

Providing Opportunities for Deeper Learning



SEPTEMBER 2014

Acknowledgments

The authors would like to acknowledge the many people who helped make this study possible. We thank the thousands of students, teachers, principals, and network and district staff who agreed to provide responses to the study's many data collections. We extend our appreciation to the William and Flora Hewlett Foundation for the grant that made this study possible, and particularly to Kristi Kimball for her initiation of the project and to Marc Chun and Barbara Chow for their consistent support throughout the research process. Our thanks also go to Kerstin Carlson Le Floch and Laura Salganik at AIR for their careful technical review and to Emma Ruckley for her thorough editing.

We are also grateful to Jim Kemple and the staff at the Research Alliance for New York City Schools for their expert analysis in this collaboration. The statements, findings, and conclusions here are those of the authors and study leads and do not necessarily represent the viewpoint of these organizations or individuals.

Funded by

The William and Flora Hewlett Foundation

Note: The content of this report is identical to the original report released in September 2014, except for Exhibit 2, which has been modified along with relevant text due to an error in the original exhibit.

REPORT 2

FINDINGS FROM THE STUDY OF DEEPER LEARNING
Opportunities and Outcomes

Providing Opportunities for Deeper Learning

SEPTEMBER 2014

Authors

Catherine Bitter, James Taylor, Kristina L. Zeiser, Jordan Rickles
American Institutes for Research

Principal Investigators

Jennifer O'Day, American Institutes for Research
Michael S. Garet, American Institutes for Research

Study Team



The Research Alliance for
New York City Schools

Megan Brown
Connie Chandra
Marian Eaton
Alison Hauser
Mette Huberman
Jamie Shkolnik
Allison Waters
Tara Zuber

Michael Segeritz
Molly Alter
James Kemple

Contents

Abstract	vi
Introduction	1
Study Design	7
Key Questions and Findings	12
To What Extent Did Students in Network High Schools Experience Opportunities for Deeper Learning?	12
Did Students Experience More Opportunities for Deeper Learning in Network Schools Than in Non-Network Schools?	13
Were Effects of Participation on Opportunities for Deeper Learning Similar for All Students?	18
Students With Low and High Levels of Prior Achievement.	18
Students Who Did or Did Not Qualify for Free or Reduced Price Lunch.....	19
Gender	19
Grade 11 and Grade 12 Students	19
Did the Most Challenging Assignments in Network High Schools Provide Greater Opportunities for Deeper Learning Than Those in Non-Network High Schools?	19
Do Students Experiencing Greater Opportunities for Deeper Learning Also Experience Better Outcomes?	22
Key Takeaways	27
References.....	30

Abstract

The *Study of Deeper Learning: Opportunities and Outcomes*—funded by the William and Flora Hewlett Foundation—aimed to determine whether students attending high schools with a mature and at least moderately well implemented approach to promoting *deeper learning* actually experienced greater deeper learning opportunities and outcomes than they would have had they not attended these schools. In this report—our second in a series of three—we focus specifically on the key question: Did students who attended deeper learning network schools have *more* opportunities to engage in deeper learning than would likely have been the case had they not attended the network schools? This question addresses a fundamental assumption that underpins the deeper learning initiative: that a well implemented approach to deeper learning *can* result in greater opportunities for students to develop deeper learning competencies. This analysis includes 11 pairs of matched deeper learning network and comparison schools in California and New York. While we collected a wide range of data for this study, we relied primarily on student survey data and examples of the work teachers assigned to students (teacher assignments) for this analysis.

Key takeaways include the following:

1. On average, students who attended the network schools in the study reported greater opportunities to engage in deeper learning than did similar students who attended non-network schools. Positive effects were found across all measures including opportunities for complex problem solving, opportunities to collaborate, opportunities to communicate, opportunities to learn how to learn, opportunities for creative thinking, opportunities to receive feedback, opportunities for assessments aligned with deeper learning, opportunities for interdisciplinary learning, and opportunities for real world connections.
2. Since the study schools served substantial populations of students living in poverty and, in some cases, large populations of English language learners, the results demonstrate that these opportunities were provided to a diverse group of students, including traditionally underserved subgroups of students.
3. The effects of attending a participating network school on deeper learning opportunities were similarly positive for initially high- and low-achievers and for students who did and did not qualify for free or reduced price lunch.
4. Teachers' most challenging assignments collected from the network schools exhibited greater opportunities for independent learning in mathematics and for real-world connections in English language arts than those collected from the non-network schools, but were not significantly different on other opportunity measures (including complex problem solving, communication, and conceptual understanding of mathematics).
5. The opportunities for deeper learning experienced by individual students, regardless of the school they attended, were associated with those students' deeper learning outcomes.

Introduction

Today's high school students face a very different world than previous generations. With the rapid evolution of technology, the global expansion of jobs and businesses, and an ever more complex and diverse democracy, new graduates must navigate an environment that is rapidly and continually changing. Postsecondary institutions and business leaders have called for students to be better prepared for this environment, but despite decades of educational reform efforts, concerns continue that too few American students acquire the complex knowledge and skills required to become engaged and productive citizens of this changing world (Murnane & Levy, 1996; Levy & Murnane, 2013). These concerns are more pronounced in schools that serve disproportionate numbers of disadvantaged students. In response, a movement in support of "deeper learning" has emerged among researchers, policymakers, and practitioners in an effort to improve students' future success in college and in their careers and civic life.

The concept of deeper learning has been used both to describe a set of competencies or goals for students, and to characterize a way of learning (or a process) that promotes these competencies. The William and Flora Hewlett Foundation—a leader in the national initiative to promote deeper learning in schools—has defined deeper learning as "a set of competencies students must master in order to develop a keen understanding of academic content and apply their knowledge to problems in the classroom and on the job" (William and Flora Hewlett Foundation, 2013, p. 1). In this view, deeper learning focuses on the development of six interconnected competencies that many argue are prerequisites for success in college, career, and civic life:

- Mastery of core academic content
- Critical thinking and complex problem-solving skills
- Effective communication skills
- Collaboration skills
- An understanding of how to learn
- Academic mindsets (William and Flora Hewlett Foundation, 2013; Chow, 2010; Trilling, 2010).

Taking a slightly different approach, a recent review of theory and research across an array of disciplines led a National Research Council panel (National Research Council [NRC], 2012) to define deeper learning as "the process through which an individual becomes capable of taking what was learned in one situation and applying it to new situations (i.e., transfer)." The panel distinguished that process from the specific "21st century competencies" it produces. The NRC grouped these competencies into three domains: the cognitive domain, the interpersonal domain, and the intrapersonal domain. These domains neatly subsume the six dimensions identified by the Hewlett Foundation, providing a compatible framework for the purposes of both research and practice.

The concept of deeper learning has gained momentum among educators and policymakers as a means to better prepare students for college and careers. However, the research on deeper learning has lagged behind the political and educational interest in this concept and the activity of practitioners in schools and districts. Although early evaluation studies of schools participating in deeper learning-focused networks suggested positive effects, they had a number of limitations (relating to their research designs, samples, data, measures, or analyses; Yuan & Le, 2010). More recent evaluations (Collins et al., 2013; Guha et al., 2014; Nichols-Barrer & Haimson, 2013) indicated positive program effects on indicators such as GPA, progress to graduation, or state test results. However, these studies represent a modest empirical research base on deeper learning, given that they are either primarily descriptive in nature or have focused on demonstrating the effectiveness of specific instructional programs or approaches aligned with the goals of deeper learning. Indeed, the NRC panel noted the limitations of existing (and primarily correlational) research in establishing linkages between 21st Century/deeper learning competencies and long-term outcomes for students, recommending that foundations and federal agencies support further research in this arena (NRC, 2012). As a result of this limited empirical base, there has recently been increased interest in rigorous research that evaluates whether school approaches explicitly focused on developing deeper learning competencies are associated with improved educational experiences and outcomes for students from all backgrounds.¹

The *Study of Deeper Learning: Opportunities and Outcomes*—funded by the Hewlett Foundation—aimed to determine whether students who attended high schools with a mature and at least moderately well implemented approach to promoting deeper learning actually experienced greater deeper learning opportunities and outcomes than likely would have been the case had they not attended these schools.² In contrast to an evaluation of a particular program or instructional strategy, this proof-of-concept study focused on providing evidence about whether schools can promote deeper learning, across a variety of reasonably well implemented approaches and a diversity of students. This study aimed to address the evidence gap related to deeper learning by using a rigorous quasi-experimental design³ to examine a set of high schools (hereafter referred to as “network” schools) associated with ten established networks from across the country that embrace the goals of deeper learning, promote instructional practices they believe are likely to lead to deeper learning competencies, and participate in the Hewlett Foundation’s Deeper Learning Community of Practice. (See Box 1 for a list of participating networks.)

¹ Prior research also notes the variation in classroom implementation of instructional approaches associated with reform efforts within and across schools, emphasizing the importance of examining opportunities to learn experienced by students at schools focused on deeper learning (e.g., see NCCSR, 2004; Berends et al., 2000; Aladjem et al., 2006).

² See our first report (Huberman et. al, 2014) for a description of the approaches to promoting deeper learning taken by schools in this study.

³ A quasi-experimental design estimates the effect of a “treatment,” program, or intervention by comparing outcomes for people who chose or were selected to participate and those who did not, rather than by randomly assigning participants (see Shadish, Cook & Campbell, 2002).

As described in the first report in this series—*The Shape of Deeper Learning: Strategies, Structures, and Cultures in Deeper Learning Network High Schools*—the network schools included in this study shared an explicit, school-wide focus on deeper learning as a goal for students (Huberman, Bitter, Anthony, & O'Day, 2014). While employing a diverse range of approaches to promote deeper learning, they had several strategies and structures in common.

