Learning to Lead in Math (LTL-Math) Project
Submitted by the University of Illinois at Chicago (UIC)

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APPENDICES

A. Significance

The University of Illinois at Chicago (UIC), in partnership with the South Cook Intermediate Service Center (ISC; acts as Regional Office of Education providing support to districts), and evaluator WestEd, is seeking Early Phase EIR funding to develop and field test the Learning to Lead in Math (LTL-Math) program. This proposal addresses **Absolute Priority #1** (Demonstrates Rationale) and **Absolute Priority #3** (Promoting Access in STEM). This proposal is submitted by a qualified Minority Serving Institution (UIC, n.d.), addressing **Competitive Preference Priority #1** (Appendix K) and **Competitive Preference Priority 2** (Addressing the Impact of COVID-19).

The LTL-Math program proposes to implement a promising strategy with national significance that will build on evidence-based models that have met WWC standards and led to improved principal and teacher effectiveness (Bradshaw et al., 2018; Master et al., 2022; Schoen et al., 2018), and will lead to improved math student outcomes, particularly for high-need students. The program's main innovation is the use of a **multi-level job-embedded professional development system** with three learning components: (1) professional development for principals to strength the school's system that supports teacher learning; (2) professional development for teacher leaders to develop and facilitate teacher team meetings as sites for continuous, job-embedded teacher learning; and (3) group coaching sessions for both principals and teacher leaders to strengthen distributed leadership practices through joint and role-specific organizational development and instructional improvement activities. Together, these components will support principals and teacher leaders in employing a distributed leadership approach for strengthening schools that cultivate teacher learning and instructional improvement leading to increases in students' math learning.

A.1 LTL-Math Meets Competitive Priority #2 (Addressing the Impact of COVID-19)

LTL-Math is strategically designed to address the impact of COVID-19. The most recent NAEP administration reveals that only 36% of 4th graders were proficient in math, with 15% of Black and 22% of Hispanic students reaching proficiency (NCES, 2023). South Cook County schools starkly reflect this pattern. Recent proficiency rates for high-needs students on the Illinois Assessment of Readiness (IAR) have decreased by as much as 50%, with only one in ten (on average) passing. Despite such needs, math teacher turnover rates are almost 70% greater in Title I schools than non-Title I schools, and 70% higher for teachers in schools with the largest concentrations of high-needs students. Given the impending budget shortfall with the expiration of federal ESSER funds (Goldhaber & Falken, 2024), these conditions are likely to continue unimpeded. LTL-Math will address this crisis by providing an innovative and evidence-based strategy that includes professional development and coaching for principals and teacher leaders to strengthen the organizational and instructional conditions and structures within schools that will support and sustain effective math teaching schoolwide and improve student math outcomes.

A.2 Significance of the Problem

Improving math teaching and learning within schools involves particular challenges. Elementary teachers' math content knowledge is often limited (Hill et al., 2008), a problem that is more pronounced with the adoption of the Common Core State Standards in Math that brings increased expectations for understanding content (National Governors Association Center For Best Practices and Council of Chief State School Officers, 2010). Elementary math teachers also have less confidence in teaching math, and often engage in less collaboration or help seeking related to math (Conference Board of Mathematical Sciences, 2012; Spillane et al., 2013). When teachers do collaborate around math, those interactions tend to be superficial and infrequent

(Spillane & Hopkins, 2013). Taken collectively, these issues highlight the challenges that need to be effectively combated to improve math teaching and student learning at scale.

