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INTRODUCTION: The After-School Corporation (TASC), in partnership with the New York City Department of Education (NYC DOE), is responding to the U.S. Department of Education's Investing in Innovation Fund (i3) – Development Grant for Absolute Priority 2—Improving Science, Technology, Engineering, and Mathematics (STEM) Education. The proposed project, Design2Learn, will advance national education interests by demonstrating a replicable science intervention's impact on student interest, engagement and academic performance in science during the middle school years, a period during which student performance in science sharply declines. Students will participate in weekly, design-based science instruction during the after-school hours. Instruction will be jointly facilitated by a trained three-person educator team (one certified teacher; two informal educators) and designed to connect science learning goals to real-world activities. We will assess the impact of the intervention on a cohort of 300 students per year for three years (6th – 8th grade), across 15 schools from the highest-need districts in NYC that serve a disproportionate number of minority students traditionally underrepresented in the sciences (i.e. black and Hispanic students, students with disabilities and English Language Learners).

A. SIGNIFICANCE: **I. PROMISING STRATEGIES:** Our hypothesis, based on a strong theory, is that the combination of three strategies – 1) collaborative teaching; 2) curricular bridging; and 3) design-based learning – will lead to positive effects in student-reported interest in science; increased student participation and reports of engagement in science activities; and improved student performance on state standardized science tests. While there is preliminary evidence that demonstrates the potential of these individual strategies, their combination as a seamless intervention with measurable impacts on student interest, engagement and achievement in science is novel. Strategies, and evidence of effectiveness supporting each, are:

a) Collaborative teaching, is defined as certified teachers and informal educators (staff employed by non-profit organizations providing school-based after-school programs) jointly delivering instruction during out-of-school time. This approach is informed by research demonstrating the effectiveness of co-teaching by two or more certified teachers (e.g., a general education teacher and a reading specialist) during the school day (Friend & Cook, 2010).[1] Co-teaching provides more opportunity for teacher-student interaction, increases differentiated instruction and serves as a predictor of student performance, suggesting that optimal learning occurs when educators collaborate (Moorehead and Grillo, 2013; Zito, 2011). Our model builds on this powerful approach by incorporating the expertise of community-based organizations in the informal sector. Non-profit organizations delivering after-school programming seek informal educators who are trained in mentoring and peer-assisted learning strategies. Informal educators contribute specialized competencies in culturally sensitive social work and positive youth development practice (Krishnamurti, Ballard, and Noam, 2014). **b) Curricular bridging** is defined as the alignment between school and after-school curricula to create seamless student learning experiences (Noam, 2003). According to Noam, Biancarosa, and Dechausay (2002) congruity of environments, learning goals and teaching styles is associated with increased student performance. Curricular bridging also shows promise as a strategy for engaging students. Out-of-school time programs that include links to academic curricular goals connect children's

[1] See Appendix J. for full references

"divergent worlds," making learning "more meaningful and relevant to [students'] life experience" (Noam, 2003). **c) Design-based learning** is defined as hands-on, real-world activities that feature the iterative selection and arrangement of elements by which artifacts, systems and tools are designed. Students identify a design problem; consider options and constraints; and plan, model, test, and iterate solutions, making higher-order thinking skills more tangible and visible. Design-based activities are intrinsically motivating to students because they engage the desire to solve problems, create and learn how things work. Children engaged through design-based activities, particularly those who do not believe they are good at science, become more motivated because they witness how core content is integral to solving problems that are personally relevant (Bennett, 2013). Research shows that design-based activities can help students develop deep conceptual understanding and support the development of self-guided inquiry skills critical to success in science. (Kimmel, 2006; Kolodner, 2000; Sadler, 2007).

II. NATIONAL SIGNIFICANCE: Design2Learn holds significance as a scalable solution to increase science achievement, interest and engagement for young people, contributing to a science-literate society with the motivation and ability to make complex decisions and succeed in 21st century careers. The national need is tremendous: among 34 countries that participate in the Programme for International Student Assessment (PISA), the United States ranks 20th in science, despite spending more per student than most countries. The middle grades are an especially risky time in the science education and career pipeline. Achievement declines sharply between grades 4 and 8, particularly for students underrepresented in science fields (i.e., Black and Hispanic students), leading to an inability to compete for high-wage jobs and a national crisis in equity in the science fields. To illustrate: in New York City's Bronx Community School District 8, where 87% of students are Black or Hispanic and nearly 89% live in poverty, 82% of 4th grade students demonstrated proficiency on the 2011 State Science Test compared to only 39% of 8th graders. White and Asian student achievement does not show the same trend, revealing a troubling and widening achievement gap (NYC DOE).