Box 1: Networks Participating in the Hewlett Foundation's Deeper Learning Community of Practice

- Asia Society – <http://asiasociety.org/international-studies-schools-network>
- Big Picture Learning – <http://www.bigpicture.org/>
- ConnectEd – <http://www.connectedcalifornia.org/>
- EdVisions Schools – <http://www.edvisions.com/>
- Envision Schools – <http://www.envisionschools.org/>
- Expeditionary Learning – <http://elschools.org/>
- High Tech High – <http://www.hightechhigh.org/>
- Internationals Network for Public Schools – <http://internationalsnps.org/>
- New Tech Network – <http://www.newtechnetwork.org/>
- New Visions for Public Schools – <http://www.newvisions.org/>

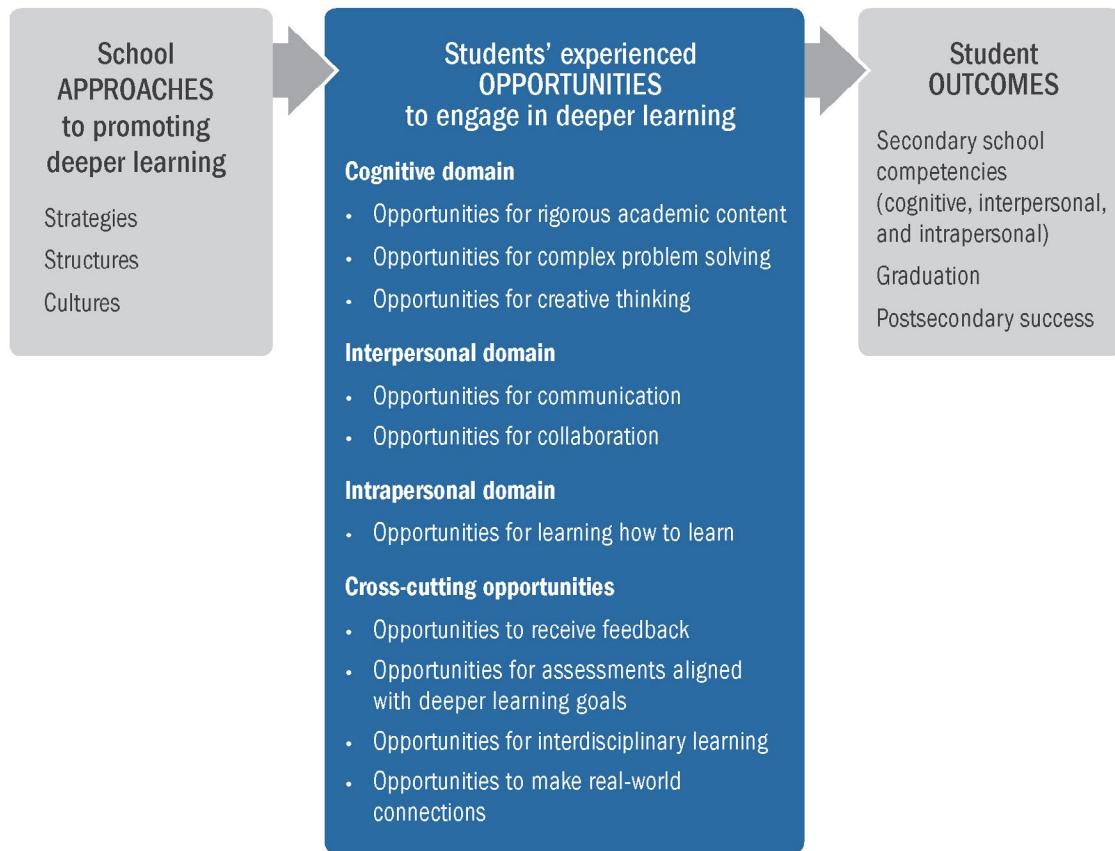
Note: See our first report (Huberman et al., 2014) for more information on the Deeper Learning Community of Practice.

The Hewlett Foundation's deeper learning initiative reflects a set of core assumptions about how a school's approach to promoting deeper learning can result in improved outcomes for students, including postsecondary success and civic and employment outcomes. In this study, we examined the underlying premise of this initiative: that explicit strategies, structures, and school culture designed to support deeper learning would result in students experiencing greater opportunities to engage in deeper learning. These opportunities would, in turn, lead to transferable knowledge and skills—or competencies—that are critical to readiness for college, career, and civic life.

For analysis and interpretation, we group these competencies into three overlapping domains, as defined by the National Research Council (2012): the *cognitive domain*, including mastery of academic content knowledge and complex problem solving; the *interpersonal domain*, including collaboration and communication skills; and the *intrapersonal domain*, including an understanding of how to learn and academic mindsets, such as motivation to learn, academic engagement, and self-efficacy (Farrington et al., 2012; Soland, Hamilton, & Stecher, 2013; NRC, 2012). Proponents of deeper learning argue that approaches focused on developing these competencies can improve outcomes for all students, including those from traditionally underserved groups and those who

have not previously experienced educational success. The abbreviated theory of action for the deeper learning initiative (shown in Exhibit 1) delineates the key hypothesized relationships between school approaches to promoting deeper learning, opportunities to engage in deeper learning, and outcomes. In this graphic, we provide additional detail related to the focus of this report—students' experienced opportunities to engage in deeper learning.

Exhibit 1: Abbreviated Theory of Action⁴



⁴ Not all of the outcomes included in this diagram are measured through survey and assessment data in this study (for example, understanding how to learn). Many of the intrapersonal outcomes shown in the diagram align with the sixth deeper learning competency: the development of academic mindsets.

Our first report from this study described key aspects of participating schools' approaches to promoting deeper learning (Huberman et al., 2014)—that is what *adults* in network schools did to develop deeper learning competencies. In that report, we described the strategies, structures, and cultures network schools instituted to foster the development of the three competency domains (cognitive, interpersonal, and intrapersonal; see Box 2). In this report—our second in a series of three—we focus specifically on the *opportunities that students experienced* to engage in deeper learning in their classrooms. In other words, we address the following key question:

Did students who attended the selected network schools experience *more* opportunities to engage in deeper learning than would likely have been the case had they not attended the network schools?

This question addresses a fundamental assumption that underpins the deeper learning initiative: that students in schools with at least moderately implemented approaches to promoting deeper learning actually experience greater opportunities to engage in deeper learning across their classes.⁵ This question is critical in that it asks whether students' classroom experiences in the network schools are significantly different than what comparable students experience in other schools. It lays the foundation for an examination of the outcomes of deeper learning, since if we do *not* find a significant, meaningful difference in students' opportunities, then any differences in student outcomes that we may find would likely be due to other factors beyond students' classroom engagement in deeper learning.

In addition, while one might expect that a school that focuses on deeper learning would provide deeper learning opportunities, prior educational research has shown that classroom implementation of an instructional approach or strategy can vary considerably within and across schools (NCCSR, 2004; Berends et al., 2000; Aladjem et al., 2006). Therefore we cannot assume that schools implementing approaches to deeper learning are actually changing students' learning experiences in a meaningful way, and we must determine whether there is evidence of such differences.

⁵ Since this was a proof-of-concept study, our aim was to determine whether *well implemented* approaches to deeper learning resulted in greater opportunities and outcomes for students. We therefore asked network leaders to identify schools that were implementing the network's approach to deeper learning at a moderate or high level based on their criteria as potential participants in the study. We did not include low implementers because the study aimed to determine whether the deeper learning approach, when at least moderately implemented, could result in greater opportunities and outcomes.

Box 2: Approaches and Structures for Deeper Learning

In the first report of the *Study of Deeper Learning* (see Huberman et al., 2014) we described the approaches (including strategies, structures, and culture) that network schools took to promote deeper learning. The analysis drew on qualitative data and teacher survey data from a broader sample of 19 network high schools and 11 comparison high schools. Key findings from this report included:

- 1. Across the three deeper learning domains, sampled network schools used a range of strategies to develop deeper learning competencies—most commonly project-based learning, internship opportunities, collaborative group work, and longer-term cumulative assessments.**
 - In the cognitive domain, all but one network school (18 of 19) employed project-based learning (PBL) to some degree to develop mastery of core academic content knowledge and critical thinking skills. PBL was integral to daily instruction in slightly over a third of these schools and used more sporadically in others.
 - Also in the cognitive domain, three-quarters of the network schools (14 of 19) provided connections to the real world through internship opportunities for students. At two schools, internships were considered central to learning and occurred two to three days per week across all four years. The remaining 12 schools incorporated internships for a portion of students at some point in their school career to provide career-related experience, boost life skills, or help with the transition from high school to college and careers.
 - In the interpersonal domain, collaboration and communication skill development was an explicit goal reported by staff at a majority of network schools (11 of 19), which they addressed through collaborative group work and longer term assessments (such as portfolios and exhibitions, where students had to present and defend their work).
 - In the intrapersonal domain, almost half of the network schools (9 of 19) reported having explicit goals related to intrapersonal competencies (learning how to learn and academic mindsets) for students and they used a variety of strategies to encourage the development of these skills, including study groups and student participation in decision making. Three schools focused on individualized learning as a way to develop independent learning and self-management skills.
- 2. Most network schools supported the implementation of instructional approaches aligned with deeper learning through the development of specific structural and cultural elements, including advisory classes (16 schools), alternative scheduling (14 schools) and personalized learning environments (all schools). However, these structures and cultures looked different across the schools. For example, advisory classes had different numbers of students (from 15 to 30 students), ran for different amounts of time (between 30 and 60 minutes), and happened with different frequencies (from every day to once or twice a week), depending on the school.**
- 3. Comparisons between the network and non-network school principal interview data suggest that the network schools employed strategies to foster the deeper learning competencies to a greater extent than did the non-network schools, particularly in the areas of project-based learning, internship opportunities, collaborative group work, longer-term cumulative assessments, and development of intrapersonal skills. Network schools also employed advisory classes and alternative scheduling to a higher degree than the non-network schools.**

Study Design

To examine the extent to which network schools provided more opportunities for students to engage in deeper learning, we surveyed students in these schools about the nature of their learning experiences, focusing on activities aligned with the six deeper learning competencies. We compared these experiences—or opportunities—with those reported by similar students attending other schools in the same geographic area that did *not* participate in one of the 10 deeper learning networks (hereafter referred to as “non-network schools”). We also examined whether certain subgroups of students (e.g., students with low and high levels of prior achievement) differentially benefited from attending a network school. In addition, we collected examples of the work teachers assigned to students (teacher assignments) in English Language Arts (ELA) and mathematics from both network and non-network schools to compare the opportunities for deeper learning provided by these assignments across the two groups of schools.

Study Participants: This analysis includes 11 pairs of matched network and non-network schools in California and New York. We included network schools that were considered to be moderate or high implementers of one of the 10 network models (based on network representatives’ reports), and we matched these schools with non-network schools that had similar incoming student populations (based on the demographics and achievements of incoming ninth-grade students). All schools were nonselective and served substantially disadvantaged populations. (See Box 3 for additional details regarding the selection process for schools and students.)

Measures of Opportunity: While we collected a wide range of data for this study, we relied primarily on student survey data and examples of assignments students were given by their teachers (teacher assignments) for these analyses (see Box 4). The survey included items that addressed nine measures of opportunities for deeper learning. These measures directly addressed four of the six dimensions of deeper learning outlined by the Hewlett Foundation (opportunities for complex problem solving, opportunities to collaborate, opportunities to communicate, and opportunities to learn how to learn), as well as additional opportunities that we expected would support the development of deeper learning competencies (opportunities for creative thinking, opportunities to receive feedback, opportunities for assessments aligned with deeper learning, opportunities for interdisciplinary learning, and opportunities for real world connections).⁶ We measured the level of opportunity by asking students to report the total number of core academic classes (including English, mathematics, science, or social studies) in which they engaged in specific activities related to each of the identified opportunities in the current school year.⁷ (See Box 5 for the opportunity measures we used, and Technical Appendix, Section III.A. for the actual survey items.)

