works Clearinghouse Standards Handbook Version 4.0, p14).

Across all virtual schools and grades 3 to 8, the average percentage 'Proficient' in Math was 37.89 (SD = 19), or a substantial 17% less than the Connections Academy schools, while the average percentage 'proficient' in Reading was 55.01 (SD = 21), again a substantial 16% less than the Connections Academy schools.

Pearson

Connections Academy schools were found to be 18% higher, which was statistically significant, than other virtual schools for free and reduced lunch (0.31 SDs, 62nd percentile). Interestingly, the ethnic category of two or more races was found to be significantly higher for Connections Academy schools, whereas there were significantly more African American students in the matched virtual schools.

Connection Academy Schools Student Profiles

Research question one from Phase One examined the key characteristics of students who enroll at Connections Academy schools in the 2015-16 school year, asking: *What are the key characteristics of students who enroll at Connections Academy schools, and in what patterns do we see certain characteristics or profiles cluster?*

Key finding 1

The first key finding indicates that students fell into seven profiles, which describe the complex needs of Connections Academy students. In addition, these profiles also highlight the various reasons student seek out Connections Academy.

Connections Academy schools serve highly mobile students with complex needs known to have an effect on academic performance. These students' needs include health concerns, bullying and safety, looking to be challenged, trying to catch up and flexible scheduling. These characteristics create a unique student population that differs from traditional bricks-and-mortar schools.

Connections Academy Schools Versus Bricks-and-Mortar Schools

Research question one from Phase Two compares the effectiveness of Connections Academy schools to traditional non-charter bricks-and-mortar schools serving similar student populations. Student cohorts (i.e., state school grade-level) were matched and then statistically compared on the percentage of students testing proficient' in 2015 and 2016 state Math and Reading assessments. It asked: *How do Connections Academy schools perform compared to matched bricks-and-mortar schools on Math and Reading state assessments?*

Key finding 2

There was no statistical difference in percentage scoring proficient in Math and Reading between student cohorts in Connections Academy schools and cohorts in bricks-and-mortar schools that were matched on prior achievement, and after adjusting for district-mean student mobility and school-mean student SES and other demographic factors.

Table 15 gives the group means and standard deviations. Though neither group differences are statistically significant, **Table 16** provides the effect sizes and p-values for the tests of statistical significance. It is important to note that the groups were statistically equivalent in the percentage of students proficient' in the matching year, indicating the groups were similar in achievement level at baseline. The differences are small, less than 0.05 standard deviations.

Connections Academy Schools Versus Virtual Schools

The second research question of Phase Two compares Connections Academy schools to matched virtual schools on Math and Reading state assessments. It asked: *How do Connections Academy schools perform compared to matched virtual schools on Math and Reading state assessments?*

Key finding 2.1

Student cohorts in Connections Academy schools statistically outperformed (by 7.9 percentage points) cohorts in other virtual schools (matched on prior achievement) in terms of the percentage scoring proficient in Reading on state assessments.

Key finding 2.2

There was no statistical difference in percentage scoring proficient in Math between student cohorts in Connections Academy schools and cohorts in other virtual schools that were matched on prior achievement.

Table 17 gives the group means and standard deviations, with **Table 18** providing the effect sizes and p-values for the tests of statistical significance. Though the group difference for Math was not statistically significant, the effect size for Reading was large. Lastly, the groups were statistically equivalent in the percentage of students proficient in the matching year. The differences at baseline were small, less than 0.10 standard deviations for Math and less than 0.20 standard deviations for Reading.

Pearson

Discussion

Virtual schools are increasingly sought out by students and their families as alternatives to local bricks-and-mortar schools – these students/families may be underserved, or otherwise dissatisfied, with their current school. Online public education can provide a student-centered approach that is personalized and flexible, widely available and able to more easily meet individual student needs in ways that traditional schools – by nature of the model – are often not able to offer. Connections Academy Schools provide free, full-time online public education to K-12 students that is both individualized and interactive. Connections Academy's virtual school model offers real-time lessons with teachers, digital curriculum material, credit recovery options, social events and a supportive online community for students and their Learning Coaches (often a parent).

Virtual schools may prove to be a logical investment of education funds if they can provide quality education to those who are not served well by the current public education system. Without reliable research on school performance, policy-makers, school officials and families risk limiting the future learning and career opportunities of students.

Phase One of this study aims to describe those student populations seeking alternatives to their current local school system and detail their complex needs. The resulting seven student profiles illustrate that Connections Academy schools serve students with a unique set of multidimensional attributes, including those with high mobility, health concerns, a desire to be challenged, trying to catch up, needing flexible schedules, experiencing bullying or safety issues, and/or who are otherwise dissatisfied with local bricks-and-mortar schools. Information from this study will allow Connections Academy to serve their students more effectively by keenly identifying clusters of students with unique needs.