Attempts to increase science achievement among U.S. students, particularly middle school students underrepresented in science fields, must address two critical and related issues. First, we must ensure continued interest in STEM, particularly in the early grades when student interests and career aspirations take shape (Business Higher Education Forum, 2010) with an emphasis on minority groups underrepresented in STEM fields, whose interest in science begins to decline in middle school (Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology, 2001). Second, we must develop strategies to increase engagement, as lack of engagement with real-world problems is the most predictive factor in students dropping out of the science education and career pipeline (Connell, Halpern-Felsher, Clifford, Crichlow, & Usinger, 1995; Jerald, 2006; Rumberger, 2004). Engagement strategies are especially impactful for the middle grades: 8th-grade students who reported participation in weekly hands-on activities showed significant gains between the 2009 and 2011 NAEP science tests, while their peers who reported no hands-on activities showed no improvement.

III. POTENTIAL REPLICABILITY: Design2Learn is optimal for replication because it:

a) Maximizes After-School Investment*:** There has been a surge in public investment in after-school programming, particularly for high-minority schools partnering with community-based organizations (CBOs). Participation in after-school has consistently increased over the past 10 years, rising from 6.5 million children in 2011 to over 10 million children in 2014 (America After 3, Afterschool Alliance, 2014). Districts can build on high community demand and existing public investments to replicate the model. ***b) Leverages Community Partners**:** Design2Learn leverages partners readily available in a given community: 1) local educational agencies with access to high-need schools; 2) non-profit community-based organizations that deliver after-school enrichments; and 3) science-rich institutions, such as museums, with expertise in innovative strategies for hands-on science teaching and learning. ***c) Aligns with Private Funder Interest:*** Following the 2014 *STEM Learning is Everywhere* report by the National Research Council, a consortium of private foundations collaborated to form the STEM Funders Network. The Network supports 25 communities in cultivating cross-sector collaborations in STEM. Findings from Design2Learn will be disseminated through the Network for potential replication in communities with support from an array of private funders.

<u>B. QUALITY OF PROJECT DESIGN</u>: **I. LOGIC MODEL** *(See Appendix D)*

a) Hypothesis: Our hypothesis, based on a strong theory, is that science instruction that includes a combination of: 1) collaborative teaching; 2) curricular bridging; and 3) design-based learning, will improve high-need students' interest, engagement and achievement in science.

b) Inputs: ***Schools (15):*** Design2Learn will serve 15 NYC public schools recruited primarily from the highest need districts: Bronx districts 7, 8, 9, 12 and Brooklyn districts 19 and 23 (See Table 1). We will recruit a minimum of 30 schools to apply to participate. Upon application, 15 schools will be randomly assigned to the Design2Learn treatment, while 15 will serve as control schools for the evaluation. All schools will be high-minority schools, as defined by the NYC LEA as schools in the top quartile of percentage of students who are American Indian/Alaska Native, Asian, Black, Native Hawaiian/Pacific Islander, Hispanic, or Two or More Races. All schools will serve a disproportionately high percentage of students with disabilities (SWD), students who are English Language Learners (ELL) and students living in poverty.

Table 1. Design2Learn Target District Profiles (Source: 2014-2015 Demographics, NYC DOE)

	NYC	**Bronx Districts**				**Brooklyn Districts**	
Demographics	**Avg**	**7**	**8**	**9**	**12**	**19**	**23**
% Asian	15.3%	1.2%	5.1%	1.4%	2.2%	6.8%	0.9%
% White	14.7%	1.5%	6.7%	1.2%	1.7%	1.6%	0.9%
% Black & Hispanic	68.2%	96.5%	87.0%	96.6%	94.7%	90.2%	96.9%
% SWD	18.2%	20.9%	21.4%	19.4%	19.5%	18.0%	20.9%
% ELL	13.1%	16.6%	11.9%	21.9%	17.8%	11.5%	4.5%
% Poverty	78.0%	92.1%	88.9%	93.4%	92.0%	88.5%	87.7%

Students (300): A cohort of 300 students across 15 schools (20/school) will start the program in 6th grade and participate over a 3-year period. New students will enter the program each year to ensure that 300 participants are served annually if any students in the original 6th grade cohort do not continue participation in subsequent years. The evaluation will remain focused all three years on the original cohort of 300 students that began in 6th grade. ***Educators (45):*** At each school, a team of three educators (one certified science teacher; two informal educators) will participate, for a total of 45 educators/year over three years. ***Managing Partner:*** TASC is a not-for-profit 501(c)(3) corporation founded in 1998. TASC's mission is to give disadvantaged students more opportunities to develop their talents; more support to overcome the challenges of poverty; and more time to achieve at the high levels essential for success in the global workplace.