⁶ We did not measure opportunities to master core academic content or develop academic mindsets directly through the survey. However, opportunities to develop a conceptual understanding of core mathematics content were measured through the analysis of teacher assignments. Also, the opportunity measures from the student survey included only opportunities offered through core academic coursework (i.e., they did not measure opportunities in elective classes or extracurricular activities). In addition, opportunities to learn how to learn and opportunities for real-world connections may reflect activities that promote the development of academic mindsets.

⁷ While we relied in large part on validated survey items and scales to measure the multiple facets of deeper learning, the measurement scales capture some of these constructs in only a limited way. For example, the survey scales for opportunities focused on the breadth of opportunities across academic classes, rather than the precise frequency or quality of those opportunities.

Box 3: Participating Schools and Students

The sample of schools included high schools participating in one of the 10 networks in the Hewlett Foundation's Deeper Learning Community of Practice and identified as moderate or high implementers of their network's approach ("network schools"). In addition, the sample included a set of comparison non-network schools serving similar student populations but not participating in any of the 10 networks ("non-network schools"). While the non-network schools were not members of the 10 networks, and deeper learning was not necessarily a focus at the schools, they may have been implementing other reforms.

Selecting Schools: We used several criteria to choose high schools from the participating networks. We selected schools that had implemented the network approach schoolwide and were considered to be moderate or high implementers of the approach, according to network representatives (based on criteria established by each network). We sought schools that had been in existence for at least four years (i.e., long enough to have graduated at least one class by the start of the study); that were non-selective in admissions (increasing the validity of comparisons between students in network and non-network schools); and that enrolled at least 200 students (ensuring a sufficiently large sample of students for data analyses). Because we were particularly interested in outcomes for economically disadvantaged students, we sought schools in which at least 25 percent of students were eligible for free or reduced-price lunch, although most of the schools we selected had a substantially larger percentage of eligible students (see Technical Appendix, Section II.A.).

We identified a matched non-network comparison school for each network school using data from the Common Core of Data (CCD), as well as aggregated student-level data obtained from each district. Student-level district data, which we aggregated to the school level, included student demographic and socioeconomic characteristics, as well as *incoming* student test scores (i.e., Grade 8 mathematics and English Language Arts test scores). For each network school, we recruited a non-network school in the same district or in a neighboring district. We sought non-network schools that, like the network schools, had been in existence for at least four years, were non-selective in admissions, and enrolled at least 200 students, at least 25 percent of whom were eligible for free or reduced-price lunch.

For the analysis described in this report, we included 11 pairs of schools with sufficient numbers of students who consented to participate in the study activities. The network schools represented 8 of the 10 networks and were located in five different districts across two states: California and New York. The non-network schools were located in six districts across these two states.*

Selecting Students: Students who participated in the data collection activities had been in the district since Grade 8 (allowing us to measure prior levels of achievement and demographic characteristics) and who entered Grade 9 in one of the sampled schools between the 2009–10 and 2011–12 academic years. In addition, for the student survey, the sample was restricted to students with parental consent to participate in the study. In some cases, challenges associated with obtaining active consent (required by four districts) limited the number of identified students who could participate in data collection activities. We used several approaches to maximize the number of students included in the data collection activities and analyses, and we accounted for non-response in the analysis model (see Technical Appendix, Section IV.A.).

* We included 12 network schools and 10 non-network schools. One non-network school was matched to two network schools, and two of the network schools were combined for analyses—because they had small student populations eligible for the study and were co-located on one campus—resulting in 11 parallel analyses. An additional eight network schools (including three schools in the two networks not included in this analysis) participated in the study but were excluded from this analysis, either because we did not identify a matched comparison school that met our criteria and was willing to participate, or because we were unable to obtain parental consent for a sufficient number of students for certain data collections.

Box 4: Data Sources

The analyses of opportunities for deeper learning presented in this report rely on three primary data sources:

1. **A Student Survey:** We administered a one-hour survey to participating students in spring 2013. The survey was designed to measure: 1) the opportunities students experienced in school related to the deeper learning competencies, and 2) the interpersonal and intrapersonal outcomes that are hypothesized to be important to college and career readiness in the theory of action. We administered the survey to all sampled and consented students in Grade 11 and Grade 12 in each participating network and non-network school. In total, we administered surveys for 1,762 students in 11 pairs of schools, with an average response rate of 76 percent among sampled students (ranging from 54 percent to 93 percent of sampled students, by school).*
The survey included previously validated item sets from national surveys, including the Consortium of Chicago School Research (CCSR) survey and the High School Longitudinal Survey (see Technical Appendix, Section III.A. for a full list of items and sources). We supplemented these existing items with original items designed to address specific constructs important to this study. The survey was piloted prior to administration to test the validity of the scales. We calculated scale scores for the survey constructs using a Rasch analysis.** These Rasch scores were standardized using the mean and standard deviation among students from non-network schools so that the results could be presented as effect sizes.
2. **Teacher Assignments:** We collected sample ELA and mathematics classroom assignments from teachers of a sub-sample of students in the 11 pairs of schools. The purpose of these data was to measure the most challenging opportunities students were given to demonstrate critical thinking, communication, and independent learning skills (“learning how to learn”) and to make real-world connections. While the survey gave us information about the usual instruction in the schools, the assignments gave us information about how students were challenged to go beyond typical expectations. We collected assignments from teachers of up to 40 randomly selected students per school (20 students in Grade 10 and 20 students in Grade 12) in spring 2013. We asked each teacher to submit an example of the “most challenging assignment” given to the sampled students they were teaching, plus an additional challenging assignment. In total we collected 148 mathematics assignments and 148 ELA assignments.
3. **Extant Student-Level Data:** We obtained extant student-level demographic data from the districts associated with the participating schools for five cohorts of students. We used these data to calculate propensity scores for students and to select student samples. Demographic data were also used as covariates in the analysis models.

* A technological complication with online survey administration resulted in a large amount of missing data in one of the non-network schools. For survey constructs affected by this technological issue, analyses excluded this pair of schools.

** Rasch analysis is a method of generating scale scores on a survey or test based on responses to individual items.

Box 5: Opportunities for Deeper Learning—Survey Measures

1. **Opportunities for complex problem solving:** The degree to which students engage in complex problem solving by analyzing ideas, judging the value and reliability of an idea or source, constructing new ideas, and applying knowledge to solve new problems
2. **Opportunities for creative thinking:** The extent to which students have the opportunity to engage in creative thinking in their core academic classes, such as thinking of original solutions to problems and new ways to do things, creating new ideas, and using their imagination.
3. **Opportunities to communicate:** The extent to which students have the opportunity to practice written and oral communication skills
4. **Opportunities to collaborate:** The degree to which students collaborate on assignments, provide feedback on each others' work, and collaborate in other ways
5. **Opportunities to learn how to learn:** The degree to which students practice monitoring and directing their own work and learning
6. **Opportunities to receive feedback:** The degree to which students receive feedback on their work from teachers, peers, or others, and the form this feedback takes (written, oral, both)
7. **Assessments aligned with deeper learning:** The extent to which students engage in various forms of assessment including assessments of problem solving, communication, and collaboration
8. **Opportunities for interdisciplinary learning:** The degree to which students engage in interdisciplinary learning, where two or more disciplines are combined to enhance inquiry and knowledge generation
9. **Opportunities for real-world connections:** The degree to which students engage in instructional activities that emphasize real-world connections

Students were asked to respond to a set of items asking about the number of core content classes (including English, mathematics, science, and social studies) in which they engaged in activities relevant to the opportunity measure. Responses options included: 0 = none of my classes; 1 = one of my classes; 2 = two of my classes; 3 = three or more of my classes.*

Analyses for opportunities for complex problem solving, opportunities to communicate, and opportunities to learn how to learn included 10 school pairs, while analyses of the remaining opportunities included 11 school pairs.

* Opportunities for interdisciplinary learning were measured on the response scale 0 = never, 1 = some of the time, 2 = most of the time, 3 = all of the time.

We also collected teachers' most challenging assignments in ELA and mathematics in order to have an authentic measure of the most challenging types of instructional activities in which students were engaged at both network and non-network schools. ELA and mathematics experts scored these assignments using rubrics that we developed in consultation with the scorers. These rubrics had been validated in previous studies conducted by American Institutes for Research (AIR), and they were modified specifically to address several of the deeper learning competencies examined in this study. The scorers used the rubrics to rate the quality of each assignment on either four criteria (ELA assignments) or five criteria (mathematics assignments), including: conceptual understanding of core content (mathematics only); critical thinking skills; effective communication

skills; independent learning skills (e.g., learning how to learn); and real-world connections (see Box 7 in Key Questions and Findings for scoring criteria). Additional information on the scoring rubrics is presented in the Technical Appendix, Section III.C.⁸ In addition to looking at the individual scoring criteria, we estimated an overall score for each assignment.

The teacher assignments and student survey data provided complementary information on opportunities for deeper learning. The goal of the survey was to collect data directly from a large sample of students in Grades 11 and 12 on the opportunities they experienced in instruction across all core classes. The collection of assignments, meanwhile, focused on a smaller sample of students in order to provide an exploratory analysis of authentic opportunity data in ELA and mathematics classes only. In addition, while the survey asked students to report on their classwork in general, the teacher assignments identified opportunities provided through the most challenging assignments that students received, thus representing only a specific subset of instructional experiences. The analysis models used for both of these data sources are summarized in Box 6.

Box 6: Analysis Models

Analysis of Survey Measures of Opportunities in Network and Non-Network Schools: To estimate the differences in opportunities for deeper learning reported by students in network and non-network schools, we used doubly robust ordinary least squares regression models.* We balanced student characteristics within pairs of schools using propensity score weighting** (described in the Technical Appendix, Section IV.A.), and accounted for non-consent and non-response. We performed student-level analyses separately within each pair of network and non-network schools, using the combined sample of students who entered Grade 9 in the 2009–10 and 2010–11 academic years, taking student cohort and characteristics measured prior to entry into high school into account. We then used a meta-analytic technique to estimate the average difference between students in network and non-network schools across the 11 pairs of schools. (See the Technical Appendix, Section IV.B. for a more detailed description of the analysis method.)

Analysis of Teacher Assignment Measures of Opportunities in Network and Non-Network Schools:

We used a two-level hierarchical linear model (HLM) to estimate differences in scores between the network and non-network assignments (for each scoring criterion and overall). Assignments were weighted by the number of sampled students to which they were assigned, and grade level was taken into account in the model.

