

Education Innovation and Research
Final Evaluation Report - EARLY-PHASE GRANT
***Project {FUTURE}: Fundamentals Teachers Unit Research Exemplars,
Innovations in Embedded Computer Science for Elementary Curricula***

Summary of Intervention

The overall goal of the intervention as originally designed for Project Future is to increase understanding of computer science concepts and computational thinking at the elementary level by increasing capacity for and proficiency with computer science instruction and its integration into elementary content instruction among elementary teachers, with intention of testing the promise of curriculum integration of computer science skills and concepts by improving computational thinking and learning outcomes on locally defined high-value content measures identified by annual standardized content tests.

To achieve these objectives and realize the expected outcomes, the project engaged K-5 teachers in the partnering school districts in professional learning on computer science as delivered by CODE.org facilitators. To build initial instructional capacity among the teachers, each of the partner schools implemented individual and PLC coaching sessions as follow-ups to the CODE.org training. The project for capacity building engaged all K-5 teachers in 7 partnering school districts and 49 K-5 schools, with large populations of underrepresented and low socio-economic status students, with the professional learning sequence.

The intervention focused on a subset of this group of teachers, the Collaborative teachers, who continued to receive more intensive professional learning, including a one-week summer session and follow-up sessions during the academic year for two consecutive years. This learning process engaged this group in collaborative curriculum design work to gain an increased understanding of how to integrate computer science and computational thinking skills into curriculum units. The teachers involved in the intensive professional learning were selected based on their interest and commitment to the intervention. Additional activities engaged in by this group of teachers include targeted PLCs and the development of integrated curriculum units for implementation in the K-5 classroom, with the focus on improving student content learning.

The intervention specifically focused on grade 4 and 5 teachers involved in the creation of math and ELA curricular units. The subset of 32 teachers was identified as the treatment group, selected from the Collaborative teacher group from the Connecticut and Wisconsin cohorts. This group was interested in pursuing further professional learning, collaborative working relationships, and developing computer science embedded curriculum units for implementation in the specific tested grade-level classrooms in the curricular areas of math and ELA. The teacher's increased capacity for computer science embedded instruction, combined with the implementation of newly

developed curriculum units, provides the actual intervention that focuses on testing the impact on the math or science learning of nearly 775 students in the selected partnering schools and districts.

Background of Program Design

Project Future addresses the urgent need for computer science (CS) instruction at the elementary level by exploring and studying the impact of CS integration on CS skills and other learning outcomes in partner schools. It provides initial CS professional learning to all teachers, potentially impacting over 19,000 K-5 students. In its culminating phase, Project Future includes an intensive and sustained cohort professional learning program for a subgroup of the initial teacher group who will develop CS-embedded curriculum units to positively impact CS skills and other locally defined high-value student outcomes. As an initiative, Project Future contributes models for professional learning in elementary CS and rigorously evaluated exemplar units for replication and learning impacts. Outcomes include expanded access to computer science education for elementary students, increased capacity for CS instruction, and increased student performance on targeted locally defined high-value outcomes.

Despite increasing demand, the number of students pursuing post-secondary degrees that develop CS skills and lead to CS jobs lags significantly behind demand. Significant factors have been shown to influence student selection of a computing-centric field in college, including:

- The amount and quality of CS instruction at the primary and secondary education levels (grades K-12) have not kept pace with other disciplinary areas (Computer Science Teachers Association, 2015).
- Students, their parents, counselors, and often their teachers, have minimal information regarding the types of careers available to someone with specialized education in CS, as current courses usually emphasize rote knowledge and application, rather than key, higher-level thinking skills, which are important even at the elementary level.
- Students from traditionally underrepresented groups often lack role models with whom they identify, which can lead them to believe that CS is not an appropriate career path for them.

Based on these factors, Project Future recognized that elementary schools are an underutilized resource for promoting broad access to assured experiences in CS, sparking interest, building foundational skills and dispositions, and establishing programmatic cohesion across the K-16 trajectory. These early experiences are especially critical as students face the impending “middle school cliff” (Jones, 2017) a dramatic loss of interest in CS, mainly as CS instruction teaches valuable skills and dispositions like problem-solving, collaboration, critical thinking, persistence, and growth-mindset, skills associated with a high-quality education in the 21st century (Batelle for Kids, 2019; Dweck, 2006). By situating the intervention in predominantly high-needs schools, the project addresses the opportunity gap that currently exists in CS education and helps to expand access and participation in rigorous computer science coursework in high-need communities.

Project Future builds on existing strategies to provide a progressive and sustained professional learning model, leading to the development of CS-embedded curriculum unit exemplars, including a professional learning program developed by Code.org, the leading provider of K-12 CS curricula and professional learning. Additional professional development includes school-embedded coaching of professional learning communities (PLCs) to create laboratories of practice for both university researchers and practicing teachers, as a way of providing continuous improvement for all involved, with a focus on improving the general lack of background, experience and confidence in teaching CS held most elementary level teachers (Greenwood & Scribner-MacLean, 1997; Tilgner, 1990). Curriculum integration is a strategy that allows computer science to become more familiar to elementary teachers, especially in ways in which they can make connections with other content areas, as CS instruction has shown the potential to positively impact elementary student outcomes in literacy, mathematics, and science (Century, Ferris, & Zuo, 2019).

Based on previous computer science integrated curricular initiatives, Project Future began with the premise that for the proposed exemplar units to appeal and impact elementary learners they would need to contain activities which allow the students to tinker with the underlying programming on a supported, developmentally appropriate platform, positioning the students as “makers” and significantly enhancing both the level of computational thinking and content mastery required to engage with a specific task. Through “plugged” and “unplugged” activities, developed units are expected to engage students with the skills, principles, vocabulary, and dispositions of CS in developmentally appropriate activities and CS-embedded units integrated in other content areas. By implementing and evaluating the impact of the teacher-developed CS-embedded curriculum unit exemplars in high-needs schools, Project Future is explicitly designed to expand access to and participation in rigorous computer science coursework for traditionally underrepresented students, as well as to impact outcomes in CS and improve student achievement.

Impact Study

Study Description

Research Questions:

The impact study focuses on two confirmatory research questions, as follows:

- At the end of two years of implementation of the intensive professional learning, coaching, collaboration, and curriculum development with teachers/specialists, what is the impact on math achievement of 4th and 5th grade students at a treatment school of one year of exposure to instruction using integrated math-CS curriculum units, as measured by scores on the WI and CT state math tests, compared to the math performance of a matched set of 4th and 5th grade students at a control school receiving the regular math curriculum?
- At the end of two years of implementation of the intensive professional learning, coaching, collaboration, and curriculum development with teachers/specialists, what is the impact on ELA achievement of 4th and 5th grade students at a treatment school of one year of exposure to instruction using integrated ELA-CS curriculum units, as measured by scores

on the WI and CT state ELA tests, compared to the ELA performance of a matched set of 4th and 5th grade students at a control school receiving the regular math curriculum.

