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PREFACE: APPROACH TO PRIORITIES

How can we improve STEM learning in the US? Starting young matters! The innovative NURTURES program teaches early elementary teachers effective science teaching strategies; it also offers families exciting STEM materials that engage families and improve community access to educational resources that support STEM learning. With a design based on the Harvard Complementary Learning Model [104], the NURTURES program focuses on K-3 grades. It includes two major components: a) teacher professional learning (PL), which is composed of a two-week Summer Institute for K-3 teachers and monthly academic-year professional learning community (PLC) meetings, and b) family engagement (composed of family science activity take-home packs and family science events hosted at school or in the community).

The proposed mid-phase replication and scale-up project, NURTURES, builds on thirteen years of teacher PL, family engagement, and community involvement to increase children's science, mathematics, and English Language Arts (ELA) achievement in grades K-3. The proposal addresses Absolute Priority 1 – Moderate Evidence and Absolute Priority 3 - Field-Initiated Innovations in STEM. It includes a minority-serving institution (MSI) Competitive Preference Priority 1 involving Georgia State University Foundation (GSU) (https://www.minorityhealth.hhs.gov/assets/PDF/2020_Minority_Serving_Institutions.pdf). The proposal comprises over 51% of schools with rural locale codes 32, 33, 41, 42, or 43. To build on promising early findings, we seek to further develop our teacher PL, adapt materials to attend to the needs of diverse underserved student populations, and *rigorously test* the NURTURES program *expansion* and *refinement* while also addressing its impact and cost-effectiveness.

A. SIGNIFICANCE

The NURTURES program is significant because it involves refining existing and developing promising new strategies that are alternatives to existing practices. These are summarized below.

NURTURES Strategy 1: Focus on STEM education in Early Grades. Despite many calls to prepare students to compete in a scientifically and technologically oriented global economy [e.g., 1, 2, 3, 7, 8, 9, 10], most reform efforts target teachers and students at middle or high school levels [4]. Limited efforts focus on early grades [5, 6]. Few early elementary classrooms offer opportunities for students to learn science [11, 12, 13, 14, 15], and elementary classes "spend an average of 17 minutes per day on science, compared to 89 minutes on reading and language arts and 55 minutes on mathematics" [16]. Science is rarely a priority in early elementary grades [12, 17, 18, 19], especially since math and reading/language arts testing begins as early as 1^{st} grade, and science is generally not tested until 5^{th} grade in most states [20, 21].

NAEP assessments (https://nces.ed.gov/statprog/handbook/naep.asp) reveal the lack of emphasis on elementary science; by 4th grade, only 35% of students scored "proficient," while 38% scored "basic," and 27% scored below "basic." Children enter kindergarten with lower science readiness scores than math or reading, and these early scores predict science learning in 8^{th} grade and beyond [22]. Children with gaps in science knowledge rarely catch up, resulting in lifelong deficits limiting children's future academic career choices [23, 24].

Early elementary students can engage in science and engineering practices [7, 25] and are motivated by and capable of engaging in sophisticated design activities [26, 27, 28, 29, 30]. Science inquiry builds vocabulary and language skills [31], accelerating problem-solving and computational thinking [6]. Early science learning impacts later grades' science achievement and career choices [32, 33, 34, 35, 36, 37, 38, 39, 40].

Significance: This proposal offers a different approach from those typically used in early grades because we focus on integrated STEM learning opportunities (Absolute Priority 3) *when most schools focus mainly on reading and mathematics in early grades.* This proposal expands our current work by replicating and rigorously testing this strategy with a new population of teachers, students, and families, which will increase knowledge about STEM in early learning.

NURTURES Strategy 2: Science-Based PL for Elementary Teachers. Elementary teachers need science content knowledge, pedagogical skills, and confidence to lead high-quality science instruction [41]. The *Next Generation Science Standards* (NGSS) [55] and similar standards call for a sophisticated understanding and integration of science and engineering practices, crosscutting concepts, and disciplinary core ideas [56, 57] that many educators need to gain [3,11, 58]. Effective PL builds teachers' content and pedagogical skills [42], increases their self-efficacy to use best practices [43], and improves the quality of science education [44]. This may compensate for a lack of science preparation in elementary teacher education training [45, 46, 47, 48, 49, 50, 51, 52, 53] and fewer science PL opportunities than for other subject areas [54].

Significance: This proposal offers a different approach because we focus on teacher PL to build early-grade teachers' content knowledge, pedagogical knowledge, and confidence to teach science (Absolute Priority 3), *an opportunity seldom provided to early-grade teachers.* This strategy builds upon our prior work and will contribute to increased knowledge regarding effective PL for teachers in early elementary grades.

NURTURES Strategy 3: Expanding our Focus on Underserved Students. The need for improved teaching in urban schools is well established [59, 60], but rural schools are especially challenged in meeting educational benchmarks for science and mathematics [61]. They are often left out of educational opportunities offered by science organizations, colleges, and corporations [63], resulting in rural teachers having more limited science backgrounds than other teachers [67]. Rural schools, like urban ones, have high numbers of minority students, English language learners, and students living in poverty [62, 63, 64]. Schools with underserved students often have financial constraints [65, 66], so providing content-specific PL is problematic due to tight budgets and limited support [66]. Given the difficult decisions facing administrators in these schools [65], support for science education in early grades is often a lower priority.

Significance: This proposal takes a different approach because we will expand from our prior demographics, which included predominately urban schools and only 15 rural schools over 13 years, to rigorously test the effectiveness of NURTURES. This will generate information about our intervention's effectiveness regarding whether, how, and for whom it is effective.

NURTURES Strategy 4: Family Engagement in Science. Many PL programs fail to include parents/caregivers. When families are included, caregivers typically "drop-off" or "stay and watch" [68] rather than actively engaging in the educative process. Involved parents and caregivers contribute to children's academic success [e.g., 69, 70, 71, 72, 73] and bring valuable experiences [74, 75]. Families that emphasize STEM [76, 77] accelerate children's interest [7, 78] and significantly increase academic skills [79]. However, some families may need extra support for equitable access to available resources [7, 81, 82, 83, 84]. As many teachers find family-school partnerships challenging [85], we foster teacher-family collaboration.

Significance: This proposal builds upon the existing NURTURES program by focusing on family and community engagement in science with new populations, and it generates knowledge about family and community engagement. Importantly, our program builds family competencies for STEM learning since it is designed to teach families how to engage in inquiry learning. This is *innovative* because most PL programs do not include parent engagement and education.