* The analysis is considered doubly-robust (Funk et al., 2011) because it accounts for preexisting differences between network and non-network students in two ways: first by adjusting for how the student differences are associated with network school selection (using propensity score weighting), and second, by adjusting for how the student differences are associated with opportunity measures (using regression models). If either of the two adjustment methods accurately accounts for student differences, we can obtain valid estimates of the network school's effect.

** Propensity score weighting is an analysis technique that balances the sample of students attending program and comparison schools to ensure that comparisons are made among similar students.

⁸ The scoring rubrics are also available upon request.

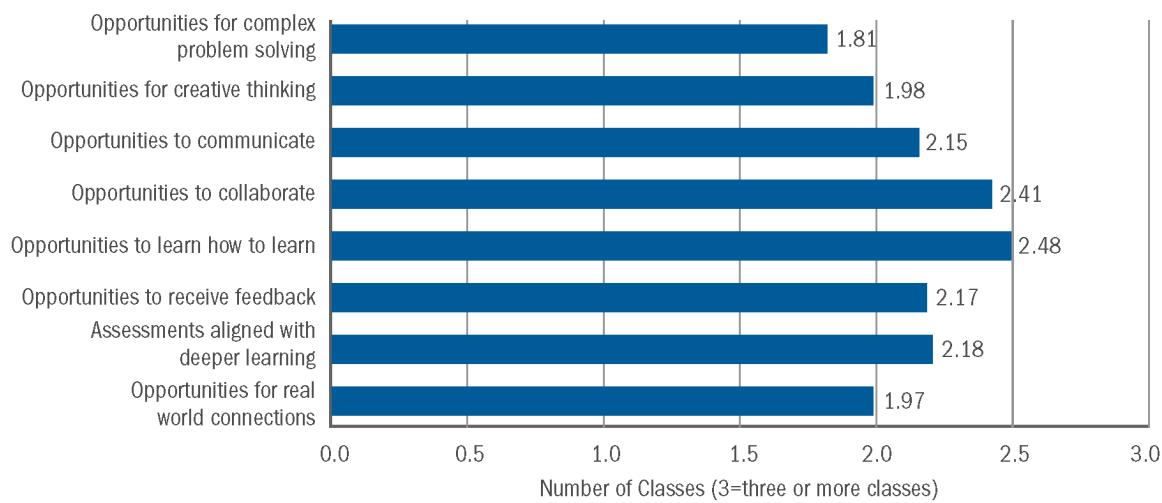
Key Questions and Findings

In this report, we explore the extent to which students attending network schools experienced opportunities for deeper learning, and whether they experienced more opportunities to engage in deeper learning than would likely have been the case if they attended a non-network school. In this section, we summarize findings relating to five key questions.

To What Extent Did Students in Network High Schools Experience Opportunities for Deeper Learning?

Students in network schools reported experiencing opportunities to develop certain deeper learning competencies (e.g., collaboration and learning-to-learn) more than others. On the survey, students were asked the number of core content classes (on a scale of 0 to 3 where 3 = three or more classes) in which they participated in activities aligned with the deeper learning competencies. Students in network schools reported experiencing opportunities to learn how to learn and to collaborate in more than two core content classes on average (mean score = 2.48 and 2.41 respectively). However, they reported opportunities for complex problem solving less often—on average, in one to two classes (mean score = 1.81). (See Exhibit 2 for the average score across network schools for all opportunity measures.)⁹ These data indicate that network schools may have focused on developing certain dimensions of deeper learning more than others, or that certain competencies were developed in a broader range of classes. Our first report in this series (Huberman et al., 2014) provides examples of the approaches used to provide these opportunities and provides insight into this variation.

Exhibit 2: Average Opportunity to Learn Across All Network Schools; Scale = 0 Classes to 3 or More Classes



Note: The bars represent the estimated mean of the school means for each opportunity scale, translated to the original response scale (0 = no classes, 1 = one class, 2 = two classes, 3 = three or more classes).

⁹ Opportunities for interdisciplinary learning were measured on the response scale 0 = never, 1 = some of the time, 2 = most of the time, 3 = all of the time. The mean score for this measure was 1.56.

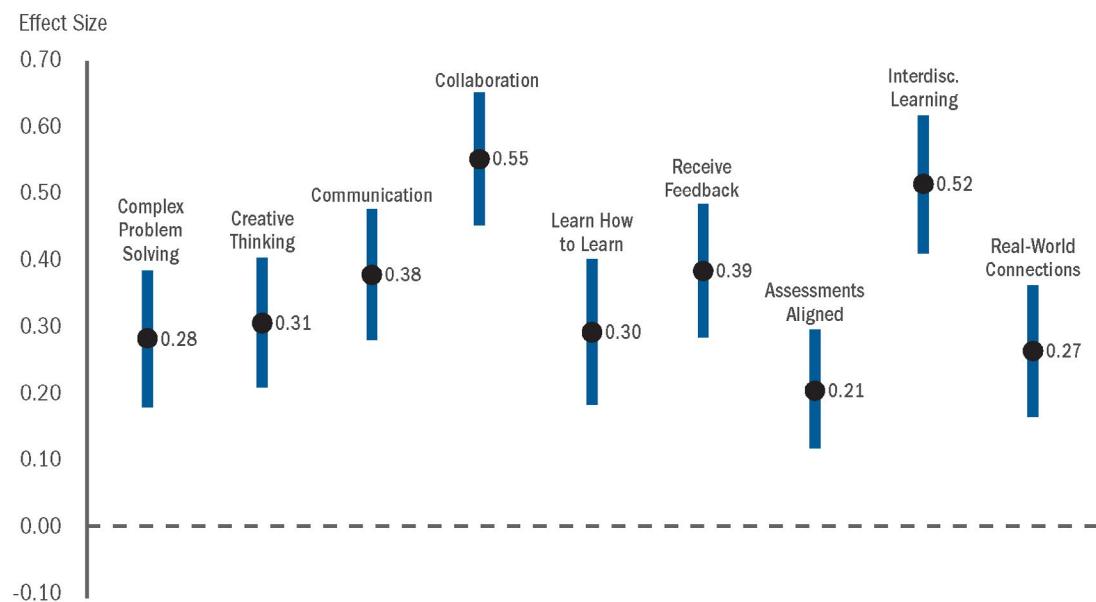
We observed similar variation in opportunities across competencies both in the network and non-network schools, but how did students' opportunities for deeper learning differ between network and non-network schools? The following results focus on the differences in the opportunities experienced in network and non-network schools overall and within individual pairs of schools.

Did Students Experience More Opportunities for Deeper Learning in Network Schools Than in Non-Network Schools?

Students in participating network high schools reported experiencing significantly more opportunities for deeper learning than their matched counterparts in the paired non-network schools. These significant differences held true for all opportunity measures. We measured these differences in terms of effect sizes, which represent the difference between the two groups of students in standard deviation units. The average effect sizes ranged from 0.21 (opportunities for assessments aligned with deeper learning) up to 0.55 (opportunities to collaborate). The average effect sizes across all pairs of schools for all nine opportunity measures are shown in Exhibit 3. The vertical lines represent the 95 percent confidence intervals. Because the confidence intervals all lie above the zero line, they demonstrate that all measures are statistically significant and positive. We observed positive effects even on the opportunity measures that were relatively low for the network schools, as described above.

To more easily interpret the magnitude of these differences, we translated the effect sizes to the original survey scale. For example, the effect size of 0.55 standard deviations on the Rasch scale for opportunities to collaborate translates to 0.5 points on the original 0 to 3 survey scale representing the number of core content classes (where 3 = three or more classes) in which they participated in activities aligned with the deeper learning competencies. That is, if, on average, students in non-network schools experienced these opportunities in two of their core courses, their counterparts in network schools more often reported opportunities in three or more of their core courses. In the Technical Appendix, Section V.A., we provide translations to the original survey scale for each opportunity measure.

Exhibit 3: Estimated Average Effect of Attending a Network School on Students' Opportunities for Deeper Learning

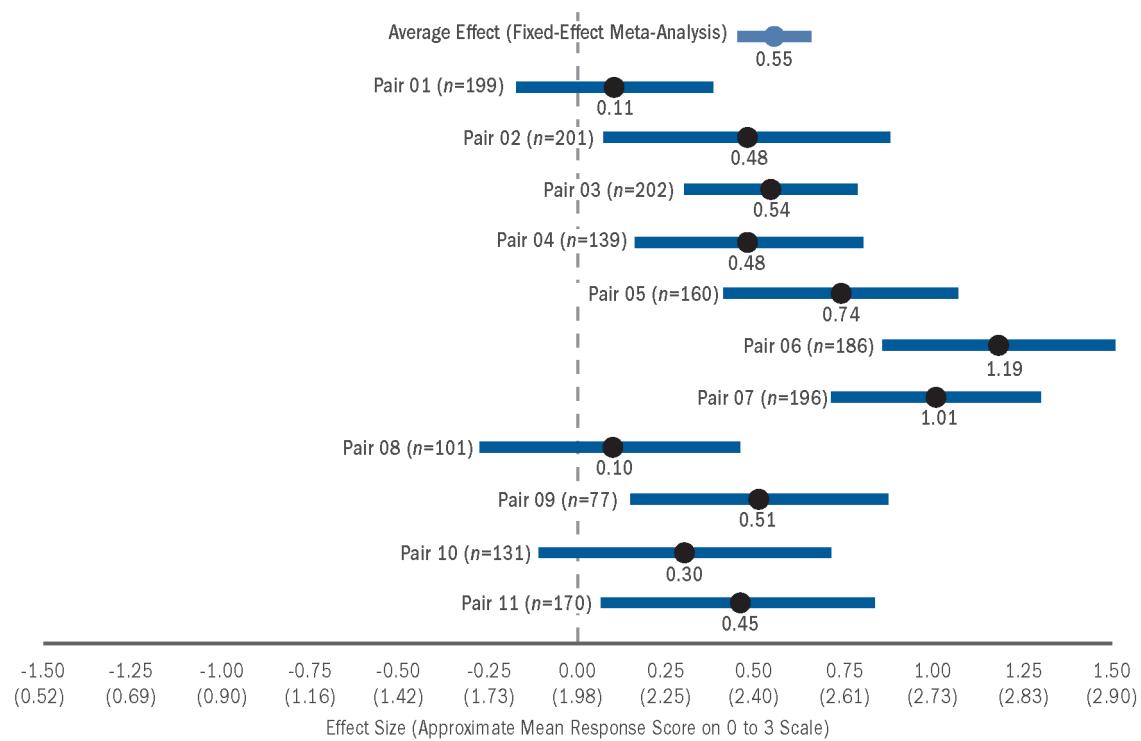


Note: The plotted points represent the meta-analytic average effect estimate for each opportunity measure (see Technical Appendix IV.B. for statistical model used), and the vertical bars represent each estimate's 95 percent confidence interval. Effect sizes are significant and positive when the full confidence interval lies above the zero line (all measures in this chart).