Although there is widespread understanding of effective teacher professional development experiences (Desimone, 2009), creating and sustaining this constellation of conditions within the context of schools to promote schoolwide improvement of teaching and learning, has proven to be a challenge (NCTM, 2014). Leadership development is critical to the cultivation of such conditions in schools. Studies show the role that principals can play in supporting teacher learning in schools (Grissom et al., 2021), including teacher professional learning communities (Buttram & Farley-Ripple, 2016) and other school-based collaborative settings like grade-level teacher teams ([redacted], 2011). Distributed forms of leadership, where principals and teacher leaders share in various leadership efforts, can also influence a school's learning organization for teachers ([redacted], 2011; DeMatthews, 2014). Their contributions come from joint activities, where principals and teacher leaders work together toward shared goals, and as well as from more role-specific leadership activities ([redacted], 2011). There is a pressing need to develop and test interventions that will generate and sustain the kinds of leadership and organizational capacities within schools that will cultivate and support teacher learning. Without such efforts, widespread improvement of math teaching and learning is likely to remain elusive.

The key to addressing the math achievement crisis and cultivating the necessary teacher learning conditions in schools is developing and testing a **multi-level job-embedded professional development system** that supports principals and teacher leaders in developing organizational capacities that support teacher learning, strengthens instruction, and produces positive student math outcomes. UIC is uniquely positioned to succeed in this endeavor because of its previous experience with multi-level professional development interventions.

A.3 Developing a Promising New Strategy Built on Prior Work

With funding from the National Science Foundation (NSF), UIC (Section C) in partnership with the ISC, developed, implemented, and tested the Collaborating Around Structures, Processes and Instructional Routines (CASPIR) Math project. CASPIR developed and implemented a multi-level professional development intervention designed to improve teachers' and administrators' understandings of math teaching and learning aligned with the CCSSM in four school districts. Since 2019, CASPIR has trained 622 K-8 teachers who served 8,264 K-8 students in high needs settings. 65% of students in the schools where teachers worked qualified for the federal Free or Reduced-Price Lunch Program. Recent NWEA MAP data from 2023 show these districts improved math proficiency scores by as much as 20 percentile points for white students, but less than a 10 percentile point increase for low income and BIPOC students. The design of LTL-Math will address this issue and bolster student outcomes.

Supporting the learning needs of high-need students requires greater learning demands for teachers, which in turn requires the development of more robust and sustained systems of learning within schools for teachers (Spillane & Thompson, 1997). As such, the distinction between CASPIR and LTL-Math lies in the latter's focus on strengthening the school-based teacher learning system—the culture and spaces (e.g. teacher teams) to support teachers in learning and implementing instruction that meets the needs of high-needs students. This shift in focus is based on data that show teachers made little progress in implementing math lessons that provided opportunities for *all* students to engage in rigorous math ([redacted] et al., 2023).

While CASPIR devoted attention to developing district-level structures ([redacted] et al., 2023), it did not sufficiently focus on developing school-level capacities for supporting the kinds of teacher learning necessary for effectively teaching high-needs students. And although

CASPIR provided large group development to principals and teacher leaders ([redacted] et al., 2024), it did not include group coaching that would allow principals and teacher leaders to cultivate productive forms of distributed leadership and align school-level structures for promoting instructional improvement that responds to the specific needs of struggling students.

A.4 LTL-Math Builds on Promising Existing Strategies

LTL-Math demonstrates a promising approach to build principals' and teacher leaders' capacities to improve organizational conditions within schools by employing a distributed leadership approach and providing coaching to promote application of new learning. As discussed below, the combination of professional development and coaching builds on studies that meet WWC standards (Bradshaw et al., 2018; Master et al., 2022; Schoen et al., 2018).

A.4.a. Studies Meeting WWC Standards Underlying LTL-Math. The principal learning component of LTL-Math builds on a study (Master et al., 2022) that has met WWC standards without reservations, in addition to being grounded in evidence-based practices (DaFlaminis et al., 2016). This study involved middle school principals who engaged in a professional development program focused on effective leadership practices (Appendix L). Professional development over 30 months included 24 full-day sessions, and over 60 hours of one-on-one coaching support. There was a small impact on student achievement when coaching was included, with the largest effects of the coaching in high-needs schools.