Intervention Condition:

The study was designed to examine the impact of Project Future using a quasi-experimental design with school-level assignment. The study evaluates the effects of computer science curriculum integration on math and ELA achievement for students in Grades 4 and 5. The intervention impact study was implemented during the 2022-2023 and 2023-24 school years with teachers and students in elementary schools in one district in Wisconsin and four districts in Connecticut. The schools where the intervention was being implemented serve students with a range of demographic characteristics, with the majority who are economically disadvantaged and underrepresented, as seen below:

Project Year	Year 1 2019-2020	Year 2 2020-2021	Year 3 2021-2022	Year 4 2022-2023	Year 5 2023 - 2024
Project Sequence	Instructional Capacity Building through CODE.org courses for all teachers in K -5		Instructional Capacity Building through Coaching for all teachers in K-5	Intervention Years	
				Intensive Professional Learning – Lesson/Unit Development for 32 committed teachers	Continued intensive training, lesson/unit development and initial piloting of lessons with Iterative Process of Revision and Refinement for grade 4-5 teachers who teach math/ELA: 1 st year for teachers implementing curriculum units
Control Teachers					
Treatment Teachers					
Control Students				Students in 4 th and 5 th grade classrooms of “business as usual” teachers who have had code.org training but are not part of the intensive training provided to the 32 treatment teachers	Students in 4 th and 5 th grade classrooms of “business as usual” teachers who have had code.org training but are not part of the intensive training provided to the 32 treatment teachers

Treatment Students		Students in grades 4 -5 in classrooms of 4 th and 5 th grade ELA and math or implementing “special” teachers who are using new integrated lessons/units	Students in grades 4 -5 in classrooms of 4 th and 5 th grade ELA and math or implementing “special” teachers who are using new integrated lessons/units: some 4 th graders may be in 2 nd year of exposure
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The confirmatory student outcomes are academic achievement in math and ELA, measured by state tests from WI or CT. Intervention or “treated” participants include students from seventeen treatment schools who are exposed to Project Future embedded units through their teachers; comparison participants are a sample of students at other, similar schools within the same districts and states as the study schools, who are not exposed to the ELA or math units. For each study implementation school, the comparison will be students in corresponding grade levels of the impacted students, creating an external-school comparison group comprised of students in the same grade(s) as treatment participants in similar control schools.

Both the comparison and treatment teachers will have had the Code.org training and follow-up support. Only the treatment teachers will have intensive training in integrating CS into content instruction. The pool of treatment participants in the impact study will be the students taught by teachers who have completed the Project Future intensive training and have completed and implemented integrated math and ELA units. Thus, treatment participants will be 4th and 5th-grade students who attend one of the 17 study implementation schools and are receiving the Project Future program as part of their regular math or ELA school curriculum during the 2023-24 school year. In some schools, 4th or 5th grade teachers in the intensive training group are implementing their integrated curriculum units with students in their classrooms. In contrast, in other schools, units are being implemented across entire grades of students because the educator participating in the intensive training is not a classroom teacher but a specialist who works with a whole grade (i.e., is not an individual classroom teacher).

The study compares outcomes across treatment and comparison schools for grade level groups of students who receive the integrated curriculum units based on their baseline math and ELA performance on state-level assessments, as well as several relevant demographic characteristics, with similar grade-level students in schools in which the integrated curriculum units were not implemented during the 2023-24 academic year. Because students from within the same district are most likely to be similar to one another in terms of essential and unobservable baseline characteristics, the intervention prioritized within-district comparisons when possible. The

evaluation utilizes state test data from Milwaukee public schools and public-school districts in CT, where treatment or comparison students are present, to create the final analytic samples. This structure enables the assessment of the impact on confirmatory outcomes.

To prepare for and implement the intervention and testing process, Project Future developed a Logic Model (Appendix C) and a four-phase project design as outlined below:

- **Phase 1 & 2:** During this phase, Project Future prepared to apply the pre-existing Code.org elementary computer science teacher workshops to all partner elementary schools, with the expectation that they would be led by facilitators who have completed a rigorous training program through Code.org. Project Coordinators were to assist with logistics and communication with the faculty at the individual schools. Phase 2 provides time for ensuring that all teachers have completed the first Code.org workshop and any additional Code.org workshops that are allowable based on the timeline needs. Additionally, time was allotted for the project leadership to collect qualitative data on the project implementation and teacher experience.
- **Phase 3:** This phase introduces grade-level-specific coaching sessions to develop PLCs and enhance understanding of computer science pedagogy. The formation and goals of the PLCs are collaboratively planned by teachers, coaches, and administrators, and include standards unpacking, alignment, and curriculum development. During this phase, the teachers transition from the more passive role of “workshop participant” into a more active role as a member of a Community of Practice (Lave & Wenger, 1998) for computer science education.
- **Phase 4** represents a paradigm shift as it begins with a teacher “opt-in” opportunity, in which a representative group of cohort teachers from partner elementary schools, are selected to engage in a two-year unit development and testing process, with each year including a five-day intensive summer session with four follow-on sessions throughout the following academic year to address, “Can the integration of CS into elementary curriculum units enhance CS skills and positively affect other identified student outcomes?” Steps are taken to ensure the new cohort will be representative of the partner elementary schools, teacher demographic characteristics, grade levels, and, if relevant, curricular areas of focus. The new cohort experience begins with a goal-setting session with cohort teachers and their building administrators to identify the locally defined high-value student outcomes that will be targeted for a computer science-embedded curriculum unit. The first summer session is designed to focus on the identification of opportunities to embed computational thinking and computer science concepts into various content areas. Each PLC or group of teachers will develop a pilot unit that incorporates computer science via “unplugged” activities to explore the target content, to be implemented and evaluated in the following school year. The second summer session focuses on refining the units and incorporating the design and development of computer science plugged activities. During the final project year, units are implemented with those aligning with the study parameters rigorously tested to measure the impact on student outcomes.

Program Setting and Implementation:

The five partner districts (Milwaukee and four districts in CT) selected for the evaluation study are a purposive sample selected based on location, demographics, commitment to computer science instruction, interest in improved pedagogical skills, and willingness to participate in the research study. The schools within the partnering districts selected for the initial capacity building activities of the grant were recruited based on administrative commitment to the project, teacher interest and investment, and student need. All treatment and comparison teachers/specialists in participating districts in CT and WI received the CODE.org training. The Collaborative teachers received further intensive training on CS pedagogy, while those identified as members of the treatment group are working with 4th or 5th graders in the 2023-24 school year. The treatment students are those taught by these teachers/specialists using the integrated curriculum units in their math and ELA classrooms.

Comparison Condition:

The comparison sample will consist of schools with districts that have matched 4th and/or 5th-grade students in CT and WI, where the integrated curriculum units have not been implemented. It is expected that schools selected into the comparison group will include fourth and/or fifth grade students who have not been exposed to the curriculum units before or during the intervention year. Instead, comparison students will receive the standard classroom instruction typically offered by the school to meet their grade level needs. The comparison condition is a “business-as-usual” comparison condition. The comparison condition will naturally differ across schools, depending on the differences in schedule and curriculum at each school.

Independence of the Evaluation:

The entity conducting the evaluation for Project Future is independent of the recipient of the grant - Sacred Heart University (SHU) - and the partnering intervention developers - SHU, Marquette University, and the associated school districts in CT and WI. CRE is a small independent evaluation firm located outside of the partnering universities and school districts. As an external evaluator, CRE and its principal evaluator meet the three criteria necessary for determining independence.

- **Independence of the outcome data collection:** The outcome data used to estimate the effect of the intervention will be collected by CRE and its evaluation team rather than the grantee or developer partners.
- **Independence of the analysis:** The analysis of outcome data used to estimate the effect of the intervention will be conducted by CRE and its contracted statistician, who is not associated with the grantee or the developing partners.
- **Independence of reporting:** The estimated impact will be independently reported by CRE, ensuring that the grantee or developing partners have no previous review or approval authority.

Impact Analysis Study **Executive Summary**

No treatment main effect was detected for any of the four multilevel models (hierarchical linear models; HLMS). That is, the impact of Project FUTURE on student performance, as measured by state administered standardized testing, was not found for either ELA or Math in the treatment schools in Connecticut or Wisconsin.

This study was completed entirely using publicly available data. Although this data was more readily accessible, its less granular nature necessitated expanding the scope of comparison or control data to all grades-within-schools for the two states where the treatment condition was implemented. Other factors that necessitated this expansion included the availability of grade-within-school assessment data that met our threshold of 95 percent completeness or data that were not censored due to small cell size (e.g., school-level ELL proportions).