Science-Rich Institution: The New York Hall of Science (NYSCI), is a 501(c)(3) corporation founded in 1964. NYSCI is New York's center for interactive science, serving a half million students, teachers, and families each year**.** NYSCI has expertise in designing standards-based content that engages students in hands-on learning through design-based activities. ***LEA:*** NYC's Department of Education (NYC DOE) oversees the largest school district in the U.S., serving 1.1 million students in over 1,800 schools. ***Evaluator:*** The Research Alliance for New York City Schools (RANYCS) is an independent evaluator housed at New York University. RANYCS strives to advance equity and excellence in education by providing nonpartisan evidence. **See Appendices B for 501c3 verification, C for Non-Profit Record of Improvement and G for Memoranda of Understanding.*

c) Activities: ***Phase 1 Activities: January 2016 – July 2016***

School Recruitment and Selection: TASC, in partnership with NYSCI and the NYC DOE, will recruit school-community-based organization (CBO) teams to apply to participate in Design2Learn (see C. Quality of Project Evaluation for school randomization and recruitment process). TASC, NYSCI and the NYC DOE will conduct targeted outreach to school principals, community leaders and district superintendents across six high-need districts in the Bronx and Brooklyn. All school-community teams will have existing partnerships to deliver publically-funded after-school. A school-community team's readiness to join the initiative will be based on a set of cultural and technical thresholds:

Table 2. Readiness Thresholds for School-Community Team Selection

Threshold	**Description**
Commitment to Model	Teams demonstrate a commitment to attend joint professional development, co-plan and collaboratively deliver science instruction.

Mission Alignment	Teams work towards a shared vision for student success, which includes clearly articulated goals and outcomes.
Collaboration	Implementation staff, school administration and community leadership are committed to ongoing collaboration. This includes shared leadership in decision making and opportunities for joint leadership training.
Culture of Communication	Teams participate in frequent, two-way communication, including opportunities for joint reflection to improve each other's practice
Student Participation Record	Teams demonstrate a track record of high student attendance, with students attending at least 60% of after-school sessions.
Secure Funding	Teams demonstrate evidence of public funding to support the delivery of after-school activities over the three years' of the initiative.

<u>Student Recruitment and Selection:</u> TASC and NYSCI staff will visit participating schools at the start of each school year to recruit students. Staff will model activities and distribute flyers in multiple languages to recruit students from diverse backgrounds. In years 2 and 3, they will aim to retain as many returning students as possible, adding new students to ensure adherence to the program design. Teachers will also conduct targeted outreach to individual students. Our aim is to recruit cohorts of students that mimic the demographics of each school.

Phase 2 Activities (August 2016 – July 2019) Activities repeat every year over the 2016-17, 2017-18, and 2018-19 school years (and the summers that precede each school year for professional development and planning).

<u>Joint Professional Development (PD): 63 hours/year</u> (*Relevant Strategies*: Collaborative Teaching, Curricular Bridging): Design2Learn supports collaboration between teachers and informal educators through year-round PD (See Table 3 for PD activities and timeline).

Table 3. Design2Learn Professional Development Plan		
Activity	**Dosage**	**Description**
Strategic	6 hours/year	Retreat for school teams each June to identify needs and

Planning Retreat	(1 six-hour session)	priorities and develop a science education strategic plan with clear objectives and implementation goals.
Summer Institute	30 hours/year (5 days, 6 hours/day)	Multi-day institute each August during which educators attend workshops that focus on design-based instruction. Teams develop unit plans that incorporate design-based learning and engineering design tasks that align to the Scope & Sequence.
School Year Workshops	12 hours/year (2 days, 6 hours/day)	Workshops for educator teams that focus on strategies for planning and delivering after-school activities that bridge: 1) the Scope & Sequence; and 2) the elements of design-based instruction (e.g, identifying problems, asking thoughtful questions, designing solutions). Includes one workshop in November and one workshop in March.
Instructional Coaching	12 hours/year (4 sessions, 3 hours/session).	School-based instructional coaching to ensure feedback and continuous quality improvement for educator teams. Sessions consist of a pre-observation planning conference, observation and post-observation reflective conference. Includes fall sessions (Oct-Dec.) and spring sessions (Feb. – May).
Annual Convening	3 hours/year (1 convening, 3 hours)	Teams convene each May to reflect on lessons learned and share promising strategies. Reflections and feedback inform adjustments for the coming school year.

<u>Collaborative Planning around Curriculum Design & Development: 36 hours/year @ 1 hour/week for 36 weeks</u> (*Relevant Strategy*: Curricular Bridging): Teaching teams of one certified teacher and two informal educators will participate in weekly planning sessions during which they map out design-based unit plans containing after-school activities that align to the NYC 6-12 Science Scope & Sequence ("The Scope & Sequence") and school day curricula. The Scope & Sequence is a framework that aligns: 1) the New York State Learning Standards for Mathematics, Science, and Technology; 2) Next Generation Science Standards – Science and Engineering Practices and the Cross-Cutting Concepts; 3) Common Core Learning Standards in Mathematics; 4) Common Core Learning Standards in English Language Arts; and 5) Excellence in Environmental Education: Guidelines for Learning (K–12). During planning sessions, teams

will focus on a particular unit of study within the Scope & Sequence and use a Curriculum Topic Study: Understanding by Design template (see Appendix J) to identify science learning goals that align with students' school-day learning experiences. See Table 4 for examples.