The teacher leader learning component of LTL-Math builds on two studies (Bradshaw et al., 2018; Schoen et al., 2018) that have met WWC standards, in addition to being grounded in evidence-based practices (Campbell & Markus, 2011; Desimone, 2009). The first study (Schoen et al., 2018) involved 149 elementary teachers (grades 3-5) who participated in a math professional development program focused on how to implement Cognitively Guided Instruction

(CGI) to improve student learning. Findings demonstrated a significant impact on student math achievement ($p = .007$) in the first year of the program, equivalent to students having shifted 5 percentile points higher in the distribution of student achievement. The second study (Bradshaw et al., 2018) involved 158 elementary and middle school teachers who participated in a professional development and coaching model that focused on school-wide behavioral interventions and practices. Findings related to the coaching component demonstrated improved student behavior outcomes in classrooms of coached teachers.

A.4.b. Development of an Innovative Strategy. LTL-Math will meet or exceed the outcomes of these studies with an overlapping population and includes an advancement of the three studies. LTL-Math is a **multi-level job-embedded professional development system** that includes three learning components: (1) professional development for principals to strength the school's system that supports teacher learning; (2) professional development for teacher leaders to develop one aspect of the school's teacher learning system—teacher teams, and facilitate teacher team meetings as sites for continuous, job-embedded teacher learning; and (3) group coaching sessions for principals and teacher leaders to strengthen distributed leadership practices through joint and role-specific leadership activities. See Section B for details regarding LTL-Math learning components.

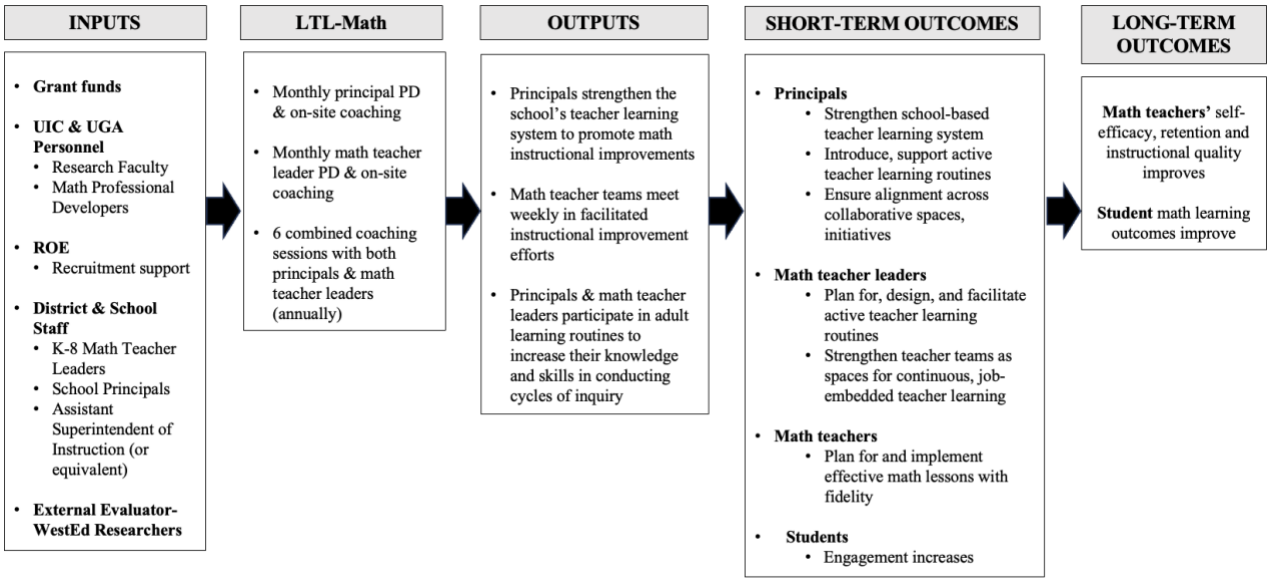
B. Quality of Project Design

B.1 LTL-Math Conceptual Framework

LTL-Math will promote equity in student access to high quality teaching through principals and teacher leaders trained to strengthen organizational capacities that support teacher learning and instructional improvement producing positive student math outcomes. LTL-Math also includes group coaching sessions for principals and teacher leaders (from the same school)