NURTURES Strategy 5: Using Science to Improve Achievement Across Subjects. Teaching science to young children results in greater levels of achievement in literacy and mathematics [e.g., 86, 87, 88, 89, 90]. Science teaching aligned with *A Framework for K-12 Education* [3] and *NGSS* [55] makes connections between science, mathematics, and ELA practices and provides systematic ways of understanding and representing the concrete world [92] and clarifying overlapping skills such as measurement, pattern recognition, data interpretation, and problem-solving [36]; it makes connections with reading (e.g., vocabulary and comprehension), writing (e.g., forming explanations, communicating information), and oral skills (e.g., asking questions, collaborative discussions, justifying findings) [86, 87, 88]. Also, with more linguistically diverse children in the United States, science learning supports language acquisition [91]; exposure to scientific terminology during inquiry aids conceptual understanding [88, 89].

Significance: This proposal builds upon the existing NURTURES work and the prior work of others (e.g., Cervetti, Romance/Vitale) by <u>*using science to improve achievement across subjects*</u>*. This contributes to knowledge about effective ways to improve science instruction in early grades and how this can concurrently improve ELA and mathematics achievement. This is particularly important since science teaching can potentially* mitigate the post-COVID steep learning losses reported for reading and mathematics on recent NAEP tests [118].

Previous Findings. The NURTURES program significantly improves student achievement in science, mathematics, and reading; offers lasting impacts that continue through middle grades; and closes achievement gaps between non-minority and minority students in reading and mathematics. A thirteen-year line of research demonstrated *moderate* evidence of effectiveness based on the *What Works Clearinghouse* evidence standards (<u>Absolute Priority 1</u>). NURTURES has served 715 teachers and 5561 high-needs students, mostly urban low-income, including 2487 African American, Hispanic, and mixed-race students and their family members. The program was recognized as an outstanding research-based professional development program with the 2017 Christa McAuliffe Award for Excellence from the American Association of State Colleges and Universities member institutions and was cited in the NSF-sponsored CADRE PreK-3 STEM report [93]. Initially funded by two National Science Foundation grants and a Department of Defense (DoD) STEM program grant, NURTURES:

- produced statistically significant positive effects (with baseline equivalence) in an RCT on multiple STAR Assessments: 11.24 points on the Early Literacy spring score (effect size 0.09), 21.75 points on the Mathematics spring score (effect size 0.18), and 47.85 points on Reading spring score (effect size of 0.29) [94]. See the Evidence Form for more on these bulleted points.

- yielded statistically significant effects on students' science, reading, and mathematics scores for students who had a NURTURES-trained teacher compared to students who did not. A multiyear quasi-experimental study (with baseline equivalence established), <u>which followed students through grade 5</u> (when science testing is administered), showed students attained 5.86 more points in science, 1.55 more points in mathematics, and 2.14 more points in reading [95].
- closed achievement gaps between non-minority and minority students in reading and mathematics by over 70% [95].

B. STRATEGY TO SCALE

To scale an educational program in the US, one must address generalizability to diverse populations. Prior work led by UT focused on urban schools, but the partnership with GSU will enable us to expand to rural schools in GA (see Appendix F, where 8 of 9 partner districts have rural school buildings). Here, we address the barriers faced in the past that limited our ability to scale the program for teachers and families in both urban and rural areas.

Barriers to Scaling NURTURES

<u>*Barrier 1: There are insufficient numbers of elementary teacher educators with expertise in science*</u>. Teaching science in early grades presents barriers unique to the subject (see Significance section). Few elementary teacher educators and district-level PL providers can provide the necessary training to improve early elementary teachers' knowledge and skills in science [96, 97]. Most university science educators have expertise in high school science, need training in early childhood development, and lack experience working in grades K-3 [7, 98]. Generally, most elementary teacher educators tend to have minimal science background [99].

Strategy 1.1. Develop a Train-a-Trainer Program. We propose to develop a scenario-based facilitator training program to ensure quality instruction, standardize training methods, and test the ability to scale NURTURES with qualified school- and university-based facilitators.

Strategy 1.2. Develop a Facilitator Certification Process. Alongside the training program, we will design a certification process to ensure quality instruction and fidelity with the new facilitators and refine and standardize training methods and experiences. This process will test the ability scale NURTURES with qualified facilitators.

Strategy 1.3. Recruit Facilitators. We will recruit facilitators from our previous pool and expand this effort to recruit exemplary teachers who have excelled in the program over the last 13 years. All new facilitators will be required to pass the certification process.

Barrier 2: Children in schools are increasingly more linguistically diverse. Our prior work found that language spoken in the home must be accommodated to enable parents to be actively involved. Nearly 68 million people spoke a language other than English in the home in 2019 [100], and over 21% of all children speak different languages at home [91]. Our program has two critical components designed to engage families in science learning at home or in their community: Family Science Packs (FSP) and Community Engagement Kits. Although schools typically teach in English, without accommodating the languages spoken at home, our home and community engagement will likely be limited or ineffective. The Hispanic population is the most considerable non-English speaking in the US, so all family materials were translated into Spanish. Still, our materials must be translated into additional languages for use at home.

Strategy 2.1. Determine Additional Languages Needed. The 2020 US Census states (after English and Spanish) that Chinese, Tagalog, Vietnamese, and Arabic are the most frequently spoken languages in the US. GA's diversity index is up to 61.1% in the 2020 Census [101], necessitating a home language needs assessment; we will survey participating school districts to determine the priorities for additional languages required for our family materials.

Strategy 2.2. Translate Family Science Materials. Previously, we accomplished translation free of cost by utilizing the Foreign Language Department at our university. We also vetted the translated materials by a K-12 English-speaking teacher who teaches Spanish at her school and is heavily involved in her Hispanic community. We plan to use this same process here.

Goals of this Proposal. This proposal aims to *expand (described next), rigorously test (Evaluation Section)*, and *refine* the NURTURES program (see Barriers and Program Design).

Expansion Goal. To date, NURTURES has served both urban and rural communities. Still, the urban populations outnumbered the rural, thereby limiting conclusions that can be made about the program's ability to be widely scaled. Some of our rural teachers commented that the online PL program reduced their isolation from peers, and our materials provided valuable family connections and resources in science not typically available in rural areas. However, our quantitative data from rural populations is minimal. Thus, we propose replicating and scaling the NURTURES program by including teachers, children, and families and researching the impact of the program in GA in both rural and urban schools, enabling us to understand better the intervention's effectiveness regarding whether, how, and for whom it is effective. The program will include participants from underserved schools in GA, including a mix of high-needs students from diverse racial, ethnic, and economic backgrounds and locale. GSU, the *only* comprehensive Predominantly Black Institution (PBI) with an R1 Carnegie Research Classification in the nation, *is uniquely positioned to address complex societal problems through a lens of equity and access* (Competitive Preference Priority). See Appendix C for 106 high-needs schools within 9 districts committed to the program. The GA Superintendent's letter of support also agrees to recruit additional schools if needed. See Appendix F for school eligibility and demographics. Based on

Figure 1. Expansion Through NURTURES

NURTURES 224 Teachers 6,720 K-3 Children 26,880 Family Members

the historical number of families that attend our programming, Figure 1 depicts the estimated number of people we will reach in this proposal.