Although the meta-analytic results averaging across all 11 pairs of schools are the most precise, our analysis model also allowed us to identify significant differences in reports of opportunities within individual pairs of schools. This analysis revealed that for each opportunity measure, there was variation in effect of network attendance by school pair. In other words, some network schools may have implemented approaches to promote a given deeper learning competency more comprehensively than other network schools did. For example, in eight pairs of schools, student reports of opportunities for *collaboration* were significantly higher in the network schools than in the non-network schools. Among these pairs, the effect sizes ranged from 0.45 up to 1.19. For three pairs, however, there was no significant effect for this measure (see Exhibit 4).¹⁰ As another example, with respect to opportunities for *complex problem solving* (Exhibit 5), student reports of opportunities were significantly higher in the network schools than the non-network schools for four pairs (effect sizes among these pairs ranged from 0.35 to 0.66). For six network schools, we observed no significant effect for this measure. In some cases, these insignificant effects may have been due to small sample sizes within pairs. Charts showing effect sizes by pair for each opportunity measure are included in Technical Appendix, Section V.A. These data suggest that for each opportunity measure, some network schools were more successful in providing increased opportunities than other network schools.

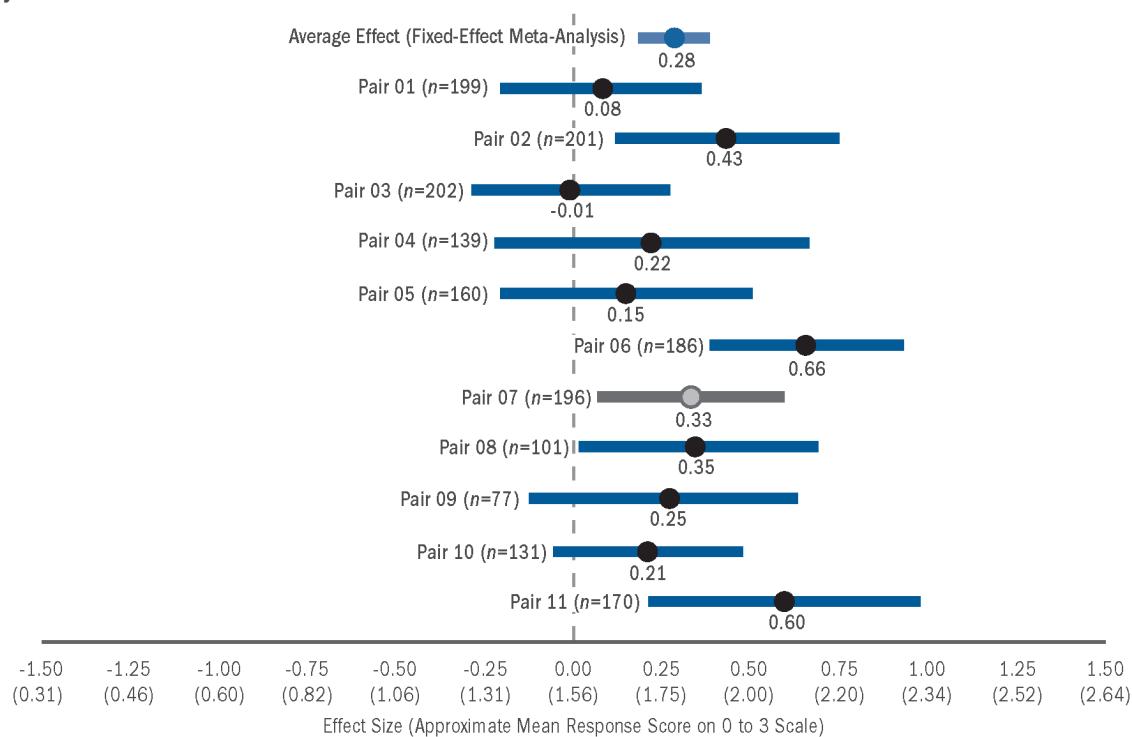
¹⁰ In some cases these insignificant results may be due to small sample sizes within pairs.

Exhibit 4: Estimated Effect of Attending a Network School on Students' Opportunities for Collaboration, by Individual School Pair



Note: The plotted points represent the effect estimate for *opportunity to collaborate* for each school pair included in the meta-analysis. The effect estimate for each pair on the Rasch scale is provided directly under each plotted point. The top scale represents the effect size based on the Rasch scale (in standard deviations); the bottom scale shows the effect size translated into the original response scale (0 = no classes, 1 = one class, 2 = two classes, 3 = three or more classes). The horizontal bars represent each estimate's 95 percent confidence interval. Effect sizes are significant and positive when the full confidence interval lies to the right of the zero line.

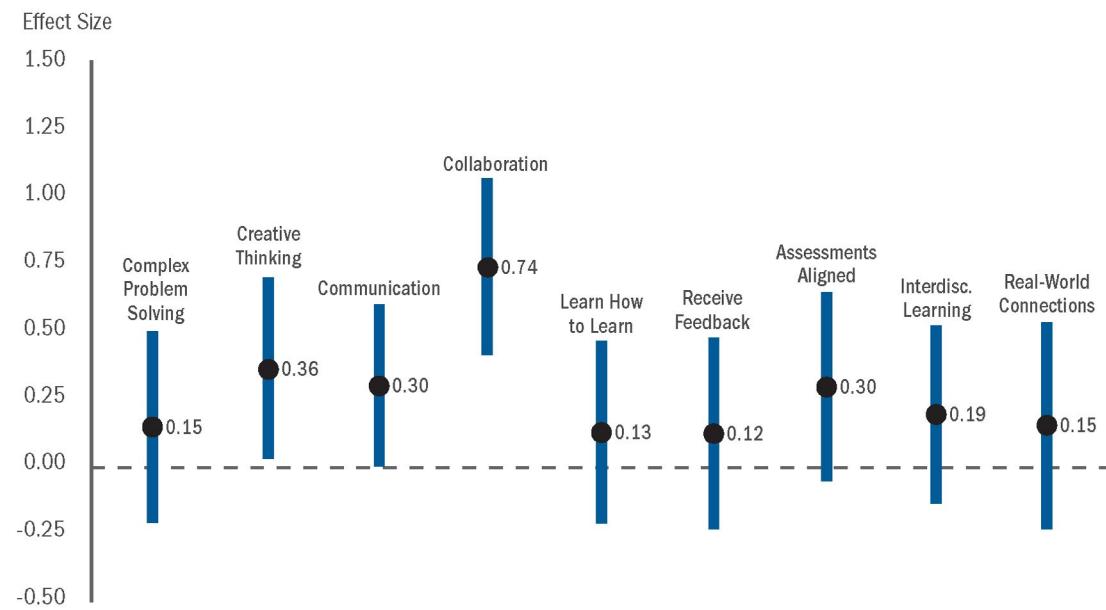
Exhibit 5: Estimated Effect of Attending a Network School on Students' Opportunities for Complex Problem Solving, by Individual School Pair



Note: The plotted points represent the effect estimate for *opportunity for complex problem solving* for each school pair included in the meta-analysis. The plot also includes Pair 07 (grey point) for reference, which was not included in the meta-analysis because of a low response rate for the opportunity for complex problem solving survey items. The effect estimate for each pair on the Rasch scale is provided directly under each plotted point. The top scale represents the effect size based on the Rasch scale (in standard deviations); the bottom scale shows the effect size translated into the original response scale (0 = no classes, 1 = one class, 2 = two classes, 3 = three or more classes). The horizontal bars represent each estimate's 95 percent confidence interval. Effect sizes are significant and positive when the full confidence interval lies to the right of the zero line.

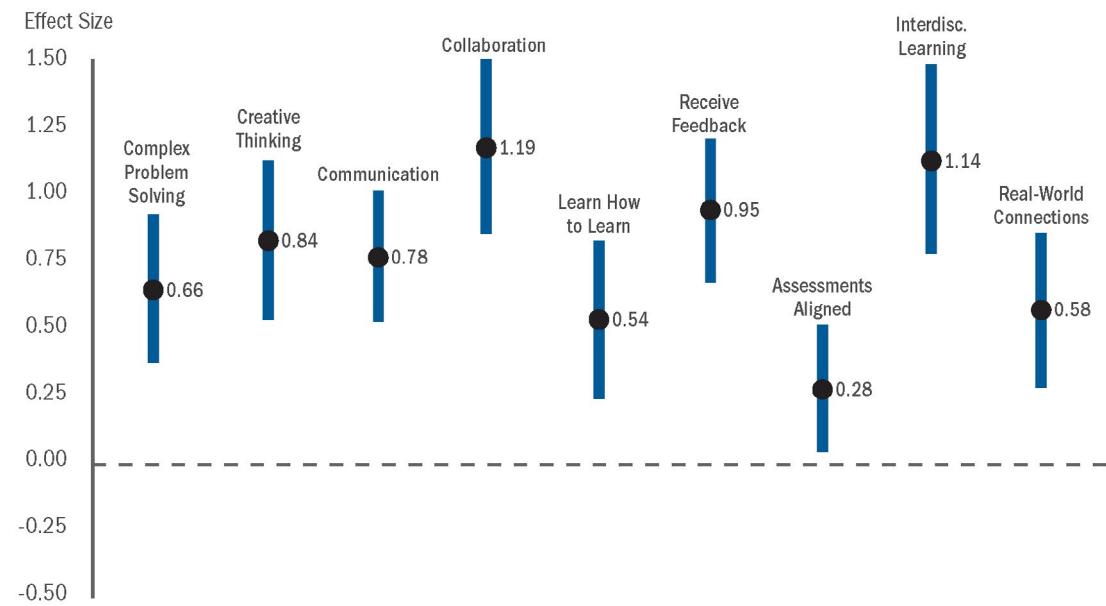
In addition, we found that for each network school, there was variation in effect by opportunity measure. In other words, individual network schools were more successful in providing greater opportunities for certain dimensions of deeper learning than they were for other dimensions. For example, students at one network school reported experiencing greater opportunities for collaboration than students in the paired non-network school (with an effect size of 0.74) but did not demonstrate significant positive effects for any other opportunity measure (see Exhibit 6 for “Pair 5” results). The network school students within another pair reported greater opportunities for deeper learning across all measures (see Exhibit 7 for “Pair 6” results), but with varying effect sizes. In 3 of the 11 pairs, significant positive differences were observed for only one opportunity measure, while in eight pairs, significant positive differences were observed for multiple opportunity measures (see Technical Appendix, Section V.A. for detailed pair results).

**Exhibit 6: Estimated Effect of Attending a Network School on Students' Opportunities for Deeper Learning,
Pair 5 Results**



Note: The plotted points represent the effect estimate for each opportunity measure for Pair 5. The vertical bars represent each estimate's 95 percent confidence interval. Effect sizes are significant and positive when the full confidence interval lies above the zero line.