Access to student-level data may have helped to uncover the expected treatment effects. That is, the order of magnitude increase in observations, going from grades-within-schools to individual students, along with increased variability in data, may have set the stage for finding evidence of treatment effects.

Project FUTURE: Analyses

In order to assess Project Future’s success at helping 3rd to 5th grade students improve their standardized test scores, our team ran two sets of analyses for schools. Using multilevel models, our team examined the factors that were associated with students’ academic success when they were assigned to grades that received Project Future treatments, controlling for the types of schools in which students are enrolled. Given that students in Connecticut and Wisconsin participated in different state standardized tests, our team examined the effects of Project Future in separate state-specific analyses.

What factors contribute to students’ academic performances in Connecticut?

Because grades are nested within schools, it was necessary to control for this nested data structure with multilevel modeling. In this way, we can assess the impact of Project Future participation on student academic success, while controlling for school-level and grade-level factors that may also influence student academic performance.

Creating the Connecticut Analytical Sample

Our first step was to build an analytical dataset of grade-levels that received Project Future participation and those comparison grade-levels that did not receive this treatment for the state of Connecticut. For more information about the variables created for these analyses, see Table A.1 in the Appendix A. The data for the Connecticut study were drawn from three publicly available data sources further described below:

Project Future Treatment: We were provided with a list of the ten schools that received the Project Future treatment. We did not have information of the individual students who received the Project Future treatment, although we were able to isolate the treatment to the three grade levels that received the treatment (Grade 3, 4, and 5) during the 2022-23 school year.¹

Standardized Tests: Connecticut State publishes their grade-level student passing rates of the Smarter Balanced Achievement Test² We selected test result data for all Grade 3 through Grade 5 levels in Connecticut Public Schools for the 2022-23 school year and all test result data for all Grades 4 through Grade 6 for the 2023-24 school year. When merged, these two datasets provided us with the proportions of students who met or exceeded the standardized tests in ELA and Math during the 2022-23 and 2023-24 school years.

School Characteristics: The Common Core of Data provided this study with school-level characteristics of the public elementary schools in the state of Connecticut to include: gender, race/ethnicity, free and reduced price lunches, student-to-teacher

¹ Connecticut also provided the number of students enrolled in each grade at each school, which we used as a measure, Total Students per Grade Level, to control for larger classroom sizes.

² https://public-edsight.ct.gov/performance/smarter-balanced-achievement-participation?language=en_US

ratios, locale of the school, and charter schools.³ Two measures - Students with Disabilities (SWD) and English Language Learners (ELL) – were not available from CCD, so they were obtained from the Connecticut State Department of Education’s EdSight portal.

These variables were combined into a final analytic dataset. When the variables were merged it was necessary to exclude several types of data. First, some schools that served Grade 5 students did not serve Grade 6 students, which meant we did not have a consistent measure of academic progress from year-to-year. Second, we only selected grade levels in which at least 95 percent of the class participated in the assessment, so as to exclude grade levels that did not truly reflect the population of students being assessed. Finally, several of the variables we measured were missing values. This was especially true for the ELL variable which was censored by Connecticut when the values were too small. The final analytic dataset for the Project Future ELA analyses contained 830 grade levels and 479 schools, while the final analytic dataset for the Project Future Math analyses contained 701 grade levels and 421 schools.

Connecticut Analyses for ELA Academic Achievement

Table 1a.i presents the means and percentages of grade- and school-level variables broken out by whether the schools received Project Future treatment. The first important finding is that grades that received Project Future treatments had lower levels of students meeting or exceeding the ELA state standardized test during the 2022-23 school year (29.4% versus 47.8%) and the 2023-24 school year (18.8% versus 32.0%). We also see that schools that received the Project Future treatment were more diverse (Black students = 19.2%; Hispanic students = 58.6%) than the control schools (Black students = 13.1%; Hispanic students = 31.2%). Project Future schools also had larger average proportions of their students receiving Free and Reduced lunches (treatment = 70.5%; control = 44.6%) and were more often located in cities (treatment = 80%; control = 27.7%). These differences suggest that Project Future was launched in schools that were different from the control schools, therefore it will be important to control for these grade- and school-level effects in any regression analyses performed to better understand Project Future.

Table 1a.i: Effects of Project Future on Student ELA Achievement in Connecticut

Variables	Project Future Descriptive Variables			Control Descriptive Variables		
	Mean or Percentage	Standard Deviation	Grade/School N	Mean or Percentage	Standard Deviation	Grade/School N
Dependent Variable						
Met/Exceeded ELA Tests, 2023-24	18.8%	9.6%	21	32.0%	20.0%	809
Grade-Level Variables						
Met/Exceeded ELA Tests, 2022-23	29.4%	13.4%	21	47.8%	22.2%	809
Grade Level 3	38.1%	---	21	45.9%	---	809
Grade Level 4	38.1%	---	21	39.3%	---	809
Grade Level 5	23.8%	---	21	14.8%	---	809

³ Data Source: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Public Elementary/Secondary School Universe Survey", 2022-23 v.1a.

Total Students Per Grade Level	50.1	24.9	21	56.4	23.7	809
School-Level Variables						
Treatment in Project Future Program	100.0%	---	10	0.0%	---	469
Female Students	49.5%	4.4%	10	49.0%	3.2%	469
Black or African American	19.2%	9.6%	10	13.1%	15.1%	469
Hispanic or Latino	58.6%	11.0%	10	31.2%	21.5%	469
Other Race Students	6.5%	3.3%	10	11.1%	7.0%	469
White Students	15.7%	7.8%	10	44.5%	28.0%	469
English Language Learners	24.1%	15.7%	10	12.6%	11.9%	469
Students with Disabilities	15.4%	7.6%	10	14.8%	4.2%	469
Free and Reduced Price Lunches	70.5%	15.6%	10	44.6%	25.4%	469
Pupil: Teacher Ratio	12.4	2.0	10	12.3	2.5	469
City Locale	80.0%	42.2%	10	27.7%	44.8%	469
Suburbs	20.0%	42.2%	10	62.3%	48.5%	469
Rural Locales	0.0%	0.0%	10	10.0%	30.1%	469
Charter Schools	0.0%	0.0%	10	2.6%	15.8%	469

Sources: Data for these analyses came from (1) Correspondence with the Project Future team, (2) Connecticut State's Smarter Balanced Achievement Tests, 2022-24, (3) Common Core of Data, Public Elementary/Secondary School Universe Survey, 2022-23, and (4) Connecticut State Departments of Education's EdSight Portal for the SWD and ELL variables.

Multicollinearity Analyses

Before we selected our final models, variables in our analyses were assessed for multicollinearity using variance inflation factors (VIFs). Variance Inflation Factors (VIFs) are a ratio of coefficients that assesses the predictability of an independent variable by another independent variable. In our model, no predictor had a VIF score over the threshold of 10, which is the recommended cutoff point for VIF scores (Neter, Kutner, Nachtshiem, & Wasserman, 1996).

Connecticut Multilevel Models for ELA Academic Achievement

Table 1a.ii presents the grade-level and school-level variables used in the multilevel models (please see Appendix B for more information on these multilevel models). The multilevel model examined the grade and school level predictors academic success in ELA, controlling for participation in Project Future. In order to learn more about the variables used in these analyses and how they were defined, please see Tables A.1 (Description of Variables) in Appendix A.