Table 4. Sample Design2Learn Curricula

Title	**Grade**	**Summary**
Engineering Community Gardens	6	Students will apply their knowledge of energy conversion and the Engineering Design Process to design a device that will transport water from one village to the next. Students will experience science and engineering practices that include: defining problems, planning and carrying out investigations and designing solutions.
Mechanical Corn Hole	7	Students will apply their knowledge of simple machines and the Engineering Design Process to design a "Mechanical Cornhole" machine that will help farmers transport crops. They will develop and use four different simple machine models to prepare for this culminating project.
Eco-Park Design	8	Students will take on the roles of environmental engineers and landscape architects to design an Eco Park that fulfills a community's needs and reduces negative environmental effects. Students apply their knowledge of ecosystems, explore ways humans impact the environment and construct 3D topographic maps to display their work.

<u>After-School Science Instruction: 72 hours/year @ 1 hour/day, 2 days/week for 36 weeks</u> (*Relevant Strategies*: Design-based Learning, Collaborative Teaching, Curricular Bridging): Students will participate in weekly design-based science instruction during the after-school hours, aligned to the Scope & Sequence and facilitated by educator teams. Students will be presented with a design task that is intended to reveal a core scientific concept. In small groups,

students will collaborate to: 1) consider options and constraints; and 2) model, test and iterate solutions. See Table 4 for examples of design-based after-school activities.

d) Goals, Outputs & Outcomes: ***Goals:*** The short-term project goals are to: (1) improve students' academic achievement in science; and (2) increase students' level of interest and engagement in science. The long-term project goal (beyond the course of the grant) is to equip high-need students with the science skills and sustained interest to compete for and succeed in 21st century jobs. ***Outputs:*** (1) 15 public schools participate; (2) 300 students participate/year; (3) 45 educators participate/year; (4) 72 hours of after-school science instruction/year; (5) 36 hours of collaborative planning/year; (6) 63 hours of professional development/year.

Outcomes: Outcomes aligned with short-term project goals, are: (1) Students in schools randomly assigned to participate in Design2Learn will demonstrate significantly greater gains on state standardized tests in science than students in schools randomly assigned to the control condition, controlling for baseline characteristics. (2) Students in schools randomly assigned to Design2Learn will demonstrate statistically significant increases in engagement and interest in science that surpass students in schools randomly assigned to the control condition. The outcome aligned with the long-term project goal is: (3) More high-need students are equipped with the science skills to compete for and succeed in 21st century careers.

II. MANAGEMENT PLAN

a) Partners/Key Personnel Roles ***(****See Appendix F for resumes of key personnel).*

Managing Partner (TASC): will design and manage the project, including: school recruitment and selection; design and delivery of professional development; coordination between project partners; and dissemination of results (See Table 5).

Table 5. TASC Key Personnel	
Chris Whipple, Vice President of Programs	Oversee the initiative, supervise staff and ensure that practice is sustainable and scalable.
Sabrina Gomez, Director of Expanded STEM Opportunities	Coordinate all aspects of Design2Learn including: school recruitment/selection; managing professional development; and ongoing communication with project partners.
Design2Learn Manager (to be hired)	Provide ongoing support to educator teams to effectively plan and facilitate after-school instruction.
Katie Brohawn, Senior Director of Research	Collaborate with educator teams to ensure the effective use of data; serve as the liaison between schools and the external evaluator to facilitate data collection/evaluation activities.
Saskia Traill, VP of Policy and Research	Contribute to initiative sustainability planning and products for dissemination, including policy briefs.
Deb Levy, Director of Communications	Oversee dissemination activities to share initiative updates and results.

LEA (NYC DOE): The NYC DOE will provide access to participating schools facilitating publically-funded after-school programs in partnership with community-based organizations. The NYC DOE will advise on all aspects of the initiative, including: school recruitment and selection; design and delivery of professional development; and collaboration with the evaluation team in activities such as data collection, reporting and random assignment (See Table 6).

Table 6. NYC DOE Key Personnel	
DOE Liaison (to be hired)	Coordinate between the DOE and project partners to ensure ongoing communication and smooth implementation.
Linda Curtis-Bey, Ed.D. Executive Director, STEM	Serve in an advisory capacity regarding cost-effective practices related to implementation and future sustainability
Nancy Woods, Director of Technology and Engineering	Facilitate access to student performance data and provide information needed to complete the evaluation; assist partners in problem-solving challenges to implementation.

Science-Rich Institution (NYSCI): NYSCI Instructors will develop and deliver professional development focused on effective design-based science instruction (See Table 7).