Phase Two is an attempt to fill the research gap by comparing the effectiveness of 21 Connections Academy schools from 19 states to matched bricks-and-mortar schools, using student mobility as a significant factor in matching student cohorts. It also compares Connection Academy schools to other virtual schools. States were included if they had a Connections Academy school that had implemented the education model for at least three school years. Here we defined effectiveness as the percentage of 3rd to 8th grade students scoring proficient on 2015 and 2016 Math and Reading state standards.

Matching student cohorts (i.e., school-grade, subject) were selected using several 2014 or 2015 district- and school-level characteristics with a focus on prior student achievement and mobility rates. It is also important to note that matched pairs were created, always selecting within the same state as the Connections Academy school, with a separate best match for each grade and subject area. This ensures matched pairs were always compared on the same state assessment.

Pearson

Connections Academy schools were found to be at least as effective in students' Math and Reading proficiency as bricks-and-mortar schools serving comparable populations. Similarly, Connections Academy schools performed statistically the same in Math to other matched virtual schools. Interestingly, there is evidence that Connections Academy schools are more effective than other virtual schools serving similar student populations as measured by proficiency in Reading. Connections Academy schools statistically outperformed the matched virtual school group here by 7.9 points (or the average Connections Academy schools performed at the 71st percentile of the matched virtual school group).

In summary, this research provides some evidence, with recent state test data, that students attending the Connections Academy schools can see at least similar performance to non-charter bricks-and-mortar schools. Furthermore, these results suggest students may perform better in Reading at Connections Academy schools than other virtual schools.

It is our belief that the resulting student profiles from Phase One reflect the wider virtual school population. This information should help Connections Academy, and other virtual schools, serve their student population more effectively.

Implications of Findings for Product Implementation and Further Research

Continued research into understanding the reasons students choose virtual schools could prove beneficial for both the schools, students and their families.

The research was independently contracted and completed in March 2017. In June 2017, the principal investigator was hired by Pearson, the parent company of Connections Academy. The research processes and resulting findings and claims were monitored and reviewed by Price Waterhouse Cooper. Further, this technical report also underwent additional independent review by SRI International in 2018.

Limitations

It was not possible to match closely on mobility for all states, even after selecting the best matched bricks-and-mortar districts with a focus on mobility and giving it the largest weighting. It should be clarified here that, though large differences remained after matching, the direction of the difference is not in Connections Academy's favor. This would tend to mean that any effects may be seen as conservative in this regard. It was also not possible to match within WWC standards on the percentage of bricks-and-mortar school students eligible for free or reduced priced lunches.

It should further be noted, as with any matched comparison study design, the specific details of the matching technique used will select different matched pairs and thus can give different results. It is important to demonstrate how sensitive the techniques used are to the ultimate findings. In the current

study, matches were selected based on a weighted formulation of several school- and district-level variables. It is reasonable to question if different weighting would produce substantively different results. For additional details on the matching methods used in this study see the Methods section above.

For these reasons, mobility rate, as well as all matching characteristics, was entered into the statistical model as a covariate (i.e., full bricks-and-mortar model). This provided an adjusted estimate of the group comparisons that further statistically equated on the matching variables, and took into account varying state proficiency standards and student mobility definitions. In other words, these analyses provided an estimate of the group comparisons with the effect of the matching variables and state differences on the percentage of students proficient set to 0.0, or otherwise being equal. This method preserves the original matching, which incorporated the importance of prior achievement and mobility, additionally statistically adjusting for any remaining effect on the results from the sample not being perfectly matched. Such adjustments would also be required by the WWC standards (WWC Procedures Handbook Version 4.0, p13).

After adjusting the group comparisons, the results remained the same, with Connections Academy schools only statistically outperforming other matched virtual schools in Reading. This result provides additional support that the results are not likely an artifact of the weighting for mobility and achievement nor of non-perfect matching. The results for the full bricks-and-mortar model are available in Tables 19 to 22.