to develop their collective capacity to employ a distributed leadership approach to strengthen the school-based teacher learning system and ensure alignment across teacher learning spaces. Multi-component learning designs that combine coaching with other professional learning components, such as large group learning (Reddy et al., 2021) and where learning is provided to leaders across multiple roles (Saunders et al., 2009), has proven effective for supporting leader learning. The combination of both professional development and coaching can also help enhance and sustain the effects of professional development, which is critical in high-needs schools (Saunders et al., 2009). Figure 1 displays the LTL-Math logic model.

Figure 1. LTL-Math Logic Model



B.1.a. LTL-Math Principal Learning Component

Our attention to principal development is supported by Grissom et al (2021), who emphasizes "the size of principal effects is nearly as large as estimates of individual teacher effects on student learning" (p. 39). They conclude that "the effectiveness of the principal is more important than the effectiveness of any single teacher" for improving a school's student

learning (p. 40) and that interventions that develop principals are "likely the most efficient way to affect student achievement" (p. 40) with few investments having "higher ceilings on [their] potential return than a successful effort to improve principal leadership" (p. 43). Moreover, our targeting of leadership actions that cultivate a school's teacher learning system is further supported by their work, who identifies this aspect of principal work as one of just four leadership practice areas of consequence to student learning. This work is also a subset of the leadership practices that received developmental attention in Masters et al (2022). In considering the school's system that supports teacher learning, we emphasize the cultivation of a job-embedded learning environment that promotes sustained, collaborative, and content-oriented, active learning experiences (Desimone, 2009).

To support principals in strengthening the school's teacher learning system, principals will receive professional development related to establishing a robust teacher learning culture, cultivating a set of within-school collaborative spaces (teacher teams) to support active teacher learning routines, and strengthening teacher leadership to enhance the school's distributed leadership approach for supporting teacher learning and instructional improvement. Appendix M has more information about the principal professional development learning component.

B.1.b. LTL-Math Teacher Leader Learning Component. For teacher leaders, LTL-Math will provide professional development focused on learning: (a) how to facilitate key active teacher learning routines, and (b) about the "content" that math teachers will need to know and enact in teacher team meetings. As advances in our knowledge about teacher professional development have made clear, sporadic and short-term traditional professional development that is disconnected from teachers' everyday contexts is not enough to make changes in teachers' instructional practice, and ultimately student learning (Foster, 2022). Instead, learning

experiences should include continuous collaborative and job-embedded, active learning experiences which explicitly connect learning to practice (Darling-Hammond et al., 2017).

We extend these ideas to teacher leaders, where teacher leader learning needs to involve active learning experiences that are grounded in the work of facilitating teacher team meetings as sites for continuous, job-embedded teacher learning. This includes working alongside a coach who models targeted facilitation practices, learning about and enacting key facilitation practices (Appendix M) that support teachers in productively analyzing artifacts from their own classrooms in evidence-based ways that can inform teachers' instruction such that they can responsively address the needs of their own high-needs students. Other experiences include learning the "content" (e.g., lesson and assessment design) that teachers need to learn (Borko et al., 2021). Grounded in NCTM's Principles to Action (2014), teacher leaders will deepen their understandings of math, instructional practices for orchestrating productive math discussions (Stein et al., 2008), and of how students' learning progresses across grade levels. Such understanding informs effective lesson and assessment design, and informs instructional decisions based on student learning artifacts (Smith, 2001). Appendix M has more information about the teacher leader professional development learning component.