Project Management Plan. The team's previous grant-funded successes provide evidence of high-quality standards and procedures for coordination and cost monitoring.

Coordination. The team will adopt an effective, inclusive, and responsive decision-making structure. GSU and the University of Toledo (UT) will have weekly meetings to plan, modify, and implement the program activities as needed. Bi-weekly check-in meetings with WestEd will ensure district interests and conditions are being heard by project staff, confirm data collection activities are being carried out, and check that implementation efforts are occurring as planned.

Cost monitoring and control system. The project PIs will meet every other week to ensure that project activities proceed as planned, on budget, and with smooth articulation across all districts and participants. Importantly, GSU, UT, and WestEd use approval, tracking, and accounting procedures that adhere to uniform administrative requirements, cost principles, and audit requirements for federal awards.

Summary of Project Milestones, Team Responsibilities, and Timeline. Table 1 summarizes project milestones (see narrative for specific details), responsible persons (by their initials), lead person for each task (initial in bold), and timeline (color-coded by year(s) the milestones occur).

Project Management Capacity. The NURTURES program includes three competent partners (Georgia State University Foundation, The University of Toledo, and WestEd), each with a

Table 1. Summary of Project Milestones, Team Responsibilities, and Timeline

Milestones	**Person(s) Responsible**	**Schedule by Month & Year** *Key:* **Year 1** 🟢 **Annually** 🔵 **Yr. 5** 🟠											
		J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Randomly assign schools as per Evaluation Plan	**T**, R, S,	🟢											
Collect baseline data as per Evaluation Plan (*rigorous testing*)	**R**, S, L, T				🟢								
Form advisory committee & modify matl's (*expansion goal*)	**D** & C				🟢								
Refine Facilitator Training as described (*trainer barrier*)	**Wi**, Wo, C	🟢	🟢	🟢	🟢								
Develop Certification Process as described (*trainer barrier*)	**C**, K, H	🟢	🟢	🟢									
Recruit/Train/Certify Facilitators as described (*trainer barrier*)	**Wi**, Wo, C, H	🟢	🟢	🟢	🟢								
Develop & Collect Language Survey (language barrier)	**D**	🟢											
Translate family materials as described (*language barrier*)	**Wi**		🟢	🟢	🟢								
Run Institutes as described	**C**, all UT, D						🔵	🔵	🔵				
Run PLC meetings as described	**D**, all UT	🔵	🔵	🔵	🔵	🔵				🔵	🔵	🔵	🔵
Community Events as described	**Wi**			🔵								🔵	
Send Family Packs as described	**Wi**	🔵		🔵							🔵		🔵
Collect post-test data as per Evaluation Plan (*rigorous testing*)	**R**, S, T										🔵	🔵	🔵
Check FOI as per Evaluation Plan (*rigorous testing*)	**R**	🔵		🔵		🔵		🔵		🔵		🔵	
Modify based on feedback as described (*refinement goal*)	**C**, All UT	🔵		🔵		🔵		🔵		🔵		🔵	

Run cost-effectiveness as per Evaluation Plan (*rigorous testing*)	**S**, Hi	●		●		●		●		●		●	
Analyze Data as per Evaluation Plan (*rigorous testing*)	**T**, R, S, L	●	●	●	●	●	●	●	●	●	●	●	●
Prepare manuscripts & present at conferences (*dissemination*)	**D**, C, K, H, R, S	●	●	●	●	●				●	●	●	●
Offer Program to Control Group	**Wi**, Wo, C						●	●	●	●	●	●	●
Run I-Corps-type analysis & pilot (*expansion goal*)	**C**, Wi	●		●		●		●		●		●	
Key: [redacted] (D), [redacted] (C), [redacted] (H), [redacted] (K), [redacted] (M), [redacted] (Wi), [redacted] (Wo), [redacted] (Hi), [redacted] (S), [redacted] (R), & [redacted] (L), [redacted] (T)													

primary and associated secondary role. The people involved in NURTURES bring a wealth of expertise in science, literacy, PL, research, and working with families in urban and rural locations. They have solid experience collaborating with numerous partners, managing large externally funded projects, and working in complex systems (See separate CVs in Appendix B). All partners provide significant time and resources to the project (see Budget & Appendix H).

Georgia State University's primary role is fiscal management; the secondary roles are providing PL and dissemination. GSU will serve as the fiscal agent, liaison to the United States Department of Education, and oversee reporting requirements. In FY 2023, GSU faculty earned $224.72 million in research funding, placing it among the top 20 percent of universities in research expenditures for the sixth consecutive year. GSU is among 115 universities in the Carnegie Foundation's elite R1: Highest Research Activity category. For the past five years, the university has been the highest-ranked institution without an engineering, medical, or agricultural school in the NSF's Higher Education Research and Development survey, a nationally recognized barometer of university research activity and ability to manage grants.

[redacted] PI and Professor at GSU, was the co-PI of the NURTURES project funded with $3 million by the DoD, and he served as a co-PI of a large-scale National Science Foundation (NSF) grant. [redacted] will help deliver programming, coordinate staff meetings focused on project progress, and hire/train a coordinator in years 2-4 to assist with expenditures. [redacted] has experience with teacher PL design and delivery, *including working with rural schools*. Thus, [redacted] is well-positioned to serve as the PI of this proposal.

The University of Toledo's (UT) primary role is the design and delivery of the program intervention, and the secondary roles include training and certifying facilitators and project dissemination. The UT (a public research university) has the necessary infrastructure to handle the implementation, management, and fiscal reporting to GSU (as a sub-contractor). The UT faculty and staff qualifications are based on 13 successful years of experience with the NURTURES program, funded with nearly $16 million in prior NSF and DoD grants. [redacted], Senior Research Professor and former elementary teacher, will serve as the PI at UT by contributing expertise as a nationally known science educator and running large-scale federal grants (leadership, management, fiscal planning, and dissemination). She will guide all aspects of the project intervention and the UT budget. [redacted], Associate Professor, will serve as co-PI and assist with refining materials and teaching. She has a deep background in formal and informal education, working with family engagement, literacy, and children's language/reading learning in science. [redacted], a Distinguished University Professor, will assist with research initiatives, dissemination, and teaching in the program. [redacted], Professor of Engineering and Interim Vice Provost, will be a facilitator in the summer. [redacted] has 12 years of experience as Program Director. He will oversee all day-to-day aspects of the project at UT, develop and maintain content for a public website, and oversee modifications to program materials as needed. [redacted] brings expertise in science teaching, research, and statistics. He teaches in the program and assists [redacted] and the PI with day-to-day activities.