Table 7. NYSCI Key Personnel	
Sylvia Perez, VP of Education Services	Oversee planning and delivery of professional development to ensure alignment with project goals.
Jasmine Maldonado, Science Coach Supervisor	Develop and implement professional development workshops and coaching to educator teams.

Evaluator (The Research Alliance for New York City Schools: RANYCS): RANYCS will conduct an independent evaluation of the project's implementation and impacts (See Table 8).

Table 8. RANYCS Key Personnel	
James Kemple, Executive Director	Will serve as the Principal Investigator. Will provide senior oversight of all aspects of the project, including refining the research design, guiding the design and execution of the quantitative and qualitative research activities, and reviewing the quality of analyses, reports and other public materials.
Saskia Levy Thompson, Deputy Director	Will serve as Project Coordinator. Will be responsible for coordinating the partnership with each of the project partners and facilitating integration of the research design recruitment and data collection procedures into program operations. Will guide development, execution, analysis and reporting for the implementation study.

b. Timeline and Milestones

Table 9. Design2Learn Timeline and Milestones		
PHASE ONE: January 2016 – July 2016		
Project Category	**Milestone**	**Date Due**
Evaluation	Evaluation plan finalized per discussions with TASC, NYC DOE and NYSCI; application for proposed evaluation activities submitted to NYC DOE and NYU IRBs for approval	February-March
Implementation	NYC DOE and TASC solicit applications from potential school-community teams.	February - April
Implementation	NYC DOE, NYSCI and TASC review applications and select school-community teams that will be interviewed	May

Implementation	NYC DOE, NYSCI and TASC conduct interviews with each prospective school-community team to assess instructional philosophy, capacity and school culture	May
Implementation/ Evaluation	NYC DOE, NYSCI and TASC make final school-community team selections; Research Alliance conducts matched-pairs randomization to select treatment schools.	June
Implementation	NYC DOE, NYSCI and TASC plan, design and facilitate strategic planning retreat with selected school-community teams	June
Implementation	NYSCI and TASC plan and design summer institute; NYC DOE reviews summer institute goals, agenda and plan	July
PHASE TWO: August 2016 – August 2019 (activities repeat each year)		
Evaluation	Evaluation activities kickoff	August
Implementation	NYSCI and TASC facilitate summer institute with school-community teams (15 teams total) and NYC DOE liaison	August
Implementation	TASC and NYSCI staff recruit students	September
Implementation	TASC conducts instructional coaching visits to every school-community team (15 visits total); NYSCI conducts instructional coaching visits to every school-community team (15 visits total); NYC DOE joins two instructional coaching visits	October – December
Implementation	NYC DOE, NYSCI and TASC participate in two conference calls to discuss program implementation, quality and connections to central NYC DOE STEM efforts	October - December
Implementation	NYC DOE, NYSCI and TASC design and deliver fall professional development workshop to school-community teams	November
Evaluation/ Dissemination	End of year Evaluation Reports from Research Alliance (Report #1; Report #2)	December (2017, 2018)
Implementation	TASC conducts instructional coaching visits to every school-community team (15 visits total); NYSCI conducts instructional coaching visits to every school-community team (15 visits total); NYC DOE joins two instructional coaching visits.	February – May
Implementation	NYC DOE, NYSCI and TASC participate in three debrief conference calls to discuss program implementation, quality and connections to central NYC DOE STEM efforts	January – May
Implementation	NYC DOE, NYSCI and TASC design and deliver spring professional development workshop to school-community teams	March
Implementation	TASC plans for annual convening; NYC DOE, NYSCI and TASC host an annual convening of school-community teams to reflect on program and lessons learned	May
Implementation	NYC DOE, NYSCI and TASC design and facilitate strategic	June

	planning retreat with school-community teams.	
Dissemination	Policy Brief highlighting results, lessons learned and/or best practices is distributed to the field	July
PHASE THREE: Sept 2019 – Dec 2019		
Evaluation/ Dissemination	Data analysis; End of year Evaluation Report from Research Alliance (Report #3); Dissemination of final report to the field.	Sept - December

III. FEEDBACK AND CONTINUOUS QUALITY IMPROVEMENT (CQI)

a. Feedback and Improvement Procedures: TASC will define clear expectations that all partners regularly communicate to ensure opportunities for feedback and troubleshoot issues as they arise. Structured feedback/CQI opportunities, as outlined in the Management Plan, include:

Table 10. Feedback and CQI

Type	Procedure	Description
Feedback	Instructional coaching	School-community teams receive four instructional coaching visits each school year. Visits consist of an observation component, followed by a small-group debrief during which NYSCI/TASC staff provide targeted feedback on strengths and improvement areas.
Feedback	Annual Convening	School-community teams convene with DOE, NYSCI and TASC staff to reflect on best practices and lessons learned and make constructive suggestions for future program improvements.
CQI	Strategic Planning Retreat	Yearly strategic planning retreats provide an opportunity for Design2Learn partners to make recommendations for project improvements and implement actionable next steps.
CQI	Workshop Planning Conference	NYSCI and TASC convene to reflect on educator needs and refine fall and spring workshops in order to meets the unique needs of each school-community team.
CQI	Debrief Calls	Ongoing debrief calls enable NYC DOE, NYSCI and TASC to discuss program implementation, quality and connections to central NYC DOE STEM efforts and make necessary program adjustments.
CQI	End-of-year Reports	TASC research staff will review end of year reports from the external evaluator to identify implementation challenges and make appropriate mid-course corrections.

b. Risks and Mitigations: TASC has identified the following potential risks across all phases of the project and related mitigation plans:

Table 11. Risks and Mitigation Plans	
Risk	Mitigation
School(s) drop out prior to implementation	TASC and NYSCI will communicate project expectations to all school-community teams and establish efficient and effective communication channels between project partners and implementation staff.
Significant leadership or teacher turnover	TASC will establish relationships with school-community staff to promote continuity of staff and leadership. TASC and NYSCI will provide additional professional development to new educators/leadership.
ELL students and/or students with IEPs have unique learning challenges	Strategy 1, collaborative teaching, will provide support mechanisms to ensure that instructional content meets the unique challenges faced by ELL students and/or students with Individualized Education Programs (IEPs). Educators of students with IEPs will receive additional professional development and support.
Student attrition during the school year and from year to year.	Informal educators, trained in positive youth development, serve as role models with links to the community. They create supportive relationships with students and encourage sustained participation.

IV. DISSEMINATION MECHANISMS: TASC will disseminate work products to share information, results and lessons learned from Design2Learn. Work products include: policy briefs (3), end-of-year research reports produced by RANYCS (3) and ongoing, informal updates (e.g., blog posts, infographics) that are easy to disseminate to broader audiences. Dissemination mechanisms include conferences, educational forums and webinars (e.g., STEM Funders Network National Meeting, National Science Teachers Association, American Educational Research Association); TASC's website and TASC's blog/social media channels.

C. QUALITY OF PROJECT EVALUATION

**Please see Supplemental Information for the SF-424 for non-exempt research narrative.*

I. KEY RESEARCH QUESTIONS

RANYCS will conduct an independent evaluation of the project's implementation and impacts. The impact study will utilize a school-random assignment design aimed at meeting What Works Clearinghouse (WWC) Evidence Standards (with reservations). The impact study will examine Design2Learn's effect on critical links in the logic model discussed above by addressing three ***Key Impact Research Questions***: What is the impact of the Design2Learn on (1a) students' exposure to design-based science curricula and learning opportunities? (2a) student interest and engagement in science? (3a) student performance on the New York State 8th grade Science Assessment? The implementation study will provide necessary context for interpreting the impact findings and offer formative feedback to program operators by addressing the following ***Key Implementation Research Questions***: (1b) What are the qualifications and prior experiences of Design2Learn's collaborative teaching teams (and their counterparts in the control schools)? (2b) How much of the intervention's planning and professional development activities did teaching teams attend and how long did they participate in the program? (3b) What is the overall level of programming quality as assessed by standardized assessments for after-school programs? (4b) What are the challenges to implementing Design2Learn and to sustaining its operation at high levels of fidelity?

II. EVIDENCE STANDARDS/METHODOLOGY

The impact evaluation will use a randomized-control trial design aimed at meeting WWC Standards with reservations. Random assignment will take place at the school level and outcome measurement will occur at the student level. The analysis will be conducted with hierarchical linear models with outcomes and covariates measured at the student level and impacts estimated at the school level. TASC will recruit up to 30 schools and their partnering after-school providers to apply to be part of the project. Schools will be informed about the services and programming activities that will be provided and of the evaluation requirements. Participating schools will sign a Memorandum of Understanding indicating their commitment to the project and to the evaluation requirements, including the outcome of the random assignment process. In consultation with TASC and the NYC DOE, RANYCS will develop matched pairs of schools based on their geographic proximity to each other, their size and demographic characteristics. The goal of the matching will be to ensure appropriate geographic and demographic distribution of treatment schools in order to serve a diverse student population and to demonstrate the degree of program effectiveness across a range of settings. RANYCS will conduct random assignment for the treatment and control groups from each of pair. This will result in 15 treatment schools to receive Design2Learn support and programming and 15 control schools that will forgo participation for two years.[2]

All treatment and control schools will be expected to enroll a minimum of 20 6th grade students in their afterschool programs starting in the 2016-17 school year. Program staff will

[2] Control schools will be informed that they may be offered the opportunity to start the program in Year 3 of the project, if there are sufficient resources and only for 6th grade students.

recruit students in treatment schools to enroll in Design2Learn. Parents will be asked to give consent for their child's participation in the evaluation, including allowing the child to complete an annual survey of their interests and engagement in science and for the evaluation team to gain access to administrative data provided by the NYC DOE.