B.1.c. LTL-Math Group Coaching Learning Component. To support principals and teacher leaders in employing a distributed leadership approach, LTL-Math will provide job-embedded, group coaching experiences that are uniquely tailored to the needs of principals, teacher leaders, and their schools. Group coaching will follow from and connect to the professional development experiences to support the application of learning from professional development. Group coaching will be a space for helping principals and teacher leaders effectively engage in joint activities, where principals and teacher leaders work together, and in

well-coordinated, role-specific activities that strategically leverage the affordances of their respective leadership roles.

B.2 Clearly Specified Goals, Objectives, Outcomes and Measures

The project's goal is to implement and study the LTL-Math program. To accomplish this, in the table below, we describe four goals, and related objectives, outcomes and measures.

Table 1. Goals, Objectives, Outcomes, and Measures

Objectives	Outcomes	Measures
Goal 1. Develop, test, and refine LTL-Math in pilot school district (Spring 2025 to Spring 2026)		
Objective 1.1. Use letters of support from ISC and districts to inform Memos of Understanding to formalize partnership agreements for participation; consent for data collection activities; apply for IRB approval	District participants agree to participate in project and consent to data collection activities.	Measure 1.1. Principals, teacher leaders sign consent forms
Objective 1.2. Develop, test data collection system	WestEd develops data collection system; begins data sharing application with ISBE to obtain student data	Measure 1.2. Data collection is established; ISBE application submitted, approved
Objective 1.3. Materials are designed for professional development experiences	LTL-Math designs materials to be used in principal and teacher leader professional development	Measure 1.3. Materials are developed; design rationales documented to inform revisions
Objective 1.4. Provide monthly training & coaching to 5 principals to improve instructional quality by strengthening school system to support teacher learning	LTL-Math provides summer training and monthly professional development (e.g., PD sessions, coaching) to principals; principals enact actions that strengthen teacher learning system	Measure 1.4. LTL-Math documents coverage of planned activities and principal participation; principal surveys/logs
Objective 1.5. Provide monthly training to 20 teacher leaders to design, facilitate teacher team meetings as sites for continuous, job-embedded professional development	LTL-Math provides summer training and monthly professional development (e.g., PD sessions, coaching) to teacher leaders; teacher leaders design, facilitate weekly teacher team meetings	Measure 1.5. LTL-Math documents coverage of planned activities and teacher leader participation; teacher leader surveys/logs

Objective 1.6. Provide six tailored group coaching sessions to 5 principals, 20 teacher leaders to strengthen distributed leadership practices	LTL-Math provides six group coaching to principals and teacher leaders to strengthen their knowledge to engage in cycles of inquiry around instruction; principals, teacher leaders support teacher teams as sites for learning	Measure 1.6. LTL-Math documents coverage of planned activities and principal, teacher leader participation; principal and teacher leader surveys/logs
Objective 1.7. Collect implementation data	WestEd analyzes implementation data; summarized data are shared with LTL-Math quarterly.	Measure 1.7. WestEd uses implementation data to develop quarterly implementation briefs
Objective 1.8. Refine LTL-Math learning components	LTL-Math refines professional development, coaching materials, activities based on pilot implementation data.	Measure 1.8. Design memos document changes made in response to implementation analyses
Goal 2. Implement LTL-Math and evaluate its impact in two treatment school districts (Summer 2026 to Spring 2028)		
Objective 2.1. Recruit 4 school districts prepared to be randomly assigned to treatment and control; use letters of support from ISC and districts to inform Memos of Understanding to formalize partnership agreements for participation, consent for data collection activities	Partner district participants agree to participate in the project for two years, and consent to data collection activities..	Measure 2.1. Principals, teacher leaders sign consent forms
Objective 2.2. Randomly assign districts to treatment, control for impact evaluation	Districts are randomly assigned by WestEd to treatment and control groups.	Measure 2.2. WestEd documents assignment of partner districts
Objective 2.3. Provide monthly training & coaching to 10 principals to improve instructional quality by strengthening school system to support teacher learning	LTL-Math provides summer training and monthly professional development (e.g., PD sessions, coaching) to principals; principals enact actions that strengthen teacher learning system	Measure 2.3. LTL-Math documents coverage of planned activities and principal participation; principal surveys/logs
Objective 2.4. Provide monthly training to 50 teacher leaders to design, facilitate teacher team meetings as sites for continuous, job-embedded professional development	LTL-Math provides summer training and monthly professional development (e.g., PD sessions, coaching) to teacher leaders; teacher leaders	Measure 2.4. LTL-Math documents coverage of planned activities and teacher leader participation; teacher leader surveys/logs