**Exhibit 7: Estimated Effect of Attending a Network School on Students' Opportunities for Deeper Learning,
Pair 6 Results**



Note: The plotted points represent the effect estimate for each opportunity measure for Pair 6. The vertical bars represent each estimate's 95 percent confidence interval. Effect sizes are significant when the full confidence interval lies above the zero line.

Despite the variation between and within schools in reported opportunities, **students in each of the 11 network schools reported experiencing significantly more opportunity for deeper learning on at least one opportunity measure than students in the paired non-network schools. In addition, we observed no negative effects of network attendance on opportunities within any individual pairs.** This consistency across pairs underscores the overall average positive effects associated with network participation.

As we described in our first report, the study team also collected qualitative data (in addition to survey data), including interview and focus group data from principals, teachers, students, and network staff from the network schools. These data provide rich descriptions of the approaches network schools used to enable these opportunities for deeper learning and the variation in these approaches (see our first report, Huberman et al., 2014).

Were Effects of Participation on Opportunities for Deeper Learning Similar for All Students?

The consistent average positive effects suggest that mature network schools were successful, on average, in providing greater opportunities for students to engage in deeper learning. These results, however, raise the question of whether *all* students in the network schools experienced these opportunities, or whether opportunities for deeper learning were differentially experienced by subgroups of students. For example, one might imagine that students with higher prior achievement may have enrolled in more advanced courses with more opportunities. To explore this issue, we looked at whether the effects differed among certain subgroups of students: students with low and high levels of prior achievement; students who did or did not qualify for free or reduced price lunch; students of different genders; and students in different grades.¹¹ **Of these categories, only gender and grade level revealed differences in the effect of network participation on opportunities for deeper learning.**

Students With Low and High Levels of Prior Achievement

Students with low prior achievement and students with high prior achievement both experienced, on average, greater opportunities for deeper learning than their counterparts in non-network schools¹². In other words, we observed no difference in the effect of attending a participating network school on deeper learning opportunities between these two subgroups of students. Therefore, students with low and high levels of prior achievement appeared to experience the same benefits of network participation in terms of opportunities for deeper learning. Since high achievers traditionally are provided greater opportunities to learn through more advanced coursework and challenging instruction, this finding suggests that the network schools provided more equitable opportunities to students of all ability levels than is typical.

¹¹ The distribution of students by race and ethnicity resulted in sample sizes that were considered too small for a valid analysis of racial/ethnic subgroups.

¹² Prior achievement was based on students' Grade 8 ELA scores. For California, we conducted the analysis by comparing students who entered high school with ELA test scores below and above the average for their state; for New York City, we compared students below and above average for their district.

Students Who Did or Did Not Qualify for Free or Reduced Price Lunch

This analysis was limited to a smaller subgroup of six school pairs for which we were able to obtain free or reduced price lunch eligibility data. Once again, **we observed no difference in the effect of network participation on the opportunities reported by the two subgroups of students.** In other words, the positive effects of attending a network school were similar for students from low- and high-income families.

Gender

We also examined whether male and female students appeared to differentially benefit from attending a network school in terms of reported opportunities for deeper learning. On eight out of nine opportunity measures (the exception being interdisciplinary learning opportunities), **we observed a larger positive effect of network participation on opportunities for deeper learning for females than males.** For two measures—opportunities to learn how to learn and opportunities for real-world connections—there was no significant effect for males, but for females there was a positive, significant difference in opportunities for deeper learning between network and non-network schools. For the remaining six measures, students of both genders reported significantly more opportunities for deeper learning in network schools than non-network schools, but the effect sizes were larger for female students.

Grade 11 and Grade 12 Students

We also examined whether the benefits of attending a network school differed for Grade 11 and 12 students. One might expect, for example, that certain activities or structures related to deeper learning opportunities (such as internships or senior projects) take place more commonly in Grade 12. **We found larger positive effects of network participation for students in Grade 12 for some opportunity measures, including opportunities for creative thinking, opportunities to learn how to learn, opportunities to receive feedback, and opportunities for real-world connections.** For all other measures, however, we did not observe any significant differences in effects between Grade 11 and Grade 12 students.

Did the Most Challenging Assignments in Network High Schools Provide Greater Opportunities for Deeper Learning Than Those in Non-Network High Schools?

Teacher assignment data complement the student survey data on opportunities for deeper learning by providing a glimpse into the types of assignments that students were actually asked to complete. Four competencies addressed in the assignment scoring rubrics (critical thinking skills, effective communication skills, independent learning skills, and real-world connections) overlapped with the competencies measured in the student survey. However, we were able to assess these

competencies in a different way through the teacher assignments. While the survey used student reports to assess the prevalence of learning activities aligned with deeper learning, collecting and analyzing the *most challenging* assignments allowed us to assess the extent to which the most challenging ELA or mathematics assignments given to students during the school year aligned with high-quality deeper learning opportunities. In other words, the assignment collection did not measure the extent to which students experienced opportunities for deeper learning on a day-to-day basis or through their most typical assignments. Instead, it focused on determining whether challenging assignments at deeper learning schools offered opportunities to learn above and beyond the opportunities provided through challenging assignments at non-network schools. In addition, the mathematics assignment collection allowed us to measure opportunities to develop conceptual understanding of core content, which was not addressed in the survey.

Box 7: Opportunities for Deeper Learning—Teacher Assignment Scoring Criteria (See Technical Appendix, Section III.C. for additional detail on scoring rubrics; scoring rubrics available upon request)

Assignments were scored using a rubric that assessed the following dimensions. Assignments were scored on a scale of 1–3 or 1–4, depending on the criterion, as noted below.

English Language Arts

1. **Critical thinking/creative thinking skills** (1–3): The extent to which students are expected to demonstrate critical thinking skills in expository assignments by completing tasks that call for student work that moves beyond the reproduction of information to the construction of knowledge; or the extent to which students are expected to learn about literary elements of a genre and create a point in an imaginative writing assignment. Our analysis combines these measures for expository and imaginative assignments.
2. **Effective communication skills** (1–4): The extent to which tasks call for student work that demonstrates effective, elaborated written communication for expository or imaginative written assignments
3. **Independent learning skills** (1–4): The extent to which students partner with faculty in crafting tasks that meet students' instructional goals
4. **Real-world connections** (1–4): The extent to which teachers' assignments ask students to connect the material they are studying with the world beyond school by thinking through how that material helps them address the problems and issues they must contend with in the real world

Mathematics

1. **Conceptual understanding of core content** (1–4): The extent to which teacher assignments focus primarily on asking students to demonstrate conceptual understanding as it relates to one or more core ideas in mathematics
2. **Critical thinking skills** (1–4): The extent to which teacher assignments focus primarily on asking students to demonstrate critical thinking skills, such as problem solving and/or reasoning skills
3. **Effective communication skills** (1–3): The extent to which communicating mathematical understanding is an explicit expectation of the assignment
4. **Independent learning skills** (1–4): The extent to which students partner with faculty to develop mathematical tasks that meet students' instructional goals
5. **Real-world connections** (1–4): The extent to which teacher assignments address mathematical questions, issues, or problems similar to those likely to be encountered by professionals in the real world who use mathematics to solve problems

The percentage of most challenging ELA and mathematics assignments that were highly scored varied across the scoring criteria and indicated that there was room for improvement in the opportunities provided by classroom assignments (See Box 7 for scoring criteria). While we found examples of assignments that demonstrated high opportunities for deeper learning (see Technical Appendix, Section III.C. for examples of highly scored assignments), overall a low percentage of assignments in both the network and non-network schools received high scores across the measures (see Technical Appendix, Section V.C. for average scores of all criteria for students in network and non-network schools). In mathematics, only a small percentage of the most challenging assignments demonstrated a high level of opportunity on any given criterion. For example, only 15 percent of the assignments that teachers gave sampled students in network schools demanded either “some” or “substantial” critical thinking (score of 3 or 4) within a complex, non-routine problem. Twenty-seven percent of network school mathematics assignments required a solution path and explanation, and explicitly set expectations for the presentation of the solution (score of 3 on the communication criterion). ELA assignments received higher scores on average on some criteria. For example, 39 percent of network school assignments went substantially beyond the reproduction of information or required students to make a point in their writing (score of 3 on the critical thinking/creative thinking criterion), and 89 percent of network school assignments required extended writing (score of 3 or 4 on the communication criterion). However, few of the most challenging ELA assignments demonstrated a high level of opportunity for real-world connections or independent learning skills.

We compared the scores of assignments from network and non-network schools and found that **the mathematics assignments we collected in network schools were significantly more likely to exhibit opportunities for independent learning than the mathematics assignments from non-network schools, and the ELA assignments in network schools were significantly more likely to exhibit opportunities for real world connections than the ELA assignments from non-network schools.** The independent learning measure for teacher assignments aligns with the deeper learning dimension “learning how to learn.” **On all other measures for mathematics and ELA assignments, opportunity scores for the challenging assignments given to students in network and non-network schools were not significantly different.** In other words, the challenging assignments given to both sets of students were similar in terms of the opportunities they provided students to demonstrate communication or critical thinking skills and demonstrate conceptual understanding of core content (mathematics only).

In sum, the student survey data demonstrate that there is a greater prevalence of opportunities for deeper learning across core classes in the network schools than in the non-network schools. However, for most dimensions of deeper learning, the most challenging assignments were rated similarly at both network and non-network schools. How do we explain this apparent discrepancy? One plausible explanation is that students in the network schools were given such challenging assignments more frequently and in more of their classes than were students in the comparison

sites. Unfortunately our current data do not allow us to explore this hypothesis. This may be a useful topic for further research.

Do Students Experiencing Greater Opportunities for Deeper Learning Also Experience Better Outcomes?

Based on our survey measures of opportunities for deeper learning, we found that students attending network schools reported experiencing greater opportunities for deeper learning than students attending non-network schools. However, to what extent are these opportunities important for students' college and career readiness? While the average outcomes associated with attending deeper learning network schools are the focus of our third report, we began to address this question by considering whether individual students who reported receiving more opportunities for deeper learning—regardless of the school they attended—also demonstrated improved outcomes. The outcomes we considered included competencies associated with deeper learning, including students' creative thinking skills, collaboration skills, academic engagement, motivation to learn, self-efficacy, locus of control, perseverance, and self-management. We also examined performance on an assessment of critical thinking and content knowledge (the Organisation for Economic Co-operation and Development [OECD] Programme for International Student Assessment [PISA]-Based Test for Schools).

This analysis tests the assumption that greater opportunities for deeper learning are associated with improved student outcomes. The data and methods for this analysis are presented in Box 8. See Exhibit 8 for graphical examples of the general relationship between students' opportunity measures and outcomes.