All consented students in the original 6th grade cohort will constitute the research sample for the evaluation and will remain in the sample throughout the study period, regardless of their afterschool participation status. RANYCS will attempt to collect follow-up survey data from these students as long as they remain enrolled in one of the participating treatment or control schools. It is expected that 90% of the students will remain in one of the participating schools through the end of their scheduled 7th grade year and 80% will remain through the end of their 8th grade year. RANYCS will collect administrative records data for all students in the study sample as long as they remain enrolled in a NYC public school (including Charter Schools). It is expected that administrative records will be obtained for at least 95% of the students in sample through the end of their 7th grade year and for 90% through the end of their 8th grade year. The evaluation's three-year time span will allow for the collection of follow-up data through the 2018-19 school year. This corresponds to the end of the scheduled 8th grade year for students in the initial 6th grade cohort (those entering in the 2016-17 school year).

In keeping with WWC Standards, RANYCS will test for baseline equivalence between students who initially enroll in Design2Learn in the treatment schools and students who initially enroll in the afterschool programs associated with the control schools. It is expected that some students will leave the participating treatment and control schools (and some the NYC public school system). In keeping with WWC Evidence Standards, the evaluation will test for both levels and compositional differences in attrition rates between treatment and control groups. Based on the findings, recommended adjustments will be made to the analysis models.[3]

The table presents minimum detectable effect size (MDES) estimates under different sample size configurations and assumptions about the percentage of students for whom survey and test score data can be obtained. The MDES estimates reflect possible impacts on student achievement measured with standardized achievement assessment. The highlighted cells show the MDES estimates for our target sample configuration, which includes a total of 30 schools and 20 6th grade students in each school. The table shows MDES estimates for data collection response rates of 100% and 80% (i.e. on 8th grade survey outcomes).

Minimum Detectable Effect Sizes[4]		**Response Rate**	
# of Schools	# of Students per School	100%	80%
20	20	0.35	0.38
	30	0.31	0.33
	40	0.28	0.3
30	**20**	**0.28**	**0.3**
	30	0.25	0.26
	40	0.23	0.24

The table indicates the ability to detect impacts as small as .28 standard deviations (SD) if obtaining data for all students in the sample (i.e. 6th grade attendance outcomes). Impacts as

[3] What Works Clearinghouse, Procedures and Standards Handbook (Version 2.1). http://ies.ed.gov/ncee/wwc/pdf/reference_resources/wwc_procedures_v2_1_standards_handbook.pdf

[4] MDES estimates were calculated using the Optimal Design Software (http://wtgrantfoundation.org/FocusAreas#tools-for-group-randomized-trials). Half of the schools will be randomly assigned to treatment and half to control. MDES estimates assume a significance level of 0.05, statistical power of 0.8, and intraclass correlations of .05, and that 60% of variation will be explained by covariates.

small as .30 SD can be detected if obtaining data for 80% of students (i.e. with survey or administrative records at the end of the 8th grade year). The table also illustrates MDES estimates for a smaller sample (i.e. only 20 schools and 20 students per school) and a larger sample (i.e. 30 schools and two cohorts of 20 students each). The MDES estimates range between .23-.40. Prior research on TASC afterschool interventions in NYC suggests that impacts on achievement in the .30-.40 range are feasible and suggests that impacts on student engagement are likely to be considerably larger (Policy Studies Associates and Abt Associates, 2012; Russell, Mielke, Miller, and Johnson, 2007; and Reisner, White, Russell, and Birmingham, 2004).

Impact Study Data and Measures: The impact study will include the following data elements for consented students in both the treatment and control schools drawn from RANYCS data archive constructed through its ongoing data sharing agreement with the NYC DOE:

- *Background Characteristics*: The archive includes baseline characteristics of all students in the NYC public school system (race/ethnicity, gender, age, special education status, English language learner status, and eligibility for free or reduced price lunch).
- *Science Achievement:* The archive includes Science state test scores for 8th grade students.
- *Other Outcomes.* The evaluation will also have access to a range of other outcomes included in the RANYCS data archive, including student attendance, school transfers, retention in grade, course grades, and test scores in mathematics and English language arts.

All students participating in the program and after-school participants in control schools will complete surveys at the end of each school year that ask them to reflect on their year. Student science engagement and interest will be measured via student surveys including the *Common*

Instrument and the *Test of Science Related Attitudes (TOSRA).* The *Common Instrument*, created by Harvard University's Program in Education, Afterschool & Resiliency (PEAR; Cronbach's alpha: 0.92) asks students about their engagement, career plans, and feelings towards both in- and out-of-school time science. The *TOSRA* (Fraser, 1978; Cronbach's alpha: 0.82) assesses changes in students' attitudes toward science across seven subscales: Social Implications of Science, Normality of Scientists, Attitude of Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science, and Career Interest in Science.