	design, facilitate weekly teacher team meetings	
Objective 2.5. Provide six tailored group coaching to 10 principals, 50 teacher leaders to strengthen distributed leadership practices	LTL-Math provides six group coaching to principals and teacher leaders to strengthen their knowledge to engage in cycles of inquiry around instruction; principals, teacher leaders support teacher teams as sites for learning	Measure 2.5. LTL-Math documents coverage of planned activities and principal, teacher leader participation; principal and teacher leader surveys/logs
Objective 2.6. Assess the implementation and impact of LTL-Math on principals, teacher leaders and students	WestEd analyzes implementation data from principals, teacher leaders; conducts impact analyses, and produces findings that meet What Works Clearinghouse standards.	Measure 2.6. WestEd documents impact analyses and findings in quarterly implementation/ impact findings memo
Goal 3. Examine sustainability of LTL-Math under normal conditions and offer delayed treatment to control districts (Summer 2028 to Fall 2029)		
Objective 3.1. Offer postponed LTL-Math treatment to 20 principals, 50 teacher leaders in control districts	LTL-Math offers summer training, and monthly professional development (e.g., PD sessions, coaching), and group coaching to principals, teacher leaders.	Measure 3.1. LTL-Math documents coverage of planned activities and principal, teacher leader participation; principal and teacher leader surveys/logs
Objective 3.2. Analyze principal/teacher leader implementation data to examine sustainability	WestEd analyzes implementation data.	Measure 3.2. WestEd documents findings on sustainability in memo
Goal 4. Disseminate findings		
Objective 4.1 Complete ED annual and summative reporting	Results communicated with ED annually with report.	Measure 4.1. Report with data and analysis
Objective 4.2 Disseminate findings	UIC, UGA and WestEd make findings from impact analyses publicly available.	Measure 4.2. Conference proceedings, journal articles, and WWC

B.3 Project Design Responds to Needs of the Target Population

Since the COVID-19 pandemic, only 27% of Illinois students met proficiency in math, with overall math proficiency scores still 15% lower than pre-pandemic levels. These rates are

much lower for high-needs students, with 14.4% and 0.5% of Hispanic and Black students achieving proficiency in math, respectively, in 2023. Within South Cook County, math proficiency rates for high-needs students on the IAR have decreased by as much as 50%. Understanding how to effectively and sustainably improve student math outcomes in these schools is critical. Effective teachers can impact math achievement for high-need students (Osborne, 2021). Principals can also have an influence on improving student learning outcomes (Grissom, 2021). LTL-Math will strategically address the needs of high-need students by improving both principal and teacher effectiveness in these students' schools.

We will prioritize the identification and hiring of diverse coaches that have prior experience working with the high-need populations in settings similar to those in which participants will be located. LTL-Math also builds on promising evidence-based models that have demonstrated impacts on student learning with student populations similar to the proposed student population (see Section A.4). LTL-Math will replicate these findings, while also testing the impact on student learning with an additional component - group coaching for principals and teacher leaders. The LTL-Math team also includes key members representing the ISC and its school districts. They possess knowledge of the communities and proposed student population, and can provide access to data and information needed to inform program improvements.