[redacted], Finance Administrator, has experience as a Senior Financial Analyst in Accounts Payable at UT. She is responsible for working with the PI, grants accounting, accounts payable, and other offices to ensure proper expenditures and accounting.

WestEd's primary role is conducting research and evaluation; its secondary role is assisting with dissemination. WestEd is a preeminent not-for-profit national leader in educational research, development, and service. From FY 2019-2023, WestEd carried out over 3,100 new contracts representing significant contributions to the nation's R&D resources, averaging over 600 new contracts annually. In FY 2024, the agency expects to operate on approximately $265 million in funding. [redacted] Ph.D., Senior Director, STEM Research and Entrepreneurship, will serve as PI for WestEd and oversee all aspects of the project to ensure obligations are met. He has led various large-scale research and development projects related to science learning and teaching. [redacted] was the PI for the *WWC* science content submission and led the development of all the NAEP STEM content assessment frameworks. [redacted] has been a PI/co-PI on multiple IES and NSF studies. She has extensive experience investigating the impact of innovative curricula at the elementary level and parent-related projects, *particularly in rural schools*. She will oversee day-to-day activities related to project implementation, including coordinating data collection and analysis. [redacted], Associate Professor in the College of Education at the [redacted], will serve as a senior methodologist and oversee data collection and analysis of program impact. [redacted], Senior Research Analyst, has extensive experience in science education, NSF & IES projects, and WestEd's development of the technology & engineering framework for NAEP. [redacted] will assist with outreach & dissemination.

Dissemination approaches will share information, materials, and research with practitioners, school districts, university educators/researchers, and policymakers. Appendix B (resumes) also attests to the strength of past dissemination efforts. ***Practitioners***. We will reach teachers by sharing results and materials on popular social media used by teachers (e.g., Pinterest), by presenting at teacher-oriented conferences (e.g., Georgia Association of Science Teachers and NSTA), and publishing in practitioner-oriented journals (e.g., *Educational Leadership* and NSTA's *Science and Children*). The project website will provide free access to materials (e.g., lessons, sample FSP sheets, sample Event Guides, and training materials). ***Other School Districts***. Materials and research will be shared with other school districts through K-12 practitioner conferences such as the Council of Great City Schools, School Superintendents Association, Association for Supervision and Curriculum Development, National Association of State Boards of Education, ASCD Conference on Educational Leadership, and Georgia Association of Science Teachers. ***University Educators/Researchers***. We will submit manuscripts to national research-oriented journals (e.g., *Journal of Research in Science Teaching, Journal of Science Teacher Education, Journal of Research in Childhood Education*). The project results will be presented at research conferences (e.g., the National Association for Research in Science Teaching and the Association for Science Teacher Education). The project website will also post research findings. ***Policymakers***. We will write a white paper/policy brief with early-grade recommendations for science and distribute it widely to education leaders and policymakers. We will promote our research through WestEd's digital channels, such as WestEd.org, which reaches tens of thousands monthly readers, including teachers, teacher educators, administrators, and policymakers.

Likely Utility of Products Being Used Effectively in a Variety of Settings. NURTURES has excellent potential for the materials developed to be used in various other settings, and we have some evidence that this is already taking place. Since our first NSF grant 13 years ago, Toledo Public Schools has continued to use NURTURES materials.

suggest a growing interest in purchasing NURTURES programming and materials. Several military-connected districts in Washington, New Mexico, and Virginia seek to replicate NURTURES on a broader scale. Districts sent instructional leaders to the program, signaling their intent to explore more widespread implementation. We also had inquiries from home-school parents and a local science center in Toledo regarding access to our materials.

Schools spend $18 billion annually on teacher professional development [102, 103], and NURTURES provides *a cost-effective way for districts to provide professional development that simultaneously targets science, mathematics, and ELA*. At the culmination of our recent DoD funding cycle, a survey sent to teachers and administrators revealed most teachers were interested in purchasing the family engagement materials (indicating they had funding provided by the principal or a parent/teacher organization). Administrators were interested in investing in the PL for their teachers and engagement materials for their families. We are uniquely positioned to explore the continued distribution of materials since [redacted] and [redacted] participated in a National Science Foundation and an Ohio State University I-Corps program that helps researchers translate products into viable businesses.

Stages to Scaling. We will implement this 5-year replication and scaling plan in three stages:

Stage One, Start-up year 1 (2025): WestEd will prepare the randomized control group design by securing Memorandums of Agreements from committed schools (Appendix C), assigning treatment and control groups, and obtaining IRB approval.

A train-a-trainer model will be used to increase the number of facilitators. This will be accomplished by fully developing and testing an online *Facilitator Training Program* initially piloted in a DoD-funded grant with three university faculty. The online training program includes a key-concept knowledge base, engagement prompts, and annotated video excerpts demonstrating high-quality facilitator pedagogical examples. Our new efforts will advance and refine this training by obtaining input from past participants and during implementing the *Facilitator Training Program* with school-based personnel.

A scenario-based *certification process* will be developed to standardize training methods and experiences and ensure quality of instruction and fidelity with the new facilitators. Certification will be designed to evaluate skill and competency on the seven conceptual elements common to all NURTURES materials (see Conceptual Framework).

Before the 1st treatment year, GSU (as a Minority Serving Institution that works with underserved populations - Competitive Preference Priority) will form an *advisory committee* composed of representative teachers, principals, parents, and a representative from the GA *Rural Education and Innovation* office to suggest revisions, if needed, to the NURTURES materials [118]. With our previous inclusion of mostly urban schools, we anticipate making program changes; for example, we may need to modify the Community Events to accommodate long distances people would need to travel in rural areas. We might also need to make accommodations for potential broadband issues while the state of GA implements its *Rural Education Initiative (https://www.gadoe.org/rural/Pages/default.aspx).* As noted earlier (Strategy 2 to reduce barriers to scaling), a survey will determine language translation needs for our family components, and we will translate materials.

Stage Two, Treatment Years 2-4: Table 2 summarizes the treatment schedule.