Connecticut ELA HLM Predictors:

Project Future was not a significant predictor of ELA academic success. Indeed there were only two significant predictors of ELA academic success – Met or Exceeded ELA Test and Pupil to Teacher ratio. Specifically, for every grade-level that had a higher proportion of students passing the ELA standardized tests during the 2022-23 school year, there was a corresponding increase in students passing the ELA standardized test during the following school year. For the Pupil-to-Teacher Ratio finding, we see that for every additional student added to the ratio, there is a corresponding increase to the proportion of students who met or exceeded the ELA test. Although we do not have any explanation for this last finding, it is

possible that smaller classrooms are devoted to students who need an alternative learning classroom (e.g., SWD), and these smaller classes might be associated with lower pass rates for students in smaller sized classrooms. Unfortunately, we do not have the data necessary to disentangle this relationship.

Table 1a.ii: Effects of Project Future on Student ELA Achievement in Connecticut

Variables	Coefficient (B)	Standard Error	Statistical Significance
Grade-Level			
Met or Exceeded ELA Test	.54	.03	***
Grade 4	.35	.47	
Grade 5	-.48	.76	
Total students	.03	.02	
Intercept	31.54	.64	***
School-Level			
Project Future Treatment	1.46	4.48	
Gender (Female)	1.98	21.16	
Caucasian	1.47	5.99	
Other Race	8.56	11.12	
City Locale	-3.16	1.80	
Rural Locale	4.34	2.36	
Free & Reduced Price Lunch	-8.06	6.44	
Pupil-to-Teacher Ratio	.90	.28	**
English Language Learners	7.22	7.28	
Students with Disabilities	-7.25	17.69	
Charter Schools	-3.56	4.53	
Variance Explained		Total Variance Explained at Each Level	Proportion of Variance Explained by Variables
Grade-Level (r)		14.6%	40.0%
School-Level (u)		85.4%	52.3%

Sources: Data for these analyses came from (1) Correspondence with the Project Future team, (2) Connecticut State's Smarter Balanced Achievement Tests, 2022-24, (3) Common Core of Data, Public Elementary/Secondary School Universe Survey, 2022-23, and (4) Connecticut State Departments of Education's EdSight Portal for the SWD and ELL variables.

* $p < .05$; ** $p < .01$; *** $p < .001$

Connecticut Math Analyses Variance Explained:

It is also important to examine the proportion of variance explained by the two-levels of the multilevel model as well as how much our variables are able to explain this level-specific variation. We see that 85.4 percent of the variation that predicts student academic success in ELA was predicted by school-level variables, while only 14.6 percent of the variability in student academic success is at the grade-level. We also see that 40.0 and 52.3 percent of grade-level and school-level variation are accounted for by our measures at each of those levels.

Connecticut Analyses for Math Academic Achievement

Table 1b.i presents the means and percentages of grade- and school-level variables broken out by whether the schools received Project Future treatment. The first notable finding is that grades that received Project Future treatments had lower levels of students meeting or exceeding the Math state standardized test during the 2022-23 school year (36.9% versus 50.3%) and the 2023-24 school year (32.8% versus 48.6%). We also see that schools that received the Project Future treatment were more diverse (Black students = 18.5%; Hispanic students = 57.7%) than the control schools (Black students = 12.1%; Hispanic students = 30.5%). Project Future schools also had larger average proportions of their students receiving Free and Reduced Priced Lunches (treatment = 68.1%; control = 42.9%) and were more often located in cities (treatment = 77.8%; control = 26.7%). These differences suggest that Project Future was launched in schools that were different from the control schools, therefore it will be important to control for these grade- and school-level effects in any regression analyses performed to better understand Project Future.

Table 1b.i: Effects of Project Future on Student Math Achievement in Connecticut

Variables	Project Future Descriptive Variables			Control Descriptive Variables		
	Mean or Percentage	Standard Deviation	Grade/School N	Mean or Percentage	Standard Deviation	Grade/School N
Dependent Variable						
Met/Exceeded ELA Tests, 2023-24	32.8%	16.2%	15	48.6%	23.0%	686
Grade-Level Variables						
Met/Exceeded ELA Tests, 2022-23	36.9%	15.7%	15	50.3%	22.8%	686
Grade Level 3	53.3%	51.6%	15	48.0%	50.0%	686
Grade Level 4	33.3%	48.8%	15	39.1%	48.8%	686
Grade Level 5	13.3%	35.2%	15	13.0%	33.6%	686
Total Students Per Grade Level	51.5	27.7	15	57.4	24.3	686
School-Level Variables						
Treatment in Project Future Program	100.0%	---	9	.0%	---	412
Female Students	50.2%	4.0%	9	49.1%	3.1%	412
Black or African American	18.5%	10.0%	9	12.1%	14.4%	412
Hispanic or Latino	57.7%	11.3%	9	30.5%	21.5%	412
Other Race Students	7.0%	3.1%	9	11.6%	7.2%	412
White Students	16.7%	7.6%	9	45.8%	27.4%	412
English Language Learners	23.3%	16.4%	9	12.6%	12.2%	412
Students with Disabilities	13.4%	4.7%	9	14.5%	4.0%	412
Free and Reduced Price Lunches	68.1%	14.4%	9	42.9%	24.8%	412
Pupil: Teacher Ratio	12.5	2.08	9	12.4	2.5	412
City Locale	77.8%	44.1%	9	26.7%	44.3%	412
Suburbs	22.2%	44.1%	9	63.6%	48.2%	412
Rural Locales	.0%	.0%	9	9.7%	29.6%	412
Charter Schools	.0%	.0%	9	2.7%	16.1%	412

Sources: Data for these analyses came from (1) Correspondence with the Project Future team, (2) Connecticut State's Smarter Balanced Achievement Tests, 2022-24, (3) Common Core of Data, Public Elementary/Secondary School Universe Survey, 2022-23, and (4) Connecticut State Departments of Education's EdSight Portal for the SWD and ELL variables.

Multicollinearity Analyses

Before we selected our final models, variables in our analyses were assessed for multicollinearity using variance inflation factors (VIFs). Variance Inflation Factors (VIFs) are a ratio of coefficients that assesses the predictability of an independent variable by another independent variable. In our model, no predictor had a VIF score over the threshold of 10, which is the recommended cutoff point for VIF scores (Neter, Kutner, Nachtsiem, & Wasserman, 1996).

Connecticut Multilevel Models for Math Academic Achievement

Table 1b.ii presents the grade-level and school-level variables used in the multilevel models (please see Appendix B for more information on these multilevel models). The multilevel model examined the grade and school level predictors academic success in Math, controlling for participation in Project Future. In order to learn more about the variables used in these analyses and how they were defined, please see Tables A.1 (Description of Variables) in Appendix A.

Connecticut Math HLM Predictors:

Project Future was not a significant predictor of Math academic success, but there were four significant school-level predictors. The proportions of Caucasian students and English Language Learner students led to increases in the Math academic success, while the proportions of students who received free and reduced lunches and schools that were located in cities decreased Math academic success. At the grade-level, there were two statistically significant predictors – Met or Exceeded Math Test and Grade 4. For every grade-level that had a higher proportion of their students passing the Math standardized tests during the 2022-23 school year, there was a corresponding increase in students passing the Math standardized test during the following school year. Grade 4 levels were associated with a decrease in Math academic success compared to Grade 3 levels.