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Appendix A. Statistical Tables

Table 1: Student-level data from 2015 provided by Connections Academy team for student profiles– Phase One of study

Variables	Categories
Math Course Average	Continuous
ELA Course Average	Continuous
Federal Race/Ethnicity	American Indian or Alaska Native Asian, Black/African American Hispanic or Latino, Multiple races Native Hawaiian or other Pacific Islander White
Enrollment Category	New late New on-time Returning late Returning on-time
Type Prior School	Home school Charter school (public) Online (virtual) public school Private/parochial school Public school No information None
Consecutive Years of Enrollment	2 consecutive years 3 consecutive years 4 consecutive years 5+ years New

	No attendance
Free and Reduced Lunch Eligibility	Eligible, Not Eligible
State Assessment (Math and Reading)	Proficient, Not Proficient
Suspended	Suspended, Not Suspended
Mobility	Mobile, Non-Mobile
Struggling	Struggling, Not Struggling
Health	Healthy, Not Healthy
Bullied	Bullied, Not Bullied
Advanced	Advanced, Not Advanced

Table 2: Reasons for enrolling in Connections Academy

For various reasons, we are dissatisfied with our local public school
Student did not receive adequate attention from the teacher
Student has or had physical health concerns
Student has or had mental health concerns
Student needs a flexible schedule
Student was ahead academically
Student was bullied
Student was struggling academically
Virtual school will enable me to be more involved with my student's learning

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Table 3: Availability of necessary data for participating Connections Academies and their corresponding matched schools in matching and comparison years

State	Match Year	Math			Reading		
		Match Year Grade Levels	2015 Comparison Grade Levels	2016 Comparison Grade Levels	Match Year Grade Levels	2015 Comparison Grade Levels	2016 Comparison Grade Levels
AZ	2014	3-8	3-8	3-8	3-8	3-8	3-8
CA – Alpaugh	2015	3-4, 7-8	-	3-4, 7-8	3-4, 7-8	-	3-4, 7-8
CA – Capistrano	2015	3-8	-	3-8	3-8	-	3-8
CA – Ripon	2015	3-8	-	3-8	3-8	-	3-8
CO	2014	3-8	3-5, 8	3-8	3-8	3, 5-8	3-8
FL	2014	3-8	3-8	3-8	3-8	3-8	3-8
GA	2014	3-8	3-8	3-8	3-8	3-8	3-8
IA	2014	8	8	8	8	8	8
ID	2015	7-8	-	7-8	8	-	8
IN	2014	3-8	3-8	3-8	3-8	3-8	3-8
KS	2015	3-8	-	3-8	3-8	-	3-8
MI	2015	3-8	-	3-8	3-8	-	3-8
MN	2014	3-8	3-8	3-8	3-8	3-8	3-8
NM	2014	4-8	4-8	4-8	4-8	4-8	4-8
NV	2014	3-4, 6-8	*	3-4, 6-8	3-8	*	3-8
OH	2014	3-8	3-8	3-8	3-8	3-8	3-8
OK	2015	3, 6-8	-	3, 6-8	7-8	-	7-8
OR	2014	3-8	3-8	3-8	3-8	3-8	3-8
SC	2014	3-8	3-8	3-8	3-8	3-8	3-8
TX	2014	3-8	3-8	3-8	3-8	3-8	3-8
UT	2014	7, 8	7, 8	*	7, 8	7, 8	7

** Necessary data was not available.*

- When matching school year is 2014-15, 2015 cannot also be a comparison year for state test scores

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Table 4: Connections Academy student profile key features: reasons for enrollment

Student Profile	Reason for Enrollment
Advanced	Students are academically advanced
Health Problems	Student has physical or mental health problems
New, Bullied	New students who were experiencing bullying
New, Struggling Academically	New students who enrolled because they were struggling academically
New, Virtual School Choice	New students who enrolled for reasons related to virtual school choice (greater flexibility, dissatisfaction with local school).
Returning, Virtual School Choice	Returning students who originally enrolled for reasons related to virtual school choice (greater flexibility, dissatisfaction with local school).
Returning, Various Challenges	Returning students who originally enrolled with various challenges including bullying, struggling academically, and health issues.

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Table 5: Connections Academy student profile key features: specific categories for enrollment

Student Profile	Number of Students	Percent Mobile	Percent Bullied	Percent Healthy	Percent Struggling
Advanced	3,693	48	12	0	0
Health Problems	5,224	52	0	100	0
New, Bullied	6,164	60	93	18	31
New, Struggling Academically	5,348	58	0	0	100
New, Virtual School Choice	14,812	48	0	0	0
Returning, Virtual School Choice	7,491	35	0	0	0
Returning, Various Challenges	4,981	49	46	11	66

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Table 6: Connections Academy student profile key features: state assessment percent proficient and average course performance

Student Profile	Percent of Students	State Test Math	State Test Reading	Course Performance Math	Course Performance Reading
Advanced	8	74	87	81	83
Health Problems	11	35	59	66	70
New, Bullied	13	27	45	63	66
New, Struggling Academically	11	15	30	61	64
New, Virtual School Choice	31	42	62	73	75
Returning, Virtual School Choice	16	42	64	78	80
Returning, Various Challenges	11	22	42	69	72