Table 2. Treatment Schedule

Year & Term	**Grade Level Teachers Included**
Year 2: Summer 2025 – Spring 2026	K & 3rd grade
Year 3: Summer 2026 – Spring 2027	1st & 3rd grade
Year 4: Summer 2027 – Spring 2028	2nd and 3rd grade

Stage Three, Follow-up Year 5 (2029): WestEd will analyze all data outlined in the Evaluation section (*testing goal*), determine the program's cost-effectiveness, and work with the project team to disseminate program findings. Importantly, we will allow selected control group teachers from years 2-4 the opportunity to participate in the program during summer and fall 2028.

Determine Cost Effectiveness. Because our program is unique with the inclusion of family engagement components, there are some added costs compared to other teacher PL programs; family engagement makes it 12% more expensive than our PL alone. We will *explore ways to lower costs* and *conduct a cost-effectiveness study*. [redacted], finance administrator at UT, has the expertise to analyze our purchasing history and suggest ways to reduce costs. For example, we might have supplies shipped directly to schools/teachers (e.g., using the university Amazon business account) and put printed materials online. WestEd will conduct a cost-effectiveness study using the resource cost model (RCM) [110]. We will populate the RCM with the CostOut tool and generate cost-effectiveness estimates based on the cost estimates and results from the impact analyses (using both personnel and non-personnel resources in this analysis).

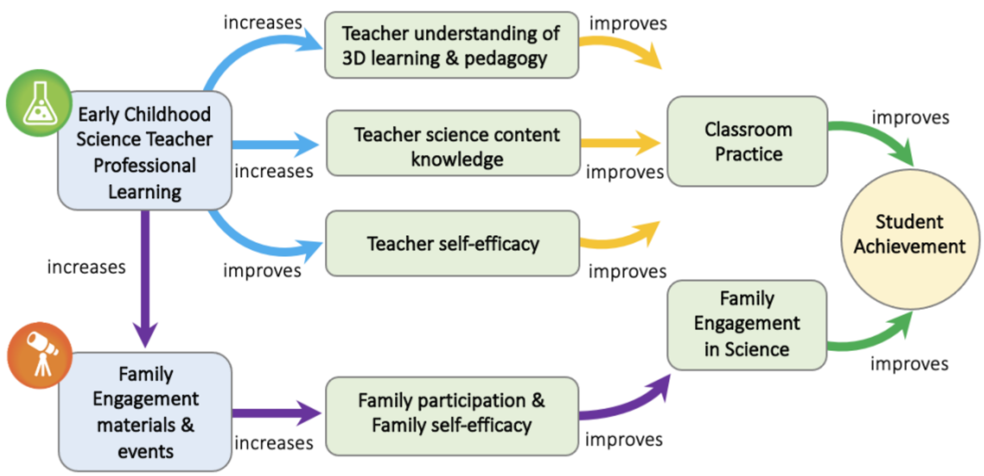
C. PROJECT DESIGN

Here, we describe the NURTURES program and conceptual framework, present program outcomes and measures, and discuss how we will address the needs of the target population.

Conceptual Framework. The NURTURES program (both in-school classroom teaching and out-of-school family engagement components) is designed with *seven common conceptual elements*: 1) exploring interesting scientific phenomenon; 2) eliciting students' ideas; 3) engaging in high-quality discourse; 4) making students' thinking visible; 5) helping children make meaningful connections to their lived experiences; 6) making connections among science, mathematics, and reading; and 7) using three-dimensional (3D[1]) learning and assessment techniques. These conceptual elements are supported by research on effective science teaching and learning [e.g., 3, 7, 105] and family engagement [e.g., 68, 76].

Theory of Change. The *Theory of Change* is depicted in Figure 2, and the *Logic Model* is in Appendix G. The *Logic Model* clarifies that improved student achievement includes 1) improved 3D science learning, 2) improved mathematics learning outcomes, and 3) improved ELA learning outcomes (all measured by Galileo standardized tests; see Evaluation Section).

Figure 2. Theory of Change



Measurement of Outcomes. The *Logic Model* in Appendix G outlines the program resources, activities, outputs, and short-term, mid-term, and long-term outcomes. We first describe the NURTURES PL, Family Engagement, and Student Learning. Next, we summarize the anticipated outcomes for these components and the measurement of those outcomes. The Evaluation Section provides detailed information about the measures. *Importantly, all outcomes will compare*

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[1] NOTE: The term 3D in *A Framework for K-12 Science Education* [3] & the *Next Generation Science Standards* [55] refers to combining 'Science & Engineering Practices,' which include mathematics (e.g., analyzing data, computational thinking) and ELA-related competencies (e.g., reading, constructing explanations, communicating information), 'Disciplinary Core Ideas', & 'Crosscutting Concepts.' In this proposal, 3D science & science teaching refers to using the *Framework & NGSS* to teach science by *integrating* mathematics and ELA-related practices.

baseline data, which will be collected in year 1, to post-intervention data to determine the significance of NURTURES's impacts on participants.

Description of the NURTURES PL. The teacher PL has two primary components: a Summer Institute and academic year PLCs, which focus on the common conceptual elements described above. *Summer Institute.* The 2-week Institute is delivered through synchronous (live videoconferencing) and asynchronous (structured online content) methods. *Inquiry immersion sessions* focus on teaching science content through inquiry science lessons. During these sessions, the K-3 teachers are grouped into grade bands (K-1 and 2-3) so the science content is contextualized to the grades they teach and model science inquiry experiences we promote in K-3 classrooms. *Metacognitive sessions* help teachers explore their thinking about teaching and learning. They address topics appropriate for all teachers (e.g., strengthening family engagement, supporting productive classroom discourse, and teaching the three dimensions (3D) of the NGSS or similarly aligned GA standards). During the *unit planning sessions*, teachers work collaboratively with guidance and feedback from facilitators to develop lessons for the academic year that can be used with their school's adopted curriculum. By the end of the Summer Institute, they have a complete science unit to teach, which can be shared with peers.

Professional Learning Communities (PLCs). During the academic year, classroom teachers participate in monthly PLCs, where we provide multiple scheduling options to accommodate teacher's schedules. Topics build on earlier ideas or focus on the teacher's interests or needs (e.g., classroom management, assessment). Using a process adapted from Pianta's "My Teaching Partner" [106, 107, 108], teachers begin by collaborating with peers and facilitators to refine their lessons developed during the summer. Next, teachers teach their lessons in their classroom and gather video excerpts to share and discuss in the PLCs- a process that deepens teacher reflection about their teaching and children's learning. This process ends with submitting a final set of tested lessons based on applied experiences and shared insights.