Table 1b.ii: Effects of Project Future on Student Math Achievement in Connecticut

Variables	Coefficient (B)	Standard Error	Statistical Significance
Grade-Level			
Met or Exceeded ELA Test	.76	.03	***
Grade 4	-3.60	.62	***
Grade 5	1.01	.97	
Total students	.01	.01	
Intercept	48.22	.32	***
School-Level			
Project Future Treatment	-.68	2.24	
Gender (Female)	-4.39	10.83	
Caucasian	11.16	3.11	***
Other Race	7.11	5.48	
City Locale	-2.21	.92	*
Rural Locale	-1.48	1.19	
Free & Reduced Price Lunch	-7.26	3.38	*

Pupil-to-Teacher Ratio	-.16	.14	
English Language Learners	8.84	3.70	*
Students with Disabilities	-9.52	9.54	
Charter Schools	1.99	2.33	
Variance Explained		Total Variance Explained at Each Level	Proportion of Variance Explained by Variables
Grade-Level (r)		87.4%	19.4%
School-Level (u)		12.6%	98.3%

Sources: Data for these analyses came from (1) Correspondence with the Project Future team, (2) Connecticut State's Smarter Balanced Achievement Tests, 2022-24, (3) Common Core of Data, Public Elementary/Secondary School Universe Survey, 2022-23, and (4) Connecticut State Departments of Education's EdSight Portal for the SWD and ELL variables.

* $p < .05$; ** $p < .01$; *** $p < .001$

Connecticut Math Analyses Variance Explained:

It is also important to examine the proportion of variance explained by the two-levels of the multilevel model as well as how much our variables are able to explain this level-specific variation. We see that 87.4 percent of the variation that predicts student academic success in Math was predicted by grade-level variables, while only 12.6 percent of the variability in student academic success is explained at the school-level. We also see that, 19.4 and 98.3 percent of grade-level and school-level variation are accounted for by our measures at each of those levels.

Creating the Wisconsin Analytical Sample

Next, we built an analytical dataset of grade-levels that received Project Future participation and those comparison grade-levels that did not receive this treatment for the state of Wisconsin. For more information about the variables created for these analyses, see Table A.1 in the Appendix A. The data for the Wisconsin study were drawn from three publicly available data sources further described below:

Project Future Treatment: We were provided with a list of the seven schools that received the Project Future treatment. We did not have information of the individual students who received the Project Future treatment, although we were able to isolate the treatment to the three grade levels that received the treatment (Grade 3, 4, and 5) during the 2022-23 school year.⁴

Standardized Tests: Wisconsin State publishes their grade-level student passing rates of the Wisconsin Forward Exam.⁵ We selected test result data for all Grade 3 through Grade 5 levels in Wisconsin Public Schools for the 2022-23 school year and all test result data for all Grades 4 through Grade 6 for the 2023-24 school year. When

⁴ Wisconsin also provided the number of students enrolled in each grade at each school, which we used as a measure, Total Students per Grade Level, to control for larger classroom sizes.

⁵ Data for this exam can be accessed on the following website: <https://dpi.wi.gov/wisedash/public>

merged, these two datasets provided us with the proportions of students who met or exceeded the standardized tests in ELA and Math during the 2022-23 and 2023-24 school years.

School Characteristics: The Common Core of Data provided this study with school-level characteristics of the public elementary schools in the state of Wisconsin to include: gender, race/ethnicity, free and reduced price lunches, student-to-teacher ratios, locale of the school, and charter schools.⁶ Two measures - Students with Disabilities (SWD) and English Language Learners (ELL) – were not available from CCD, so they were obtained from the Wisconsin Department of Public Instruction.

These variables were combined into a final analytic dataset. When the variables were merged it was necessary to exclude several types of data. First, some schools that served Grade 5 students did not serve Grade 6 students, which meant we did not have a consistent measure of academic progress from year-to-year. Second, we only selected grade levels in which at least 95 percent of the class participated in the assessment, so as to exclude grade levels that did not truly reflect the population of students being assessed. Finally, several of the variables we measured were missing values. This was especially true for the ELL variable which was censored by Wisconsin when the values were too small. The final analytic dataset for the Project Future ELA analyses contained 1,669 grade levels and 890 schools, while the final analytic dataset for the Project Future Math analyses contained 1,708 grade levels and 895 schools.

Wisconsin Analyses for ELA Academic Achievement

Table 2a.i presents the means and percentages of grade- and school-level variables broken out by whether the schools received Project Future treatment. The first important finding is that grades that received Project Future treatments had lower levels of students meeting or exceeding the ELA state standardized test during the 2022-23 school year (11.3% versus 40.6%) and the 2023-24 school year (18.9% versus 53.2%). We also see that schools that received the Project Future treatment were more diverse (Black students = 31.0%; Hispanic students = 61.6%) than the control schools (Black students = 7.7%; Hispanic students = 14.3%). Project Future schools also had larger average proportions of their students receiving Free and Reduced Price Lunches (treatment = 91.0%; control = 44.0%) and were more located in cities (treatment = 100%; control = 27.9%). These differences suggest that Project Future was launched in schools that were different from the control schools, therefore it will be important to control for these grade- and school-level effects in any regression analyses performed to better understand Project Future.

Table 2a.i: Effects of Project Future on Student ELA Achievement in Wisconsin

⁶ Data Source: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Public Elementary/Secondary School Universe Survey", 2022-23 v.1a.

Variables	Project Future Descriptive Variables			Control Descriptive Variables		
	Mean or Percentage	Standard Deviation	Grade/School N	Mean or Percentage	Standard Deviation	Grade/School N
Dependent Variable						
Met/Exceeded ELA Tests, 2023-24	18.9%	10.6%	16	53.2%	19.2%	1,653
Grade-Level Variables						
Met/Exceeded ELA Tests, 2022-23	11.3%	9.9%	16	40.6%	18.3%	1,653
Grade Level 3	31.3%	47.9%	16	46.0%	49.9%	1,653
Grade Level 4	25.0%	44.7%	16	40.0%	49.0%	1,653
Grade Level 5	43.8%	51.2%	16	14.0%	34.7%	1,653
Total Students Per Grade Level	42.9	20.7	16	57.3	36.5	1,653
School-Level Variables						
Treatment in Project Future Program	100%	---	7	0%	---	883
Female Students	46.9%	1.9%	7	48.3%	3.2%	883
Black or African American	31.0%	38.6%	7	7.7%	16.0%	883
Hispanic or Latino	61.6%	40.1%	7	14.3%	15.2%	883
Other Race Students	4.0%	4.0%	7	11.2%	9.6%	883
White Students	3.4%	5.6%	7	66.9%	25.9%	883
English Language Learners	35.0%	28.3%	7	7.7%	10.3%	883
Students with Disabilities	18.8%	3.1%	7	16.3%	5.1%	883
Free and Reduced Price Lunches	91.0%	5.3%	7	44.0%	23.0%	883
Pupil: Teacher Ratio	15.9	2.5	7	13.3	2.5	883
City Locale	100%	0%	7	27.9%	44.9%	883
Suburbs	0%	0%	7	27.7%	44.8%	883
Rural Locales	0%	0%	7	44.4%	49.7%	883
Charter Schools	28.6%	48.8%	7	3.9%	19.3%	883

Sources: Data for these analyses came from (1) Correspondence with the Project Future team, (2) Wisconsin State's Forward Achievement Exams, 2022-24, (3) Common Core of Data, Public Elementary/Secondary School Universe Survey, 2022-23, and (4) Wisconsin Department of Public Instruction's WISE data portal for the SWD and ELL variables.

Multicollinearity Analyses

Before we selected our final models, variables in our analyses were assessed for multicollinearity using variance inflation factors (VIFs). Variance Inflation Factors (VIFs) are a ratio of coefficients that assesses the predictability of an independent variable by another independent variable. In our model, no predictor had a VIF score over the threshold of 10, which is the recommended cutoff point for VIF scores (Neter, Kutner, Nachtsiem, & Wasserman, 1996).

Wisconsin Multilevel Models for ELA Academic Achievement

Table 2a.ii presents the grade-level and school-level variables used in the multilevel models (please see Appendix B for more information on these multilevel models). The multilevel model examined the grade and school level predictors academic success in ELA, controlling for participation in Project Future. In order to learn more about the variables used in these analyses and how they were defined, please see Tables A.1 (Description of Variables) in Appendix A.