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Table 7: Connections Academy students profile key features: percentage of students in each ethnic group

Student Profile	White	African American	American Indian or Alaskan Native	Asian	Hispanic or Latino	Multiple races	Native Hawaiian or other Pacific Islander
Advanced	67.94	8.20	0.73	3.28	12.37	7.15	0.32
Health Problems	70.79	6.01	0.88	1.07	14.93	6.11	0.21
New, Bullied	68.38	7.58	1.07	0.65	16.06	6.04	0.23
New, Struggling Academically	61.46	11.46	1.29	0.93	17.71	6.79	0.36
New, Virtual School Choice	61.58	10.41	0.95	2.40	17.91	6.38	0.36
Returning, Virtual School Choice	65.01	10.05	0.95	2.74	14.96	5.94	0.35
Returning, Various Challenges	68.48	9.48	1.02	0.90	13.53	6.22	0.36

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Table 8: Connections Academy student profile key features: percentage of students in each enrollment category

Student Profile	Percent New On-Time	Percent New Late	Percent Returning On-Time	Percent Returning Late	Percent Missing
Advanced	34.55	31.00	30.79	1.87	1.79
Health Problems	17.84	48.81	27.30	4.31	1.74
New, Bullied	34.94	65.04	0.00	0.00	0.02
New, Struggling Academically	35.88	64.12	0.00	0.00	0.00
New, Virtual School Choice	45.65	54.35	0.00	0.00	0.00
Returning, Virtual School Choice	0.00	0.00	86.41	6.71	6.87
Returning, Various Challenges	0.00	0.00	85.22	9.13	5.64

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Table 9: Connections Academy and best match group summary statistics for measures used to match Math non-charter bricks-and-mortar districts

	Connections Academy			Best Match		
Measures	Matched Pairs	Mean (SD)	Median	Matched Pairs	Mean (SD)	Median
Percent Proficient [P]	107	45.99 (17.56)	45.00	107	47.57 (18.37)	47.00
Mobility [P S]	107	40.57 (22.40)	36.00	107	28.21 (16.89)	24.60
Free or Reduced Lunch [P S]	97	41.91 (11.89)	47.08	100	50.10 (12.13)	51.08
White [P]	107	65.81 (15.16)	64.91	107	66.13 (21.40)	66.14
Expenditure [E S]	96	6,254.27 (1,999.50)	6,735.00	106	5,276.09 (1,359.80)	5,177.00
IEP [P S]	107	9.02 (3.26)	9.00	107	11.33 (5.57)	10.99
Grade 3 Enrollment	17	113.59 (84.85)	100.00	17	108.71 (78.43)	83.00
Grade 4 Enrollment	17	124.06 (85.95)	115.00	17	178.41 (309.56)	91.00
Grade 5 Enrollment	15	156.40 (103.91)	148.00	15	193.53 (292.30)	139.00
Grade 6 Enrollment	17	185.94 (117.38)	176.00	17	244.24 (285.91)	187.00
Grade 7 Enrollment	20	203.30 (145.29)	192.50	20	645.85 (1,248.81)	173.00
Grade 8 Enrollment	21	228.38 (166.78)	237.00	21	289.57 (314.09)	156.00

Note. The school with the top matching score was chosen from the top three matching districts within each state (i.e., AZ, CA, CO, FL, GA, IA, ID, IN, KS, MI, MN, NM, NV, OH, OK, OR, SC, TX and UT), subject area (i.e., Math, Reading) and Common Core grade (i.e., 3rd to 8th).

The matching formula did not include free or reduced priced lunch when that information was missing for a state's Connection Academy (i.e., OK, OR).

[E] Expenditure indicates instructional expenditure per pupil in US dollars.

[P] These measures are percentages.

IEP indicates Individualized Education Program.

[S] The group mean difference for these measures is statistically significant at the 0.05 probability level

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Table 10: Connections Academy and best match group summary statistics for measures used to match Reading for non-charter bricks-and-mortar districts

	Connections Academy			Best Match		
Measures	Matched Pairs	Mean (SD)	Median	Matched Pairs	Mean (SD)	Median
Percent Proficient [P]	105	65.38 (17.31)	66.20	105	64.35 (16.68)	65.64
Mobility [P S]	105	40.68 (22.40)	36.00	105	26.30 (15.82)	23.16
Free or Reduced Lunch [P S]	97	41.83 (11.88)	45.45	97	47.07 (11.31)	46.47
White [P]	105	65.63 (15.21)	64.91	105	67.24 (20.69)	74.19
Expenditure [E S]	94	6,240.05 (1,946.18)	6,735.00	104	5,533.88 (1,805.30)	5,428.00
IEP [P S]	105	8.97 (3.28)	9.00	105	11.06 (4.50)	11.80
Grade 3 Enrollment	16	117.69 (85.88)	100.50	16	471.94 (1,140.72)	116.00
Grade 4 Enrollment	17	124.06 (85.95)	115.00	17	617.88 (1,054.21)	167.00
Grade 5 Enrollment	16	153.13 (101.24)	143.50	16	402.44 (817.84)	99.00
Grade 6 Enrollment	16	193.63 (116.73)	179.00	16	431.50 (765.31)	148.00
Grade 7 Enrollment	19	209.74 (146.31)	195.00	19	708.63 (1,279.92)	214.00
Grade 8 Enrollment	21	228.38 (166.78)	237.00	21	289.57 (314.09)	156.00