Overall, we found a statistically significant relationship among each of the nine measures of opportunities for deeper learning and the eight measures of cognitive, interpersonal, and intrapersonal outcomes measured on the survey, for individual students (see Technical Appendix, Section V.D.). Each estimated relationship was statistically significant, with a 1.0 standard deviation difference in an opportunity measure associated with a 0.12 to 0.52 standard deviation difference in an outcome measure (see Exhibits 9 and 10). For example, the estimated relationship between opportunities for complex problem solving and motivation to learn was 0.46 among the California schools, suggesting that a student with opportunities for complex problem solving that were one standard deviation higher than average had a measure of motivation to learn that was 0.46 standard deviations higher than average. Similarly, the estimated relationship between opportunities for collaboration and academic engagement was 0.34 among the California schools, indicating that a student with opportunities to collaborate that were one standard deviation higher than average had a measure of academic engagement that was 0.34 standard deviations higher than average.

Box 8: Relating Opportunities to Outcomes

To test whether the opportunities reported by students were related to outcomes, we examined the association—regardless of individual students' participation in a network school—between opportunities (measured through the student survey) and key interpersonal, intrapersonal, and cognitive outcomes (measured through the survey and through the OECD PISA-Based Test for Schools).

Measurement of Interpersonal, Intrapersonal, and Cognitive Outcomes:

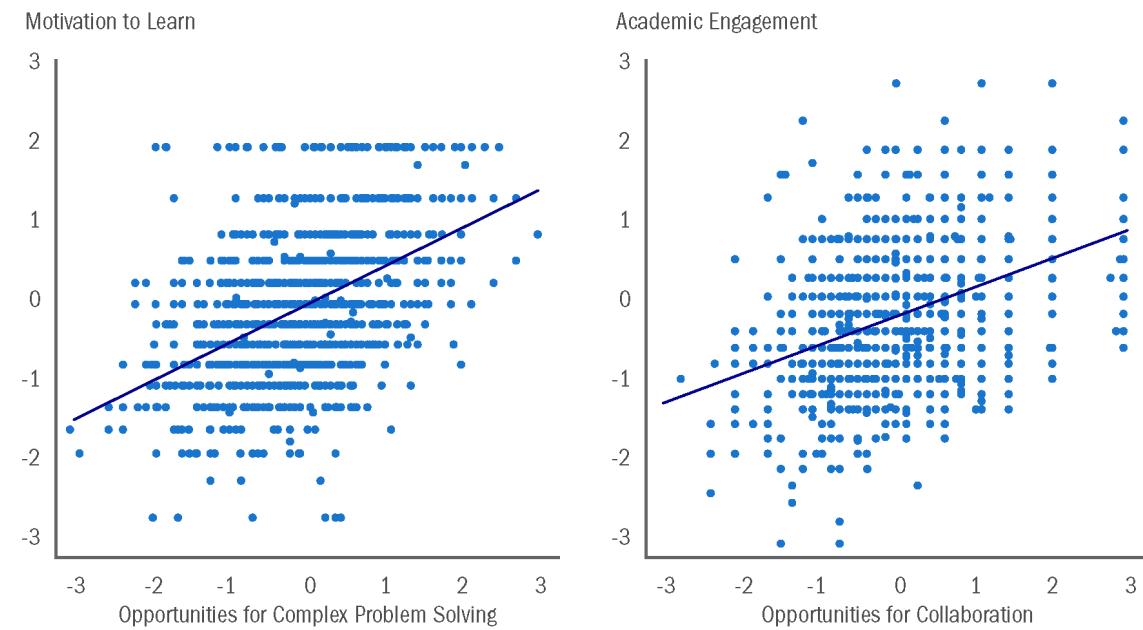
Student survey: The student survey administered to students attending network and non-network schools in spring 2013 included measures of eight cognitive, interpersonal, and intrapersonal outcomes, including creative thinking skills, collaboration skills, academic engagement, motivation to learn, self-efficacy, locus of control, perseverance, and self-management. These measures were drawn or adapted from existing instruments (which had been piloted and scaled) and are based in the interpersonal and intrapersonal outcomes and academic mindsets literature cited earlier (e.g., Farrington et al., 2012; Soland, Hamilton & Stecher, 2013; National Research Council, 2012).

OECD PISA-Based Test for Schools: We administered the OECD PISA-Based Test for Schools to examine two key deeper learning outcome dimensions: critical thinking and mastery of content knowledge. For the purposes of this research, we contracted with the approved U.S. vendor to administer the OECD PISA-Based Test for Schools to all sampled and consented students in Grades 11 and 12 in each network and non-network school in spring 2013. We administered the assessment to these grade levels, rather than the traditional age sample for the OECD PISA-Based Test for Schools (which typically includes students in Grade 9 and 10), because they had experienced a longer exposure to the network's deeper learning approach.* In total, we administered the assessment to 570 students in network schools and 697 students in non-network schools, with an average response rate of 61 percent. The OECD PISA-Based Test for Schools is based on the internationally recognized PISA and provides measures of students' content knowledge and application of higher-order thinking skills in reading, mathematics, and science.

Analysis Method: We used a general three-level HLM model, adjusting for student-level Grade 8 characteristics, to identify the relationship between opportunities and outcomes. We conducted separate analyses for different regions (California and New York) because the available data on student characteristics differed across districts.

* We also administered the assessment to the traditional age sample (15 year olds) in a subset of schools but did not use those data in the analysis because of the short time frame that those students had been in the schools. The results for the traditional sample were provided to the schools so they could see their students' performance against established international benchmarks and performance patterns.

**Exhibit 8: Two Examples of the Student-Level Relationship Between Opportunity Measures and Outcomes:
California Schools**



Note: Each plotted point represents a student's opportunity measure and outcome measure, expressed in standard deviation units. The diagonal line represents the general relationship between the opportunity and outcome measure. For display clarity, not all students are plotted.

The relationship between the opportunities for deeper learning measures and OECD PISA-Based Test for Schools scores was less pronounced, however. **Only our measure of opportunities for complex problem solving had a positive statistically significant relationship with OECD PISA-Based Test for Schools scores in mathematics and science.** This relationship is one that might be expected because the OECD PISA-Based Test for Schools aims to measure problem solving and critical thinking skills. One would not necessarily expect a relationship between some of the other measures, such as opportunities for collaboration, and the individually administered OECD PISA-Based Test for Schools scores, which does not measure skills in collaboration.

Exhibit 9: Estimated Student-Level Relationship Between Opportunity Measures and Outcomes: California Schools

	Interpersonal and Intrapersonal Outcome Measures								OECD PISA-Based Test for Schools		
	Creative Thinking	Collaboration Skills	Academic Engagement	Motivation to Learn	Self-Efficacy	Locus of Control	Perseverance	Self-Mgmt	Reading	Math	Science
Opportunities for Complex Problem Solving	0.41	0.43	0.40	0.46	0.42	0.37	0.42	0.39	ns	0.05	0.08
Opportunities for Creative Thinking	0.36	0.33	0.33	0.37	0.36	0.34	0.34	0.30	ns	ns	ns
Opportunities for Communication	0.39	0.33	0.35	0.41	0.33	0.35	0.37	0.35	ns	ns	ns
Opportunities for Collaboration	0.25	0.29	0.34	0.35	0.29	0.31	0.30	0.27	ns	ns	ns
Opportunities for Learning How to Learn	0.24	0.29	0.35	0.33	0.27	0.26	0.29	0.24	ns	ns	ns
Opportunities to Receive Feedback	0.30	0.35	0.41	0.42	0.41	0.37	0.36	0.32	ns	ns	ns
Opportunities for Assessments Aligned with Deeper Learning	0.30	0.30	0.35	0.39	0.33	0.35	0.33	0.31	ns	ns	ns
Opportunities for Interdisciplinary Learning	0.27	0.27	0.24	0.31	0.27	0.26	0.24	0.24	ns	ns	ns
Opportunities to Make Real-world Connections	0.33	0.38	0.40	0.45	0.46	0.44	0.37	0.36	ns	ns	ns

Note: The numbers in this exhibit represent the expected standard deviation difference in the outcome for a standard deviation difference in the OTL measure, based on an analysis model that accounts for measurement error in the outcome, student-level characteristics, and students nested in schools (see Technical Appendix, Section IV.B.). All coefficients shown are significant at a 0.05 level; non-significant results are designated by “ns.”

Exhibit 10: Estimated Student-Level Relationship Between Opportunity Measures and Outcomes: New York Schools

	Interpersonal and Intrapersonal Outcome Measures								OECD PISA-Based Test for Schools		
	Creative Thinking	Collaboration Skills	Academic Engagement	Motivation to Learn	Self-Efficacy	Locus of Control	Perseverance	Self-Mgmt	Reading	Math	Science
Opportunities for Complex Problem Solving	0.43	0.51	0.47	0.52	0.45	0.43	0.48	0.45	ns	0.14	0.12
Opportunities for Creative Thinking	0.29	0.30	0.31	0.34	0.38	0.39	0.33	0.32	ns	ns	ns
Opportunities for Communication	0.30	0.25	0.27	0.30	0.29	0.30	0.28	0.31	ns	ns	ns
Opportunities for Collaboration	0.29	0.36	0.32	0.31	0.31	0.34	0.27	0.31	ns	ns	ns
Opportunities for Learning How to Learn	0.18	0.29	0.35	0.24	0.25	0.27	0.18	0.25	ns	ns	ns
Opportunities to Receive Feedback	0.25	0.33	0.36	0.34	0.36	0.37	0.30	0.32	-0.11	ns	ns
Opportunities for Assessments Aligned with Deeper Learning	0.18	0.24	0.27	0.24	0.28	0.32	0.22	0.25	ns	ns	ns
Opportunities for Interdisciplinary Learning	0.16	0.12	0.12	0.22	0.30	0.26	0.13	0.27	ns	ns	ns
Opportunities to Make Real-world Connections	0.25	0.30	0.35	0.36	0.36	0.36	0.29	0.34	ns	ns	ns

Note: The numbers in this exhibit represent the expected standard deviation difference in the outcome for a standard deviation difference in the OTL measure, based on an analysis model that accounts for measurement error in the outcome, student-level characteristics, and students nested in schools (see Technical Appendix, Section IV.B.). All coefficients shown are significant at a 0.05 level; non-significant results are designated by “ns.”

Box 9: Design Limitations

While this study used a rigorous design with strict school and student selection criteria to ensure that we had sufficient numbers of students to make valid conclusions, we note a few limitations. First, because this was a proof-of-concept study rather than an evaluation of the network approaches, we only included schools that implemented the network approaches at a moderate or high level, which means that the findings cannot be generalized to all schools that are trying to implement approaches to deeper learning. Furthermore, the sample ultimately did not include some of the network schools that had implemented the models to the highest standard (due to the application of selection criteria relating to school size, grade range, or ongoing participation in other studies, for example) and it focused only on two specific state contexts.