Wisconsin ELA HLM Predictors:

Project Future was not a significant predictor of ELA academic success, but there were four significant school-level predictors. Larger proportions of Caucasian students and other race students led to increases in the ELA academic success, while schools with larger proportions of students who received free and reduced lunches and were identified as students with disabilities decreased ELA academic success. At the grade-level, there were three statistically significant predictors – Met or Exceeded ELA Test and Grade 4. For every grade-level that had a higher proportion of their students passing the ELA standardized tests during the 2022-23 school year, there was a corresponding increase in students passing the ELA standardized test during the following school year. Grade 4 levels were associated with a decrease in ELA academic success compared to Grade 3 levels, while Grade 5 levels were associated with an increase in ELA academic success.

Table 2a.ii: Effects of Project Future on Student ELA Achievement in Wisconsin

Variables	Coefficient (B)	Standard Error	Statistical Significance
Grade-Level			
Met or Exceeded ELA Test	56.64	1.95	***
Grade 4	-3.92	.46	***
Grade 5	1.34	.65	*
Total students	-.01	.01	
Intercept	53.1	.23	***
School-Level			
Project Future Treatment	-.07	2.55	
Gender (Female)	10.18	7.32	
Caucasian	15.72	1.99	***
Other Race	10.24	2.75	***
City Locale	.26	.80	
Suburbs Locale	1.03	.67	
Free & Reduced Price Lunch	-18.83	2.04	***
Pupil-to-Teacher Ratio	.14	.10	
English Language Learners	3.60	2.78	
Students with Disabilities	-18.24	5.44	***
Charter Schools	.18	1.14	
Variance Explained		Total Variance Explained at Each Level	Proportion of Variance Explained by Variables
Grade-Level (r)		87.8%	8.6%
School-Level (u)		12.2%	96.9%

Sources: Data for these analyses came from (1) Correspondence with the Project Future team, (2) Wisconsin State's Forward Achievement Exams, 2022-24, (3) Common Core of Data, Public Elementary/Secondary School Universe Survey, 2022-23, and (4) Wisconsin Department of Public Instruction's WISE data portal for the SWD and ELL variables.

*p<.05; **p<.01; ***p<.001

Wisconsin ELA Analyses Variance Explained:

It is also important to examine the proportion of variance explained by the two-levels of the multilevel model as well as how much our variables are able to explain this level-specific variation. We see that 87.8 percent of the variation that predicts student academic success in ELA was predicted by grade-level variables, while only 12.2 percent of the variability in student academic success is predicted at the school-level. We also see that 8.6 and 96.9 percent of grade-level and school-level variation are accounted for by our measures at each of those levels.

Wisconsin Analyses for Math Academic Achievement

Table 2b.i presents the means and percentages of grade- and school-level variables broken out by whether the schools received Project Future treatment. The first important finding is that grades that received Project Future treatments had lower levels of students meeting or exceeding the Math state standardized test during the 2022-23 school year (11.9% versus 46.8%) and the 2023-24 school year (14.8% versus 53.9%). We also see that schools that received the Project Future treatment were more diverse (Black students = 31.0%; Hispanic students = 61.6%) than the control schools (Black students = 7.7%; Hispanic students = 14.4%). Project Future schools also had larger average proportions of their students receiving Free and Reduced lunches (treatment = 91.0%; control = 44.1%) and were located in cities (treatment = 100%; control = 27.9%). These differences suggest that Project Future was launched in schools that were different from the control schools, therefore it will be important to control for these grade- and school-level effects in any regression analyses performed to better understand Project Future.

Table 2b.i: Effects of Project Future on Student Math Achievement in Wisconsin

Variables	Project Future Descriptive Statistics			Control Descriptive Statistics		
	Mean or Percentage	Standard Deviation	Grade/School N	Mean or Percentage	Standard Deviation	Grade/School N
Dependent Variable						
Met/Exceeded ELA Tests, 2023-24	14.8%	9.7%	20	53.9%	21.6%	1,688
Grade-Level Variables						
Met/Exceeded ELA Tests, 2022-23	11.9%	8.5%	20	46.8%	21.1%	1,688
Grade Level 3	30.0%	47.0%	20	46.0%	49.8%	1,688
Grade Level 4	35.0%	48.9%	20	40.0%	49.0%	1,688
Grade Level 5	35.0%	48.9%	20	14.0%	34.8%	1,688
Total Students Per Grade Level	41.5	20.7	20	57.3	36.2	1,688
School-Level Variables						
Treatment in Project Future Program	100%	---	7	0%	---	888
Female Students	46.9%	1.9%	7	48.3%	3.2%	888
Black or African American	31.0%	38.6%	7	7.7%	15.9%	888
Hispanic or Latino	61.6%	40.1%	7	14.4%	15.4%	888
Other Race Students	4.0%	4.0%	7	11.2%	9.6%	888
White Students	3.4%	5.6%	7	66.7%	25.9%	888
English Language Learners	35.0%	28.3%	7	7.8%	10.5%	888
Students with Disabilities	18.8%	3.1%	7	16.3%	5.1%	888
Free and Reduced Price Lunches	91.0%	5.3%	7	44.1%	23.0%	888
Pupil: Teacher Ratio	15.9	2.5	7	13.3	2.5	888

City Locale	100%	0%	7	27.9%	44.9%	888
Suburbs	0%	0%	7	27.8%	44.8%	888
Rural Locales	0%	0%	7	44.3%	49.7%	888

Sources: Data for these analyses came from (1) Correspondence with the Project Future team, (2) Wisconsin State's Forward Achievement Exams, 2022-24, (3) Common Core of Data, Public Elementary/Secondary School Universe Survey, 2022-23, and (4) Wisconsin Department of Public Instruction's WISE data portal for the SWD and ELL variables.

Multicollinearity Analyses

Before we selected our final models, variables in our analyses were assessed for multicollinearity using variance inflation factors (VIFs). Variance Inflation Factors (VIFs) are a ratio of coefficients that assesses the predictability of an independent variable by another independent variable. In our model, no predictor had a VIF score over the threshold of 10, which is the recommended cutoff point for VIF scores (Neter, Kutner, Nachtsiem, & Wasserman, 1996).

Wisconsin Multilevel Models for Math Academic Achievement

Table 2b.ii presents the grade-level and school-level variables used in the multilevel models (please see Appendix B for more information on these multilevel models). The multilevel model examined the grade and school level predictors academic success in Math, controlling for participation in Project Future. In order to learn more about the variables used in these analyses and how they were defined, please see Tables A.1 (Description of Variables) in Appendix A.

Wisconsin Math HLM Predictors:

Project Future was not a significant predictor of Math academic success, but there were five significant school-level predictors. Schools with larger proportions of Caucasian students, other race students, and English Language Learner students led to increases in the Math academic success, while schools with larger proportions of students who received free and reduced lunches and students with disabilities experienced decreased Math academic success. At the grade-level, there was one statistically significant predictor – Met or Exceeded Math Test. For every grade-level that had a larger proportion of their students passing the Math standardized tests during the 2022-23 school year, there was a corresponding increase in students passing the ELA standardized test during the following school year.