Implementation Study: The implementation study will explore measures of: 1) student participation in the science collaborative teaching environment; 2) the quality and intensity of professional development and programming; and 3) the integration of science programming in school and after-school contexts. Various sources of data will be used to assess implementation:

- *Enrollment and participation data* – Sites will enter student-level afterschool attendance information into an online enrollment and daily attendance platform provided by TASC an shared with RANYCS. This information is collected for all of TASC's students.
- *Annual Site Visits and Interviews with Project Staff.* RANYCS will conduct site visits to each of the Design2Learn programs during each year of the project. Data collection will include interviews with project staff and observations of program activities. Interviews will focus on challenges staff face in implementing the program and in sustaining student and teacher participation. Field researchers will use structured interview protocols and interviews will be recorded and transcribed. Interview transcripts will be coded and analyzed using the Atlas.Ti Qualitative Data Analysis and Research Software. Each site visit will also be documented

with a detailed reflection memo describing the setting, the afterschool schedule, the core program activities that were observed, science topics that were covered and examples of student engagement and student-teacher interactions.

- *Standardized Program Quality Assessments* - Observations of programs will be conducted by trained and certified observers using PEAR's Dimensions of Success (DoS) observation tool. Programs will be rated on twelve dimensions: Organization, Materials, Space Utilization, Participation, Purposeful Activities, Engagement with STEM, STEM Content Learning, Inquiry, Reflection, Relationships, Relevance, Youth Voice.

The implementation study will also include exploratory analyses of the relationship between student participation in the project (including receipt of the additional aligned science learning in the collaborative teaching environment) and academic, behavioral and attitudinal outcomes.

Evaluation Reporting: RANYCS will produce annual reports with key findings that are relevant to the key stages of the program's implementation and students' participation. These include:

- *Year 1 Report:* This report will provide a description of the school and student recruitment process, the random assignment process, and baseline equivalency checks for the students in the study sample. It will include information about the first year of implementation and rates of student attendance in afterschool programming for both treatment and control groups. The report will include results from the teacher survey regarding the nature of their collaboration and perceptions of the program and afterschool programs. Finally, the report will include impacts on student engagement and interest in science from the end-of-year survey.

- *Year2 Report:* This report will provide updates on material covered in the Year 1 report, with more emphasis on findings from analyses of impacts on student engagement and interest in science. This will include results from students in the study sample who have reached their 7th grade year.
- *Year3 Report:* This report will provide a summary of implementation findings from the full three years of program operations and present findings on student attendance in the after-school programming across those three years. It will focus on the program's impact on 8th grade science test scores and engagement with science as measured by the 8th grade survey.

III. RESOURCES/QUALIFICATIONS OF THE EVALUATOR

RANYCS has built a strong and successful track record managing large, complex research projects. To date, they have undertaken more than 20 major studies; presented findings via numerous conferences, forums and published reports; and worked to promote the use of data and evidence in decisions made at the school and district level. RANYCS's work is undergirded by several key organizational capacities that speak to their ability to successfully complete the project. These include: ***1) Genuine engagement with education stakeholders.*** RANYCS staff has relationships with educators, policymakers and community leaders citywide. They regularly participate in meetings that help them stay abreast of emerging issues in the City's schools and actively collaborate with their stakeholders through all phases of their work. ***2) Access to data and schools, and strong data security protocols*.** RANYCS has a well-established partnership with the NYC DOE, including a formal Data Use Agreement that gives them access to a wide range of data for research purposes. As part of their commitment to the wellbeing of NYC students, they take the utmost care in safeguarding their data archive and protecting students' privacy. All physical data storage is securely maintained by NYU. Any personally identifying information is held in the University's highest-security data center and is only accessible to a select group of pre-approved RANYCS staff. Data are transferred from the NYC DOE through secure FTP. These data can only be accessed from specific, secure work stations, and are never downloaded or copied. Before receiving access to data, research staff must sign a legally binding nondisclosure agreement. These and other measures allow them to fully protect student, parent, and school employee information. ***3) Robust institutional infrastructure***. RANYCS has a full-time staff of 15, including senior leadership, research associates, analysts, a data manager and support staff. This core team is augmented by fellows and interns who support data collection, analysis, and writing. As an institute within NYU, RANYCS has access to many resources that bolster their efforts, including graduate and undergraduate students to conduct analyses and fieldwork and faculty members with wide-ranging expertise. Finally, RANYCS benefits from the guidance of a Steering Committee which includes the Chancellor of NYC Schools; the heads of the two major unions representing the City's teachers and school administrators; and leaders from business, academia and community groups. The Steering Committee meets several times a year, offering an array of perspectives on key issues, as well as connection to vital networks of education stakeholders.