PL Outcomes and Measurement of Outcomes. There are five anticipated outcomes and associated measures for the teacher PL. **Outcome 1.1** Increased ability to understand NGSS (3D learning); **Measurement of 1.1** SCIIENCE instrument. **Outcome 1.2** Increased ability to integrate NGSS (3D learning); **Measurement of 1.2** Lesson Plan rubric. **Outcome 2.1** Increased Content Knowledge; **Measurement of 2.1**. AIM instrument. **Outcome 3.1** Improved family engagement; **Measurement of 3.1** Family Engagement Survey. **Outcome 4.1** Improved teacher self-efficacy; **Measurement of 4.1** Teacher Sense of Efficacy instrument. **Outcome 5.1** Increased use of effective science pedagogy; **Measurement of 5.1** SCIIENCE tool. **Outcome 5.2** Increased pedagogical knowledge; **Measurement of 5.2** EQUIP rubric. **Outcome 5.3** Increased time teaching science; **Measurement of 5.3** teacher survey.

Description of the NURTURES Family Engagement Components. There are two family engagement components, *which focus on the common conceptual elements described earlier*. *Family Science Packs* (FSP). FSPs designed for each grade level (K, 1st, 2nd, and 3rd) are mailed to schools and sent home quarterly by teachers to foster home-school science connections and encourage family science inquiry. Each FSP is in a drawstring backpack containing activities aligned with standards [55], which families can keep. Each FSP is self-guided and includes a newsletter with directions, materials, and a *Journal Sheet* for children to record data or visually represent understanding. The FSPs are designed to be educative for parents/caregivers, with built-in, research-based prompts for using higher-level questions, wait-time, talk moves, and suggestions for seeking additional resources. Students return the *Journal Sheets* for follow-up lessons linking family experiences to classroom learning. Importantly, we found that English-speaking families, regardless of race, socioeconomic status, or education, could complete the FSP at home [109 and cited by the National Academy of Science 7]

Community Events. Community events (four per year) give families free-of-charge opportunities to engage in informal science activities. The events are designed for urban and rural locations and different age groups, providing various options depending on the school location, culture, or community resources (e.g., a farm, park, zoo, or public library). Different activities (e.g., engineering challenges, simulations, observations) are designed to foster adult-child interaction around various topics. Each activity is scaffolded by an *Event Guide* for parents/caregivers to facilitate children's experiences, and roles are given to adults and children (e.g., adult "navigators" and child "science investigators"). The *Event Guides* include step-by-step directions for adults (e.g., suggestions for questions, vocabulary, and spaces to record children's findings). These novel design features help adults *learn how to support* their children's science learning. Materials for the events are shipped as kits to schools with all materials, *Event Guides*, and set-up directions needed to host them. Classroom teachers host the events at convenient locations and times to optimize family turnout (e.g., during already scheduled open houses). We found that this teacher-led process results in high turnout with multiple family members attending regardless of socioeconomic status or urban/rural locale.

Family Engagement Objective, Outcomes, and Measurement of Outcomes. There are three anticipated outcomes and associated measures for family engagement. **Outcome 6.0** Improved family communication through written documentation such as graphic organizers, illustrations, models, and journal entries**; Measurement of 6.0** FUSE rubric. **Outcome 6.1** Improved quantity and quality of family STEM discussions; **Measurement of 6.1** FUSE rubric and Teacher Family Engagement Survey. **Outcome 6.2** Increased family and children's use of scientific vocabulary; **Measurement of 6.2** FUSE rubric. **Outcome 7.0** Increased parent/caregiver self-efficacy; **Measurement of 7.0** Teacher Family Engagement Survey. **Outcome 8.0** Families seek out additional STEM learning opportunities and resources independently; **Measurement of**

8.0 Teacher Family Engagement Survey.

Objective, Outcomes, and Measurement of Outcomes for Student Learning. The expected outcomes of the NURTURES program on student learning are **Outcome 9.0** Increased science, mathematics, and ELA achievement; **Measurement of 9.0** Both *Galileo* and state test scores in mathematics and ELA, *Galileo* scores in science.

Successfully Addressing the Needs of the Target Population. The 2023 Georgia Milestones assessment results for 5th-grade science highlight ongoing challenges in rural schools, where students exhibit lower proficiency rates than those in urban and suburban areas. Similar challenges are seen for mathematics and ELA, particularly after the COVID-19 pandemic [80, 118]. This disparity is primarily attributed to the shortage of specialized science teachers in rural regions, adversely affecting science education quality [119]. Contributing to these educational difficulties are broader socioeconomic issues: 39.7% of GA's population resides in rural areas, with 19.4% living in poverty, compared to 13.2% in urban settings. One in four children in rural GA lives in poverty, complicating efforts to attract and retain quality rural educators [120, 121].

Our proposal addresses the needs of the targeted GA schools by improving science achievement (and mathematics and ELA), training more rural teachers to effectively teach science in early grades (before it is too late to start in 5^{th} grade), and providing materials free-of-cost to the rural schools and families living in poverty. Ninety-two languages are spoken in students' homes in GA schools [122]; we meet these needs by translating at-home materials for families that don't speak English. Lastly, we meet the needs of rural teachers by connecting them with peers in online PL, which addresses geographic distances and isolation in rural schools.

D. PROJECT EVALUATION

Toward meeting WWC standards without reservations, WestEd will lead an independent evaluation of the NURTURES program, including a rigorous impact study *designed to meet What*

Works Clearinghouse (WWC) standards without reservations, an implementation study, and a cost analysis. To estimate program impacts, WestEd will use a multisite (blocked) cluster randomized trial (MSCRT) that compares grades K-3 teacher and student outcomes from NURTURES schools to those of the Business-as-Usual (BaU) control group of schools. The evaluation will involve approximately 6,360 students in 106 schools and 9 districts. We will assign schools randomly so that each school will have a 50% probability of being assigned to treatment. Within the 9 district blocks, we expect approximately half of the sample (3180 students in 53 schools) to be assigned to treatment and control conditions, respectively. The implementation study will investigate how NURTURES is implemented relative to a consistent set of standards for intended NURTURES implementation and *will provide valuable and timely formative information to support program improvement and replication*. The cost-effectiveness analysis will provide critical insights into the investment of resources required for high-fidelity implementation (FOI) of NURTURES and the association between program cost and program impact on student and teacher outcomes. The evaluation will measure all *key program components, mediators, and outcomes*.

The impact evaluation will address the research questions (RQ) in Table 3 below. RQ 1 regarding the effect of NURTURES on students' science achievement is considered *confirmatory*. Effects on mathematics and ELA achievement are considered *exploratory* as those outcomes are less aligned with the program's theory of change, and there is less prior effectiveness evidence for the teacher and family outcomes.

Evaluation Produces Evidence That Meets WWC Standards. Table 3 summarizes the research questions, program *outcomes*, and associated data sources for the impact study. The research questions include the *meditating* and *moderating* effects to be studied.