Note. The school with the top matching score was chosen from the top three matching districts within each state (i.e., AZ, CA, CO, FL, GA, IA, ID, IN, KS, MI, MN, NM, NV, OH, OK, OR, SC, TX and UT), subject area (i.e., Math, Reading) and Common Core grade (i.e., 3rd to 8th).

The matching formula did not include Free or Reduced Priced Lunch when that information was missing for a state's Connection Academy (i.e., OK, OR).

[E] Expenditure indicates instructional expenditure per pupil in US dollars.

[P] These measures are percentages.

IEP indicates Individualized Education Program.

[S] The group mean difference for these measures is statistically significant at the 0.05 probability level.

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Table 11: Connections Academy and best match group summary statistics for measures used to match Math for non-charter bricks-and-mortar schools

Measures	Connections Academy			Best Match		
	Matched Pairs	Mean (SD)	Median	Matched Pairs	Mean (SD)	Median
Percent Proficient [P]	107	45.99 (17.56)	45.00	107	46.80 (18.13)	48.94
Free or Reduced Lunch [P S]	97	41.91 (11.89)	47.08	107	51.09 (16.89)	51.00
Grade 3 Enrollment	17	113.59 (84.85)	100.00	17	94.94 (53.83)	85.00
Grade 4 Enrollment	17	124.06 (85.95)	115.00	17	91.35 (74.71)	77.00
Grade 5 Enrollment [S]	15	156.40 (103.91)	148.00	15	81.53 (50.70)	68.00
Grade 6 Enrollment	17	185.94 (117.38)	176.00	17	118.35 (86.59)	102.00
Grade 7 Enrollment	20	203.30 (145.29)	195.50	20	146.30 (113.14)	122.50
Grade 8 Enrollment	21	228.38 (166.78)	237.00	21	160.57 (111.46)	141.00
White [P]	107	65.81 (15.16)	64.91	107	64.40 (24.22)	65.07
Hispanic [P]	107	15.90 (11.66)	10.79	107	18.55 (17.33)	12.75
African American [P]	107	7.92 (6.87)	6.44	107	6.42 (14.80)	1.40
Asian [P]	107	2.20 (1.90)	1.70	107	1.30 (2.89)	0.42
Two or More Races [P S]	107	6.61 (3.49)	5.79	107	3.62 (2.89)	3.04

Note. The school with the top matching score was chosen from the top three matching districts within each state (i.e., AZ, CA, CO, FL, GA, IA, ID, IN, KS, MI, MN, NM, NV, OH, OK, OR, SC, TX and UT), subject area (i.e., Math, Reading) and Common Core grade (i.e., 3rd through 8th).

[P] These measures are percentages.

[S] The group mean difference for these measures is statistically significant at the 0.05 probability level.

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Table 12: Connections Academy and best match group summary statistics for measures used to match Reading for non-charter bricks-and-mortar schools

	Connections Academy			Best Match		
Measures	Matched Pairs	Mean (SD)	Median	Matched Pairs	Mean (SD)	Median
Percent Proficient [P]	105	65.38 (17.31)	66.20	105	65.27 (17.08)	66.67
Free or Reduced Lunch [P S]	97	41.83 (11.88)	45.45	105	51.16 (17.59)	47.60
Grade 3 Enrollment	16	117.69 (85.88)	100.50	16	100.13 (59.29)	82.00
Grade 4 Enrollment [S]	17	124.06 (85.95)	115.00	16	73.31 (44.23)	72.50
Grade 5 Enrollment [S]	16	153.13 (101.24)	143.50	16	83.94 (76.32)	58.50
Grade 6 Enrollment	16	193.63 (116.73)	179.00	16	158.06 (179.90)	76.00
Grade 7 Enrollment	19	209.74 (146.31)	195.00	19	140.68 (124.28)	98.00
Grade 8 Enrollment	21	228.38 (166.78)	237.00	20	174.20 (111.93)	171.00
White [P]	105	65.63 (15.21)	64.91	105	67.26 (21.44)	72.66
Hispanic [P]	105	16.11 (11.72)	10.79	105	17.43 (15.75)	13.64
African American [P]	105	8.04 (6.89)	8.05	105	6.05 (10.55)	1.92
Asian [P]	105	2.24 (1.90)	1.70	105	2.62 (5.73)	0.78
Two or More Races [P S]	105	6.60 (3.49)	5.79	105	4.33 (3.33)	3.73