Table 2b.ii: Effects of Project Future on Student Math Achievement in Wisconsin

Variables	Coefficient (B)	Standard Error	Statistical Significance
Grade-Level			
Met or Exceeded ELA Test	58.78	1.86	***
Grade 4	.75	.49	
Grade 5	-.18	.72	
Total students	.01	.01	
Intercept	53.83	.25	***
School-Level			
Project Future Treatment	.19	2.57	
Gender (Female)	-2.02	7.97	
Caucasian	19.11	2.23	***
Other Race	8.29	2.98	**
City Locale	-.18	.88	
Suburbs Locale	.22	.74	
Free & Reduced Price Lunch	-15.72	2.20	***
Pupil-to-Teacher Ratio	-.02	11	
English Language Learners	7.09	2.91	*
Students with Disabilities	-17.55	5.89	**
Charter Schools	.08	1.26	
Variance Explained		Total Variance Explained at Each Level	Proportion of Variance Explained by Variables
Grade-Level (r)		89.9%	2.9%
School-Level (u)		10.1%	97.5%

Sources: Data for these analyses came from (1) Correspondence with the Project Future team, (2) Wisconsin State's Forward Achievement Exams, 2022-24, (3) Common Core of Data, Public Elementary/Secondary School Universe Survey, 2022-23, and (4) Wisconsin Department of Public Instruction's WISE data portal for the SWD and ELL variables.

* $p < .05$; ** $p < .01$; *** $p < .001$

Wisconsin Math Analyses Variance Explained:

It is also important to examine the proportion of variance explained by the two-levels of the multilevel model as well as how much our variables are able to explain this level-specific variation. We see that 89.9 percent of the variation that predicts student academic success in Math was predicted by grade-level variables, while only 10.1 percent of the variability in student academic success is explained at the school-level. We also see that, 2.9 and 97.5 percent of grade-level and school-level variation are accounted for by our measures at each of those levels.

Summary of Findings and Future Research

No treatment main effect was detected for any of the four multilevel models (hierarchical linear models; HLMs). That is, the impact of Project FUTURE on student performance, as measured by state administered standardized testing, was not found for either ELA or Math in the treatment schools in Connecticut or Wisconsin.

This study was completed entirely using publicly available data. Although this data was more readily accessible, its less granular nature necessitated expanding the scope of comparison or control data to all grades-within-schools for the two states where the treatment condition was implemented. Other factors that necessitated this expansion included the availability of grade-within-school assessment data that met our threshold of 95 percent completeness or data that were not censored due to small cell size (e.g., school-level ELL proportions).

Access to student-level data may have helped to uncover the expected treatment effects. That is, the order of magnitude increase in observations, going from grades-within-schools to individual students, along with increased variability in data, may have set the stage for finding evidence of treatment effects.

Another consideration for future research includes expansion of this program to different schools and locales to test its impact in other environments.

Fidelity of Implementation

Introduction:

The purpose of this section of the report is to document the degree and extent to which Project Future and the elements of the intervention were implemented as intended.

Methodology:

The external program evaluator was responsible for documenting fidelity data, which was collected during monthly leadership meetings, annual review of program documentation, and through a final comprehensive program survey.

Fidelity criteria:

The following chart identifies the essential features or components of the program that are expected to be implemented and the desired level of fidelity.

Indicators	Definitions	Unit of Implementation	Score for levels of implementation at unit level	Threshold for adequate implementation at unit level	Expected Sample for fidelity measure
CODE.org Training					
Code.org Capacity Building Courses	Teacher workshops to explore teaching of CS, including <i>Fundamentals</i>	6.5 workshop hours for teachers	2=completes 6.5 hours 1=completes 3 hours 0=completes less than 2 hours	80% of teachers have score of 1 or 2	Approx. 750 teachers
PLC Coaching					
Instructional Coaching	K-5 grade clustered coaching sessions focused on curriculum and instruction	3 half day coaching sessions per teacher	2=completes 2-3 half-day sessions 1=completes 1 half day sessions 0=completes less than 1 half-day session	80% of teachers have score of 1 or 2	Approx. 750 teachers
Intensive Professional Learning					
Summer Institute #1	5-day institute to support understanding of CS and content integration and instructional best practices	Daily attendance by teacher	Scores 0-5 by teacher depending on number of days of attendance	80% of teachers have a score of 3 or higher	49 Collaborating Teachers
School Year Follow-up Sessions	Workshops during the school year to share feedback on unit implementation	Teacher participation in 2 workshops during the school year	2=completes 2 workshops 1=completes 1 workshop 0=completes less than 1 workshop	80% of teachers have a score of 1 or higher	49 Collaborating Teachers

Summer Institute #2	5-day institute to support curricular revisions and enhancements	Daily attendance by teacher	Scores 0-5 by teacher depending on number of days of attendance	80% of teachers have a score of 3 or higher	49 Collaborating Teachers
Curricular Unit					
Unit Development	Completion of integrated curricular unit	Each Developed Unit	2=10 Completed Units 1=5 Completed Units 0=No Completed Units	80% of expected units are completed	10 Units
Unit Implementation	Implement the curricular unit in the classroom	Unit implementation by teacher	2=10 Implemented Units 1=5 Implemented Units 0=No Implemented Units	80% of units are implemented by teachers	40 Teachers

Overall Fidelity:

The following chart breaks down the fidelity of the for the components identified above:

Indicators	Quality of Delivery	Dosage/Exposure	Levels of implementation	Teacher Engagement	Adherence
CODE.org Training					
Code.org Capacity Building Courses	A required one-day session across most schools and districts	One all day virtual or in-person workshop session	2=completes 6.5 hours 1=completes 3 hours 0=completes less than 2 hours	99% of participating teachers score of 1 or 2	Complete
PLC Coaching					
Instructional Coaching	Due to the impact of Covid and the return to the classroom coaching took on many formats -individual, grade level, and classroom level during the school year or summer through virtual or in-person formats.		Levels varied by format and extended timelines	75% of districts encouraged teachers to participate in the coaching although substitute and staffing issues impacted participation	Not as expected but revised to accommodate needs of most teachers at most district schools
Intensive Professional Learning					
Summer Institute #1	Recruitment issues due to	By the end of year two every	All collaborating teachers	Every Collaborating	Complete with all

School Year Follow-up Sessions	Covid, school closures, and staffing issues led to mixed levels of attendance during formal summer institutes and school year sessions	Collaborator Teacher had participated in at least on summer institute session or one full set of professional development days equal to the summer institute, with many attending school year check-in and update sessions, and some attending two full summer institute sessions.	attended professional learning sessions at the time of or relevant to the focus of the two summer institutes with most attending periodic school year sessions	teacher engaged in professional learning sessions throughout the unit development phase of the project to develop curricular units, with most attending one or two summer institute sessions	teachers attending various schedule sessions held to accommodate all Collaborative teachers.
Summer Institute #2					
Curricular Unit					
Unit Development	Units developed	Units completed or in the development process	2=Completion of Unit 1=Partial completion of Unit 0=No unit completed	200% of expected units completed or in development	20 units in development process
Unit Implementation	Units implemented	Implementation of completed units by teachers	2=Completed units Implemented 0=No Implementation	100% of teacher have a score of 2 as all unit developers implemented to some extent the developed units	49 Collaborating Teachers

Discussion:

Although Project Future was not implemented as originally designed, nearly every K-5 teacher in the CT and WI school districts engaged in at least one Code.org computer science workshop and one of the various coaching sessions, increasing CS understanding and capacity across the participating schools at the two program sites. Similar results were documented among the Collaborative teacher subgroup, with every selected teacher interested in unit development engaged in professional learning during at least one, if not both, summer institute sessions or alternative sessions, including school year sessions. An outcome of Project Future and the professional learning provided over the span of the project is the development of twice the expected units, with each being enhanced, revised, and implemented in the classrooms of the developing teachers and prepared for publication and dissemination beyond the school and district, including at the state level and beyond. The primary barrier to full implementation was the result of COVID, which impacted Project Future almost immediately, leading to recruitment issues and

the lack of a standardized implementation process, especially with implementation sites across two states, including many different districts and schools. This inconsistency in implementation was likely one factor leading to the outcome of the evaluation study, which shows no significant academic impact based on the annual year-end assessment scores. Beyond this result, teachers involved in the development process were engaged and invested in creating and implementing new curricular units in their classrooms, identifying positive impacts on their students, indicating that using lessons learned to restructure Project Future for implementation during regular school timelines may be more likely to demonstrate the expected effects.