WestEd will randomly assign one cohort of 106 schools within 9 district blocks to receive treatment from Summer 2025 through Spring 2028 (grant years 2 through 4) or to continue with

Table 3. Outcome Evaluation Research Questions, Program Outcomes, and Data Sources

Research Questions	Outcomes	Data Sources
Student Outcomes		
1. What is the effect of the NURTURES program on the science, mathematics, and English/language arts achievement of 3rd grade students? (exploratory main effects for mathematics and ELA, **confirmatory** main effects for science)	* Increased science, mathematics, & ELA achievement	* *Galileo* Assessments in science, mathematics & ELA [111] * Student-level math and ELA test scores from the state (GA Milestones Assessments)
2. To what extent does the effect of the NURTURES program on 3rd grade student achievement, differ by student (e.g., race, sex at birth), teacher/classroom, or school characteristics? (exploratory moderating/differential effects)	* Equitable program effects in science, mathematics, & ELA achievement	* Student-level state math & ELA test scores from district administrative records * *Galileo* Assessments in science, mathematics & ELA
3. To what extent is the impact of NURTURES on 3rd grade student achievement mediated by short and mid-term teacher outcomes such as: understanding of 3D learning & pedagogy, classroom practice (including pedagogical knowledge, content knowledge, use of family engagement strategies, and self-efficacy? (exploratory mediating effects)	* Increased science, mathematics, & ELA achievement * Increased teacher outcomes as listed in research question	* Student-level state math & ELA test scores from state records * *Galileo* Assessments in science, mathematics & ELA * *SCIIENCE*; *AIM*; *Teacher Sense of Efficacy; EQUIP rubric*
4. To what extent is the impact of NURTURES on 3rd grade student achievement mediated by school-level aggregates of short and mid-term	* Increased science, math, & ELA achievement	* Student-level state math & ELA test scores from state records

outcomes such as: family communication and interactions around STEM, family uptake of supplementary STEM learning opportunities/resources, family use of scientific vocabulary? (exploratory mediating effects)	* Increased family communication, use of supplementary materials, & vocabulary use around STEM	* *Galileo* Assessments in science, mathematics & ELA * *Teacher Family Engagement Survey* results aggregated to school level
Teacher Outcomes		
5. What is the effect of the NURTURES program on teachers' understanding of 3D learning & pedagogy, classroom practice, content knowledge, knowledge of family engagement strategies, and self-efficacy? (exploratory main effects)	* Increased teacher outcomes as listed in the research question	* *SCIIENCE*; *AIM*; *Teacher Sense of Efficacy*; *Teacher Family Engagement Survey; EQUIP rubric; Lesson Plan Rubric*
6. To what extent does the effect of the NURTURES program on teacher outcomes differ by teacher demographics, experience, and academic preparation? (exploratory moderating/differential effects)?	* Equitable program effects on teacher outcomes	* Teacher demographic and experience survey (intake form) * *SCIIENCE*; *AIM*; *Teacher Sense of Efficacy*; *Teacher Family Engagement Survey*
Parent/Family Outcomes		
7. What is the effect of the NURTURES program on family communication & interactions around STEM, family uptake of supplemental STEM learning opportunities/resources, quantity/quality of STEM discussions, & use of scientific vocabulary (exploratory main effects)?	* Increased family communication, use of supplementary materials, & vocabulary use around STEM	* *Teacher Family Engagement Survey* results aggregated to school level **FUSE* rubric
8. To what extent does the impact of NURTURES on family/parent outcomes differ by school-level aggregate student	* Equitable program effects on	* *Teacher Family Engagement Survey* results aggregated to school level

characteristics (e.g., percent free/reduced lunch, percent minority) (exploratory moderating/differential effects)?	parent/family outcomes	

the existing "business-as-usual" (BaU) PL for teachers and existing science, math, and ELA student programs. For the primary **confirmatory** impact question, WestEd will compare *Galileo* science scores of 3rd-grade students who received instruction from a NURTURES teacher for three years (grades 1-3) to those of control students who received no NURTURES-informed instruction. *Galileo* was selected because it measures science learning in grades 1-3 (where few states test for science), includes math and ELA tests, and has strong psychometric [111] properties. See Table 4.

Table 4. Experimental Cohort: Testing Years for *Galileo* Science Assessments

Academic Year	Grade: K	Grade: 1	Grade: 2	Grade: 3
2025-26	y	X (baseline)	y	y
2026-27	y	y	X	y
2027-28	y	y	y	X (outcome)

Note: X=experimental cohort (n~6,360 students, total). y=treated students not in impact study.

This study design is optimal because the school-level assignment to treatment limits treatment contamination while allowing for within-school collaboration during implementation and for the experimental cohort of students to receive instruction from a NURTURES teacher for all grades K-3. Further, random assignment within districts balances district effects across treatment (i.e., NURTURES) and control conditions.

Student and teacher outcomes will be analyzed separately using multilevel (two-level) regression-based methods with students or teachers nested within schools. The analytic models include a binary variable at the school level to indicate school participation in NURTURES (i.e., treatment); the coefficient for this treatment variable will be our estimate of program impacts. Tests of moderation will involve additional multilevel analyses that estimate interaction effects (same level or cross-level) between the treatment indicator and relevant demographic or developmental characteristics for students or teachers.

Across the study schools, teachers and 3rd grade students are expected to contribute data to the confirmatory impact evaluation on 3rd grade science achievement (3rd grade students who have had a NURTURES teacher in 1st, 2nd, and 3rd grade). WestEd expects low school-level attrition, a major threat to internal validity in a school-level MSCRT because participating schools/districts have provided letters committing them to full participation in the study.

WestEd will identify ~ 120 schools for the study, aiming to retain 90% (106) after attrition. Power analyses suggest that the impact analysis will be sensitive, having adequate statistical power to detect an effect size as small as 0.12 standard deviations for the confirmatory science outcome. See details of the impact analyses and multilevel model specifications in Appendix J.

Valid and Reliable Performance Data on Relevant Outcomes. The rigorous evaluation design will be bolstered by objective and reliable outcome measures that capture the key constructs in the logic model (See Appendix G). For RQ 1, the impact study will include a *confirmatory* test of impact on **science achievement**, as measured by the *Galileo* science assessment [111]. *Georgia does not have a third-grade state assessment in science.* Thus, for the experimental cohort of students who get the full 3-year dosage of NURTURES programming, *Galileo* science assessments will be administered early in first grade (i.e., the 2025-26 school year) before the NURTURES intervention, and those scores will serve as a baseline for the third grade *Galileo* science scores, which will be collected at the end of the 2027–28 school year (see Table 4). The *Galileo* assessments have strong reliability for assessing achievement aligned with current science, ELA, and math standards [111]. The mean marginal reliability estimates of the benchmark assessments is 0.88 [112]. A similar approach will be taken for our *exploratory* tests of impact on ELA and Math outcomes, using both *Galileo* assessments and GA state test scores.