Note. The school with the top matching score was chosen from the top three matching districts within each state (i.e., AZ, CA, CO, FL, GA, IA, ID, IN, KS, MI, MN, NM, NV, OH, OK, OR, SC, TX and UT), subject area (i.e., Math, Reading) and Common Core grade (i.e., 3rd through 8th).

[P] These measures are percentages.

[S] The group mean difference for these measures is statistically significant at the 0.05 probability level.

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Table 13: Connections Academy and best match virtual school group summary statistics for measures used to match Math pairs

Measures	Connections Academy			Best Match		
	Matched Pairs	Mean (SD)	Median	Matched Pairs	Mean (SD)	Median
Percent Proficient [P]	104	45.72 (17.54)	43.10	104	44.04 (18.36)	43.10
Free or Reduced Lunch [P S]	94	41.95 (12.42)	45.23	94	36.40 (19.20)	36.91
Grade 3 Enrollment	17	113.59 (84.85)	100.00	17	195.24 (278.60)	54.00
Grade 4 Enrollment	16	128.88 (86.37)	115.00	16	179.69 (285.48)	46.50
Grade 5 Enrollment	14	164.43 (102.89)	149.50	14	254.50 (333.86)	111.00
Grade 6 Enrollment	17	185.94 (117.38)	176.00	17	204.82 (301.69)	105.00
Grade 7 Enrollment	20	203.30 (145.29)	192.50	20	235.50 (337.34)	132.50
Grade 8 Enrollment	20	237.35 (165.83)	240.50	20	288.50 (446.43)	124.00
White [P]	104	65.90 (14.93)	65.52	104	66.08 (17.01)	66.39
Hispanic [P]	104	15.47 (11.21)	10.79	104	14.17 (11.27)	12.11
African American [P S]	104	8.11 (6.92)	8.05	104	11.88 (12.25)	8.12
Asian [P]	104	2.30 (1.90)	1.73	104	2.76 (3.24)	1.83
Two or More Races [P S]	104	6.71 (3.55)	5.79	104	3.08 (3.85)	1.55

[P] These measures are percentages.

[S] The group mean difference for these measures is statistically significant at the 0.05 probability level.

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Table 14: Connections Academy and best match virtual school group summary statistics for measures used to match Reading pairs

Measures	Connections Academy			Best Match		
	Matched Pairs	Mean (SD)	Median	Matched Pairs	Mean (SD)	Median
Percent Proficient [P]	102	65.34 (17.00)	66.60	102	62.28 (16.80)	64.44
Free or Reduced Lunch [P S]	94	41.86 (12.41)	43.29	94	35.59 (19.40)	39.11
Grade 3 Enrollment	16	117.69 (85.88)	100.50	16	146.56 (229.45)	83.00
Grade 4 Enrollment	16	128.88 (86.37)	115.00	16	128.31 (234.33)	43.00
Grade 5 Enrollment	15	160.40 (100.37)	148.00	15	148.33 (281.62)	44.00
Grade 6 Enrollment	16	193.63 (116.73)	179.00	16	156.06 (297.78)	58.00
Grade 7 Enrollment	19	209.74 (146.31)	195.00	19	242.63 (380.48)	101.00
Grade 8 Enrollment	20	237.35 (165.83)	240.50	20	232.15 (379.73)	124.00
White [P]	102	65.76 (14.96)	65.52	102	65.13 (17.05)	66.26
Hispanic [P]	102	15.65 (11.27)	10.79	102	13.76 (11.24)	9.54
African American [P S]	102	8.22 (6.94)	8.05	102	12.25 (13.21)	8.08
Asian [P]	102	2.33 (1.91)	1.73	102	3.20 (4.13)	1.83
Two or More Races [P S]	102	6.69 (3.53)	5.79	102	3.64 (3.95)	3.66

[P] These measures are percentages.

[S] The group mean difference for these measures is statistically significant at the 0.05 probability level.