Additional Findings

Although statistically the outcome of the implementation study resulted in no significant finding regarding increases in achievement as measured by the annual state level proficiency exam, a secondary research initiative engaged in by the project leadership included teacher level focus groups with qualitative data indicating impacts of the curricular development process having a positive effect on student engagement, interest, and learning with the following shared statements:

- Teachers consistently observed that students were highly engaged during CS-integrated lessons, with one teacher noting that students were “so interested and so invested” that their attention improved even in other contexts, including behavior management.
- Students showed excitement, pride, and ownership over their work on the unit-developed projects. For example, one teacher recounted how some students who were often harder to engage became enthusiastic and successful in creating their own stories using the integrated coding.
- Overall, the coding projects sparked curiosity, prompting some students to ask critical questions about how technology around them (e.g., commercials, games, robots) works.
- Teachers also observed that students were applying CS-related thinking (like sequencing, debugging, cause and effect, and logical reasoning) in other academic areas such as math, reading, and SEL. One teacher explained that coding concepts became reference points for explaining math errors or behavioral decisions: “You didn’t do your math right? We have to debug it.”
- Integration made abstract academic concepts more tangible, particularly for special education and English language learners. For example, one teacher said her students with disabilities “got more out of it than students in Gen Ed,” highlighting CS’s equalizing potential.
- Integrated units frequently embedded social-emotional learning (SEL), reinforcing growth mindset, persistence, and collaboration. Teachers reported students were becoming more independent problem-solvers and peer collaborators.
- Teachers emphasized the equitable benefits of CS integration—especially for students with disabilities and those in under-resourced schools. As one teacher said, “It’s not a luxury. We have to do it” because of its transformative and inclusive power

Based on the comments and observations from the developer teachers, it is clear that, overall, integrating computer science into core instruction through project-based and standards-aligned units seems to enhance student engagement, deepen learning across content areas, and foster new pathways for student agency, creativity, and equity. With teachers reporting not only shifts in their practice and mindset but also evidence of student growth, interest, and motivation resulting from this integrated approach, it is likely that with more time, a better organizational structure, and a more relevant assessment instrument, measured student impact is likely an outcome of additional project implementation.

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**APPENDIX A:
Analyses for Connecticut and Wisconsin**

Table A.1 Description of Connecticut and Wisconsin Variables

Type	Variable Names	Measurement
Dependent Variable		
	Students Who Met or Exceeded State Standardized ELA Tests, 2023-24	%
	Students Who Met or Exceeded State Standardized Math Tests, 2023-24	%
Grade-Level Variables		
	Students Who Met or Exceeded State Standardized ELA Tests, 2022-23	%
	Students Who Met or Exceeded State Standardized Math Tests, 2022-23	%
	Grade Levels	
	Grade Level 3	0/1
	Grade Level 4	0/1
	Grade Level 5	0/1
	Total Students per Grade Level	#
School-Level Characteristics		
	Treatment in the Project Future Program	0/1
	Female Students	%
	Race/Ethnicity	
	Black or African American	%
	Hispanic or Latino	%
	Other Race Students	%
	White Students	%
	English Language Learner	%
	Students with Disabilities	%
	Free and Reduced Price Lunches	%
	Pupil: Teacher Ratio	Ratio
	Locale	
	City Locale	0/1
	Suburbs	0/1
	Rural Locales	0/1
	Charter Schools	0/1

Sources: Data for these analyses came from (1) Correspondence with the Project Future team, (2) Connecticut State's Smarter Balanced Achievement Tests, 2022-24, (3) Common Core of Data, Public Elementary/Secondary School Universe Survey, 2022-23, (4) Connecticut State Departments of Education's EdSight Portal for the SWD and ELL variables; (5) Wisconsin State's Forward Achievement Exams, 2022-24, and (6) Wisconsin Department of Public Instruction's WISE data portal for the SWD and ELL variables.

APPENDIX B: HLM Models

Multilevel models include error terms at each level of analysis (i.e., grade levels, schools) which helps to control for similar grades of students attending schools with other similar grades of students, or issues of dependence. These error terms allow the intercepts to vary across classrooms and schools; however the grade-level variables were fixed, or constrained from varying across higher aggregational units. Additionally, all variables were grand mean centered to ease with the translation of variables (Raudenbush & Bryk, 2002).

Grade-Level Multilevel Models:

At level 1 of the multilevel analyses the outcome of passing rates of standardized tests is predicted as a linear combination of the following grade-level variables, plus intercept as:

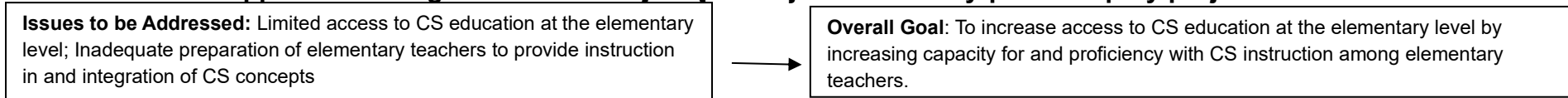
$$Y(\text{Pass Rate } 23 - 24)_{ij} = \beta_{0j} + \beta_{1j}(\text{Pass Rate } 22 - 23)_{ij} + \beta_{2j}(\text{Grade } 4)_{ij} + \beta_{3j}(\text{Grade } 5)_{ij} + \beta_{4j}(\text{Total Students})_{ij} + r_{ij}$$

Y_{ij} represents the outcome for grade levels i in the j school. β_{0j} represents the initial status of classroom j . β_{1j} represents the slope of variable for the pass rate in grade i in school j , and r_{ij} represents the residual for grade level i in school j . On subsequent levels, the level 1 (grade-level) slopes and intercept become dependent variable for level 2 (school-level):

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{Project Future Treatment})_j + \gamma_{02}(\text{Female})_j + \gamma_{03}(\text{Caucasian})_j + \gamma_{04}(\text{Other Race})_j + \\ &\gamma_{05}(\text{City})_j + \gamma_{06}(\text{Rural})_j + \gamma_{07}(\text{Free \& Reduced Priced Lunches})_j + \gamma_{08}(\text{Pupil:Teacher Ratio})_j + \\ &\gamma_{09}(\text{English Language Learners})_j + \gamma_{10}(\text{Students with Disabilities})_j + \gamma_{11}(\text{Charter Schools})_j + U_{0j} \\ \beta_{1j} &= \gamma_{10} \\ &\dots \\ \beta_{4j} &= \gamma_{40} \end{aligned}$$

In the above equations, γ_{00} and γ_{01} are the intercepts for β_{0j} and β_{1j} , and the coefficients γ_{10} through γ_{40} represent their variables' slopes predicting γ_{00} . Through this process, we accurately model the effects of level 1 and level 2 variables on the outcome.

Appendix C - Logic Model for Project {Future} – an EIR early-phase inquiry project



Process: Provide CS based professional learning and curricular development supports to elementary teachers, impacting their attitude, beliefs, and instructional development and practice and Study the impact of CS integration in the elementary classroom on student’s CT skills and other high value learning outcomes

Specific Goals: To expand access to CS education for K-5 students; To contribute innovations to professional learning and curriculum integration to elementary CS education; To contribute validated instruments and curricular tools to the field of CS education; To improve CT skills and other learning outcomes for K-5 students.