In addition, while the network schools were not academically selective in admissions, in some cases, students self-selected into the network schools. These students may have differed in some unmeasured ways from students with otherwise similar characteristics and prior performance who did not choose to attend a network school. Participants from network schools may also have been more invested in the study due to their interest in deeper learning, although we found no evidence suggesting that this was the case. Finally, despite having sufficient numbers of participating students and strong initial matching procedures, non-consent and non-response reduced the sample for some analyses. To adjust for this limitation, we took non-consent and non-response into account in the analysis (see Technical Appendix, Section IV.A.).

Key Takeaways

The findings outlined in this report provide a promising foundation for further exploration of the outcomes associated with approaches to promoting deeper learning. They support the key assumption underlying the Hewlett Foundation's deeper learning initiative: that the network schools can provide greater opportunities for students to develop the deeper learning competencies, and that they can do so for students from a range of backgrounds and initial achievement levels. This finding is non-trivial. Prior research has shown that schools often struggle to implement programs and instructional initiatives across classrooms and for all students. This study demonstrates that it is possible to implement a deeper learning-focused instructional approach (in many different ways) that offers opportunities for a wide range of students. While we note several limitations of our study design in Box 9, the consistency of these findings across multiple measures of opportunities, and among a wide range of models and approaches, provides strong evidence for the five key takeaways from our analysis.

- 1. On average, students who attended the network schools in the study reported greater opportunities to engage in deeper learning than did similar students who attended non-network schools.** Analyses of student survey data confirmed the first core assumption of the deeper learning initiative: that network schools provided students with greater opportunities to engage in deeper learning. These findings were consistent across all measures of opportunities aligned with the deeper learning competencies. In addition, we observed positive effects of network participation for at least one opportunity measure in all individual pairs of schools; and we observed no negative effects. These consistent positive findings are notable, particularly given the wide range of approaches and practices to promote deeper learning that were implemented in the participating schools. While we

observed some commonalities in the strategies, structures, and cultures schools used to promote deeper learning, each network had a unique approach that emphasized the development of deeper learning competencies in different ways. The common positive influence these approaches had on the opportunities experienced by students suggests that deeper learning opportunities can be provided through many different models and approaches. By demonstrating that these schools are achieving what they set out to achieve in terms of opportunities for students, this finding lays the groundwork for additional research into the effect of network participation on student outcomes.

- 2. These differences in opportunities were observed among schools serving diverse student populations, including substantial subgroups of traditionally underserved students.** The network schools did not base admissions on students' prior academic achievement, and therefore served students of all ability levels. In addition, only schools with at least 30 percent eligibility for free or reduced price lunch participated in the study. In many cases, the participating schools had a much higher percentage of students who were eligible for free or reduced price lunch (e.g., in two schools, 100 percent of students were eligible), and a subset of schools included substantial populations of English language learners. The consistent positive findings from this proof-of-concept analysis therefore demonstrate that these types of opportunities can be and were provided to a diverse group of students, including traditionally underserved student populations.
- 3. The effects of attending a participating network school on deeper learning opportunities were similarly positive for subgroups of students including initially high- and low-achievers and students who did or did not qualify for free or reduced price lunch.** To further explore the consistency of opportunities across subgroups of students, including high-need student populations, we examined whether students with incoming high or low achievement experienced significantly different effects of network participation. We found that they did not. This finding demonstrates that the participating schools were successful in providing deeper learning opportunities to the full range of students, not just those who had experienced greater academic success in the past or were enrolled in more advanced courses. In addition, we also found no difference in effect for students who did or did not qualify for free or reduced price lunch. Providing opportunities equitably to all students is a core goal of the Hewlett Foundation's deeper learning initiative. This finding again suggests that the schools are accomplishing what they set out to achieve in terms of providing deeper learning opportunities to all students.
- 4. Teachers' most challenging assignments collected from the network schools exhibited greater opportunities for independent learning in mathematics and real-world connections in ELA than the challenging assignments collected from the non-network schools, but were not significantly different on other opportunity measures (including complex problem solving, communication, and conceptual understanding in mathematics).** Findings also indicated that in both network and non-network schools, there was room for improvement in the opportunities for deeper learning provided to students through even the most challenging assignments.

5. The opportunities for deeper learning experienced by individual students, regardless of whether they attended a network school, were associated with those students' deeper learning outcomes. An analysis of the relationship between opportunities and outcomes demonstrated an association between opportunities for deeper learning and interpersonal and intrapersonal competencies, as well as the ability to solve complex problems on a standardized assessment. We found a significant relationship between opportunities for deeper learning and outcomes of interest for individual students across all participating schools, regardless of network affiliation. Having confirmed this relationship, any differences in outcomes between network and non-network schools can more clearly be attributed to schools' focus on providing opportunities for deeper learning.

The differences we found in the student survey responses indicate that there was a meaningful difference in students' experienced learning opportunities between those attending network and non-network schools, including for subgroups of traditionally underserved students. These findings demonstrate that students' learning experiences in the network schools were indeed different than what comparable students experienced in other schools, and that students engaged in more opportunities for deeper learning across their core content classes. Since the sample of schools included a wide range of approaches to promoting deeper learning (see our first report), these results also suggest that these opportunities can be provided in many different ways. Nonetheless, our survey measures did not examine the *quality* of the opportunities nor the *frequency* with which they were experienced within classes. In addition, teacher assignment data suggested that the opportunities provided at the network schools through the most challenging assignments could be further improved. Therefore, while these results suggest that the network schools have made significant changes in students' learning experiences, in comparison to more traditional approaches, they also suggest that more investigation could be done to better understand and define these experiences, and that continued work could be done by network schools to offer greater quality opportunities.

In sum, we believe that these findings confirm one of the primary assumptions outlined in the abbreviated theory of action described in the introduction to this report – that explicit strategies, structures, and school culture designed to support deeper learning would provide students with greater opportunities to engage in deeper learning. The findings in this report also help to confirm another assumption of this theory of action – that a relationship exists between individual students' experienced opportunities for deeper learning and student outcomes. These findings lay the foundation for our analysis of deeper learning outcomes, which is summarized in our third report, *Evidence of Deeper Learning Outcomes* (Zeiser, Taylor, Rickles, Garet, & Segeritz, 2014). In that report, we discuss the differences between network and non-network student outcomes, including interpersonal and intrapersonal outcomes, performance on the OECD PISA-Based Test for Schools, state test scores, graduation rates, and postsecondary enrollment. Taken together, this series of reports provides an overall picture of deeper learning network approaches, as well as the opportunities and outcomes associated with these approaches.

References

- Aladjem, D., LeFloch, K. C., Zhang, Y., Kurki, A., Boyle, A., Taylor, J. E., ... Fashola, O. (2006). *Models matter: National Longitudinal Evaluation of Comprehensive School Reform (NLECSR) final report*. Washington, DC: U.S. Department of Education.
- Berends, M., Kirby, S. N., Naftel, S., & McKelvey, C. (2000). *Implementation and performance in New American Schools: Three years into scale-up*. MR-1145-EDU. Santa Monica, CA: RAND Corporation. Retrieved from http://www.rand.org/pubs/monograph_reports/MR1145.html
- Chow, B. (2010). The quest for deeper learning. *Education Week*. Retrieved from http://www.edweek.org/ew/articles/2010/10/06/06chow_ep.h30.html
- Collins, S., Davis-Molin, W., & Conley, D. (2013). *Journey toward deeper learning: An evaluation of the Roadtrip Nation Experience in the San Jose PLUS academies*. Eugene, OR: Educational Policy Improvement Center.
- Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., & Beechum, N. O. (2012). *Teaching adolescents to become learners. The role of noncognitive factors in shaping school performance: A critical literature review*. Chicago: University of Chicago Consortium on Chicago School Research.
- Funk, M., Westreich, D., Wiesen, C., Sturmer, T., Brookhard, M., & Davidian, M. (2011). Doubly robust estimation of causal effects. *American Journal of Epidemiology*, 173(7), 761–767. Retrieved from <http://aje.oxfordjournals.org/content/early/2011/03/08/aje.kwq439.full.pdf+html>
- Guha, R., Adelman, N., Arshan, N., Bland, J., Caspary, K., Padilla, C., ... Biscocho, F. (2014). *Taking stock of the California Linked Learning District Initiative: Fourth-year evaluation report*. Menlo Park, CA: SRI International.
- Huberman, M., Bitter, C., Anthony, J., & O'Day, J. (2014). *The shape of deeper learning: strategies, structures, and cultures in deeper learning network high schools. Report #1 Findings from the Study of Deeper Learning: Opportunities and outcomes*. Washington, DC: American Institutes for Research.
- Levy, F., & Murnane, R. (2013). *Dancing with robots: Human skills for computerized work*. Washington, DC: Third Way NEXT.
- Murnane, R., & Levy, F. (1996). *Teaching the new basic skills: Principles for educating children to thrive in a changing economy*. New York, NY: The Free Press.
- National Clearinghouse for Comprehensive School Reform (NCCSR). (2004). *Putting the pieces together: Lessons from comprehensive school reform research*. Retrieved from <http://elschools.org/sites/default/files/PTPLessonsfromCSRRResearch.pdf>
- National Research Council. (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. Washington, DC: The National Academies Press.
- Nichols-Barrer, I., & Haimson, J. (2013). *Impacts of five expeditionary learning middle schools on academic achievement*. Cambridge, MA: Mathematica Policy Research.
- Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference* (2nd ed.). Boston, MA: Houghton-Mifflin.
- Soland, J., Hamilton, L. S., & Stecher, B. M. (2013). *Measuring 21st century competencies: Guidance for educators*. Santa Monica, CA: RAND Education. Retrieved from <http://asiasociety.org/files/gcen-measuring21cskills.pdf>
- Trilling, B. (2010). *Defining competence in deeper learning* (Draft report to the Hewlett Foundation). Menlo Park, CA: Hewlett Foundation.

William and Flora Hewlett Foundation. (2013). *Deeper learning competencies*. Retrieved from <http://www.hewlett.org/library/hewlett-foundation-publication/deeper-learning-defined>

Yuan, K., & Le, V. (2010). *A review of model school networks that emphasize deeper learning*. Santa Monica, CA: RAND Education.

Zeiser, K., Taylor, J., Rickles, J., Garet, M. S. & Segeritz, M. (2014). *Evidence of deeper learning outcomes. Report #3 Findings from the Study of Deeper Learning: Opportunities and outcomes*. Washington, DC: American Institutes for Research.



1000 Thomas Jefferson Street NW
Washington, DC 20007-3835
202.403.5000

www.air.org

The Research Alliance for New York City Schools

285 Mercer Street, 3rd Floor
New York, NY, 10003
212.992.7697

steinhardt.nyu.edu/research_alliance