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Table 15: Connections Academy and best match bricks-and-mortar group percentage of students 'Proficient' in Math and Reading across states in the study and Grades 3 to 8

		Match Year		Combined 2015 and 2016	
Group	Content	n	Mean (SD)	n	Mean (SD)
Connections Academy	Math	107	45.99 (17.56)	171	34.27 (13.00)
Best Matched Bricks-and-Mortar Schools	Math	107	46.80 (18.13)	161	35.29 (17.22)
Connections Academy	Reading	105	65.38 (17.31)	171	51.55 (14.16)
Best Matched Bricks-and-Mortar Schools	Reading	105	65.27 (17.08)	167	48.86 (17.92)

Note. Here the pool of matching schools included non-charter traditional bricks-and-mortar schools.

SD indicates standard deviation

Study states include AZ, CA, CO, FL, GA, IA, ID, IN, KS, MI, MN, NM, NV, OH, OK, OR, SC, TX and UT

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Table 16: Connections Academy and best match bricks-and-mortar group difference in percentage of students 'Proficient' in Math and Reading

		Matching Year	
Comparison	Content	Effect Size	P-Value
Connections Academy vs Best Matched Bricks-and-Mortar Schools	Math	-0.045 (48.22)	0.787
	Reading	0.006 (50.26)	0.967
		Combined 2015 and 2016	
Comparison	Content	Effect Size	P-Value
Connections Academy vs Best Matched Bricks-and-Mortar Schools	Math	-0.059 (47.65)	0.544
	Reading	0.150 (55.96)	0.106

Note. Here the pool of matching schools included non-charter traditional bricks-and-mortar schools.

The effect size denotes group mean difference in matched group standard deviations similar to Cohen's d, and (-) denotes the percentile rank of the Connections Academy mean in the matched group distribution (i.e., Cohen's U3).

Neither group mean difference is statistically significantly different at the 0.05 probability level.

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Table 17: Connections Academy and best match virtual school group percentage of students 'Proficient' in Math and Reading across states and Grades 3 to 8

		Match Year		Combined 2015 and 2016	
Group	Content	n	Mean (SD)	n	Mean (SD)
Connections Academy	Math	104	45.72 (17.54)	165	34.25 (12.00)
Best Matched Virtual Schools	Math	104	44.04 (18.36)	142	32.30 (13.97)
Connections Academy	Reading	102	65.34 (17.00)	165	51.77 (13.53)
Best Matched Virtual Schools	Reading	102	62.28 (16.80)	138	43.83 (14.61)

Note. Here the pool of matching schools included non-charter traditional bricks-and-mortar schools.

SD indicates standard deviation

Study states include AZ, CA, CO, FL, GA, IA, ID, IN, KS, MI, MN, NM, NV, OH, OK, OR, SC, TX and UT

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Table 18: Connections Academy and best match virtual school group difference in percent students proficient in mathematics and reading

		Matching Year	
Comparison	Content	Effect Size	P-Value
Connections Academy vs Best Matched Virtual Schools	Math	0.092 (53.65)	0.500
	Reading	0.182 (57.23)	0.198

		Combined 2015 and 2016	
Comparison	Content	Effect Size	P-Value
Connections Academy vs Best Matched Virtual Schools	Math	0.140 (55.57)	0.206
	Reading	0.543 (70.64)	<0.001

Note. Here the pool of matching schools included only fully online public schools.

The effect-size denotes group mean difference in matched group standard deviations similar to Cohen's d, and (-) denotes the percentile rank of the Connections Academy mean in the matched group distribution similar to Cohen's U3.

[S] *Indicates statistically significant difference at 0.05 probability level.*

Table 19: Connections Academy school and district Math model effects

Source	Wald Chi-Square	df	Sig
Intercept	0.82	1	0.775
Group	2.884	1	0.089
State	440,910.348	14	0.000
School			
Percent Proficient Matching Year	61.970	1	0.000
Grade Enrollment School	1.668	1	0.197
Free or Reduced Lunch [P]	0.183	1	0.668
White School [P]	4.551	1	0.033
Hispanic School [P]	0.047	1	0.828
African American School [P]	0.402	1	0.526
Asian School [P]	6.198	1	0.013
Two or More Races School [P]	0.314	1	0.575
District			
Expenditure [E]	0.388	1	0.533

IEP District [P]	2.991	1	0.084
Mobility Rate [P]	0.944	1	0.331
Mobility Category	0 [R]		
Mobility Category by Mobility Rate [P]	1.458	2	0.482

[E] *Expenditure indicates instructional expenditure per pupil in US dollars.*

[P] *These measures are percentages.*

IEP indicates Individualized Education Program.