The impact study includes *exploratory* tests of teacher outcomes using the measures: a) understanding of 3D learning & pedagogy, b) classroom practice/lessons, c) content knowledge, d) knowledge of family engagement strategies, and e) self-efficacy (RQ 5), with all except for knowledge of family engagement (a new construct) measured with instruments with strong reliability evidence in prior administrations. Knowledge of 3D learning & pedagogy will be measured with a study-specific survey previously used by the research team. Classroom practice will be measured with SCIIENCE [113] that has shown strong interrater reliability ($k = .89$). Content knowledge will be measured with AIM [52] ($\alpha = .87$). Knowledge of family engagement strategies will be measured with a survey, to be developed by the WestEd team. Teacher self-efficacy will be measured with a Teacher Sense of Efficacy Scale [114] ($\alpha = 0.77$).

Finally, the impact study includes *exploratory* tests of parent and family outcomes using the measures: a) family communication and interactions around STEM, b) family uptake of supplemental STEM learning opportunities/resources, c) quantity/quality of family STEM discussions, and d) family use of scientific vocabulary (RQ 7). As these are all nascent, study-specific outcomes will be measured with a study-specific survey, developed and validated by the WestEd research team and administered through each participating study teacher.

Once exploratory impact analyses are estimated for teacher understanding of 3D learning & pedagogy, classroom practice, pedagogical knowledge, content knowledge, use of family engagement strategies, and self-efficacy, as well as family communication and interactions around STEM, family uptake of supplementary STEM learning opportunities/resources, and family use of scientific vocabulary, a statistical mediation analysis will be conducted that assesses the mediational role that these variables might play in the effect of NURTURES on student outcomes. We will use a multilevel "causal steps" approach suggested by Pituch [123].

Performance Feedback and Periodic Assessment of Progress. The formative evaluation will examine fidelity and quality of implementation throughout the project using a descriptive design. Some of the data collected annually (Teacher Family Engagement Survey, SCIIENCE, AIM, Teacher Sense of Efficacy Scale) will inform the *formative* and *summative* evaluation. Other data described below (e.g., PL observations and videos of lessons) will be collected and analyzed annually to specifically inform the formative evaluation.

FOI refers to the extent to which implementation adheres to a defined program model and is critical to interpreting outcome and impact results. Five key formative questions are: 1) What is the fidelity of instruction across sites and by different facilitators? 2) To what extent do teachers report that the use of the NURTURES program is feasible and useful? 3) What are teachers' overall level of FOI of instructional practices associated with the PL? 4) To what extent was there variation in implementation across classrooms and schools; what factors contribute to this variation? 5) To what extent are FSP and Community Events being used as designed?

To address the questions described above, WestEd researchers will use (1) observations over years 2-4 of a strategic sample of PL opportunities conducted by different facilitators to look at consistencies and variations across sites, (2) annual teacher and facilitator surveys regarding the delivery of PL and PLCs, (3) short, online logs where treatment teachers document time and teaching of NURTURES-developed lessons/units, (4) pre/post teacher instructional videos using SWIVL cameras (10 teachers throughout the study, a stratified random sample to limit costs). Pre-videos will be collected before the first SI, and post-videos will be collected from the same teachers in years 2-4. Videos will be analyzed by the WestEd team using the (5) annual in-person pre/post observations of a random sample of treatment teachers (10%) to document lesson implementation and (6) teacher interviews with 10% of treatment teachers chosen at random.

A crucial part of the formative evaluation will assess the extent to which treatment teachers' lessons align with 3D teaching and the elements of instruction presented in NURTURES PL. Videotaped and observed lessons will be analyzed annually using the Electronic Quality of Inquiry Protocol (EQUIP) to examine instruction, curriculum, assessment, and discourse, and feedback will be provided to program staff and used to modify the PL if warranted. This tool has evidence of content and construct validity [115]. Elements of the EQUIP also document teacher content knowledge and student inquiry practices. There is a strong positive relationship between proficient scores on the EQUIP and student achievement [115]. Before scoring lessons, researchers will be trained to use the rubric and continue calibration work until inter-rater reliability on independent ratings exceeds 0.70.

To measure family engagement FOI, WestEd will develop a *Teacher Family Engagement Survey* to be given to all treatment teachers annually in years 2-4; the survey will assess teachers' perceptions about the impact of the FSP and Community Events on engagement, discourse, and self-efficacy. To investigate the extent to which families are using the FSP as designed, we will annually analyze a random sample of 50 NURTURES *Journal Sheets* (completed by families and returned to teachers), using the *Family Understanding of Science and Engagement* (FUSE) rubric [116], which assesses students' scientific understanding and use of science vocabulary. We will also observe a strategic sample of community events at treatment schools.

WestEd will develop implementation rubrics for the five formative questions described above by identifying specific implementation indicators and associated *thresholds* for program delivery, activities, and participation aligned to the primary features of the logic model. For example, a *threshold* for participation could be 75% of participating teachers attend 75% of all PL events. WestEd will code and analyze data from the data sources described above to determine whether expected *thresholds* for adequate implementation are met for the implementation indicators. The analyses will aggregate indicators across participants to produce frequency estimates of overall core program activity implementation and examine implementation variations across schools. This method will provide a quantitative and replicable assessment of the extent to which program features were implemented as expected.

WestEd will share feedback assessing progress toward achieving intended outcomes through bi-weekly check-in meetings with the NURTURES team and interim presentations two times annually in years 2-4. NURTURES will use these formative findings to make iterative improvements to the program as discussed in the Project Management Plan. Impact study findings and the final evaluation report will inform the NURTURES team about how NURTURES meets its intended parent/family, teacher, and student outcomes, with qualitative interview and survey data supplementing outcome evaluation findings.

Implementation and Evaluation of Project to Guide Replication. The evaluation will inform development and *generate guidance for future scaling and replication in other settings* through its formative and outcome evaluations. WestEd will use four strategies to ensure replication of the program and research: (a) document NURTURES implementation, including key components and adaptations, as part of the formative evaluation, (b) explore whether the program impact differs across the 9 distinct blocks; these results will indicate whether the program needs refinement to better support participants and their students in specific settings and provide insights to inform later scaling efforts, (c) pre-register the NURTURES impact study in the Registry of Efficacy and Effectiveness Studies, including research and analysis activities and sample information, and update the registry if changes occur, (d) publicly disseminate formative and evaluation data.