[R] *Set to zero because this parameter is redundant.*

Table 20: Connections Academy school and district Reading model effects

Source	Wald Chi-Square	df	Sig
Intercept	1.401	1	0.236
Group	0.300	1	0.584
State	3.18×10^{14}	15	0.000
School			
Percent Proficient Matching Year	13.046	1	0.000
Grade Enrollment School	7.048	1	0.008
Free or Reduced Lunch [P]	7.764	1	0.005
White School [P]	6.308	1	0.012
Hispanic School [P]	0.337	1	0.561
African American School [P]	0.009	1	0.926
Asian School [P]	6.151	1	0.013
Two or More Races School [P]	3.549	1	0.060
District			
Expenditure [E]	0.440	1	0.507

IEP District [P]	0.019	1	0.891
Mobility Rate [P]	0.194	1	0.659
Mobility Category	0 [R]		
Mobility Category by Mobility Rate [P]	1.017	2	0.601

[E] *Expenditure indicates instructional expenditure per pupil in US dollars.*

[P] *These measures are percentages.*

IEP indicates Individualized Education Program.

[R] *Set to zero because this parameter is redundant.*

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Table 21: Connections Academy School and district Math model parameters

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi Square	df	Sig
Intercept	17.928	9.5333	-0.757	36.613	3.537	1	0.060
Best Match	5.350	3.1502	-0.825	11.524	2.884	1	0.089
Connections Academy	0 [R]						
State	Model parameters for individual states are not listed here						
School							
Percent Proficient Matching Year	0.423	0.0537	0.317	0.528	61.967	1	0.000
Grade Enrollment School	0.013	0.0100	-0.007	0.033	1.668	1	0.197
Free or Reduced Lunch [P]	0.053	0.1247	-0.191	0.298	0.183	1	0.668
White School [P]	0.105	0.0491	0.009	0.201	4.551	1	0.033
Hispanic School [P]	0.018	0.0845	-0.147	0.184	0.047	1	0.828
African American School [P]	-0.061	0.0966	-0.251	0.128	0.402	1	0.526
Asian School [P]	0.534	0.2145	0.114	0.954	6.198	1	0.013
Two or More Races School [P]	0.227	0.4040	-0.565	1.018	0.314	1	0.575
District							
Expenditure [E]	0.000	0.0007	-0.001	0.002	0.388	1	0.533
IEP [P]	-0.504	0.2912	-1.074	0.067	2.991	1	0.084
Mobility Rate [P]	0.232	0.1683	-0.097	0.562	1.908	1	0.167

Mobility Category	0 [R]						
Mobility Category = 1 by Mobility Rate	-0.131	0.1478	-0.421	0.158	0.790	1	0.374
Mobility Category = 2 by Mobility Rate	-0.227	0.1951	-0.610	0.155	1.355	1	0.244
Mobility Category = 3 by Mobility Rate	0 [R]						

[E] *Expenditure indicates instructional expenditure per pupil in US dollars.*

[P] *These measures are percentages.*

IEP indicates Individualized Education Program.

[R] *Set to zero because this parameter is redundant.*

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Table 22: Connections Academy School and district Reading model parameters

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi Square	df	Sig
Intercept	8.365	12.8556	-16.831	33.562	0.423	1	0.515
Best Match	1.250	2.2837	-3.226	5.726	0.300	1	0.584
Connections Academy	0 [R]						
State	Model parameters for individual states are not listed here						
School							
Percent Proficient Matching Year	0.200	0.0554	0.092	0.309	13.046	1	0.000
Grade Enrollment School	0.016	0.0060	0.004	0.028	7.048	1	0.008
Free or Reduced Lunch [P]	-0.152	0.0544	-2.58	-0.045	7.764	1	0.005
White School [P]	0.308	0.1225	0.068	0.548	6.308	1	0.012
Hispanic School [P]	0.092	0.1590	-0.219	0.404	0.337	1	0.561
African American School [P]	0.016	0.1726	-0.322	0.354	0.009	1	0.926
Asian School [P]	0.739	0.2980	0.155	1.323	6.151	1	0.013
Two or More Races School [P]	0.720	0.3821	-0.029	1.469	3.549	1	0.060
District							
Expenditure [E]	0.000	0.0005	-0.001	0.001	0.440	1	0.507
IEP [P]	0.024	0.1730	-0.315	0.363	0.019	1	0.891
Mobility Rate [P]	0.185	0.2373	-0.280	0.650	0.606	1	0.436

Mobility Category	0 [R]						
Mobility Category = 1 by Mobility Rate	-0.150	0.2370	-0.614	0.315	0.400	1	0.527
Mobility Category = 2 by Mobility Rate	-0.267	0.2789	-0.814	0.280	0.916	1	0.339
Mobility Category = 3 by Mobility Rate	0 [R]						

[E] *Expenditure indicates instructional expenditure per pupil in US dollars.*

[P] *These measures are percentages.*

IEP indicates Individualized Education Program.

[R] *Set to zero because this parameter is redundant.*