C. Quality of Project Personnel

LTL-Math includes a diverse and comprehensive personnel group from UIC, UGA, the ISC and its district partners, and WestEd. These individuals have expertise in large-scale instructional change, math education, educational leadership, professional development, and research methods (Appendix B). Team members represent groups that have been traditionally

underrepresented and have extensive experience working with individuals from various races, gender, age, disability, and socioeconomic levels, which reflect the target student population. The LTL-Math team, with team members from underrepresented groups including Mexican-American and Latinx, is focused on inclusion and equity to ensure that all students and teachers receive the support and resources needed to be successful. Recruiting of additional personnel will follow the model used in [redacted] NSF projects, which had teams including individuals who identify as Black, Hispanic, U.S. non-resident, female, and with disabilities. LTL-Math will intentionally recruit diverse participants that reflect the predominantly minority and low-income student populations served by the partnering school districts. This recruitment model includes analyzing all position descriptions for biased language, placing non-discrimination statements in job advertisements, and disseminating jobs on listservs to reach diverse audiences. [redacted], [redacted] and [redacted] have prior experience partnering on CASPIR (see Section A.3), which was implemented successfully, on time and within budget.

[redacted]* will be the **Project Director**, **Principal Investigator (PI), and Teacher Leader Design Lead**[1]. She will provide oversight and leadership on all project activities, and lead the design of materials for the math teacher professional development. She has previously taught 5th grade math, and currently teaches math content and methods courses for prospective and practicing elementary teachers. She has also served as PI and Co-PI for several large NSF, Institute of Education Sciences awards focused on teacher professional development. [redacted]* will serve as the **Co-Project Director, Co-Principal Investigator (Co-PI), and Principal Design Lead**. She will assist [redacted] with

[1] * = Members of the Leadership Team and Professional Development Design Team; # = Members of the Professional Development and Coaching Implementation Team; & = Members of the Advisory Committee

oversight of project activities and lead the design of materials for the principal professional development. She was previously a high school teacher, and then a middle school principal for 10 years, after which she served as a Director of Continuous Improvement for Student Learning in a K-8 school district. She has also served as PI and Co-PI on several large private and federally-funded grants focused on school leadership development. [redacted]* will serve as the **Continuous Improvement and Dissemination Lead** and **Co-Principal Investigator (Co-PI)**. He will lead continuous improvement and dissemination efforts. He teaches courses for principals and superintendents and has expertise in education policy and research used to improve instruction. He is Senior Director of the Institute of Government and Public Affairs, University of Illinois' "think tank". [redacted]* (UIC) will be **Project Manager**, supervising day-to-day activities and logistics. He has expertise in education leadership and professional development, and project management experience. [redacted] **(#)** (UIC) will serve as **Professional Development and Coaching Implementation Lead,** training coaches, and facilitating principal and teacher leader professional development and coaching. She is a former math teacher, math coach and has expertise in math education.

[redacted] **(&)** (ISC) will serve as **Advisory Committee Lead**, providing guidance and input to promote project sustainability. He is Executive Director of the ISC and was a former teacher. [redacted] **(&)** (District 127.5) will serve on the Advisory Committee. She is a Director of Curriculum and Instruction, and was a former math teacher and elementary principal. [redacted] **(&)** (District 2) will serve on the Advisory Committee. She is an Assistant Superintendent of Teaching and Learning, and a former elementary school principal. See Appendix C for letters of support.

D. Quality of Management Plan

The management plan and timeline have been developed based on research, lessons learned from previous projects, and the needs of partners and participants.

D.1 Clearly Defined Roles and Responsibilities

The LTL-Math management plan is three-tiered for effective partnership management and to ensure those closest to the work have a voice. The proposed project will be achieved through strict monitoring imposed and facilitated by the Leadership and Design Team (represented with * in Table 2) led by the Project Director. See Table 2 for the LTL-Math Management Structure and Appendix N for the LTL-Math organizational chart to ensure effective collaboration. Appendix O has additional information about roles and responsibilities.

Table 2. Three-tiered Effective Partnership Management Structure

Tier I: Leadership and Professional Development Design Team (*)	Meet weekly and is the working group responsible for project implementation. This team will be responsible for key components, benchmark goals, and working with the evaluation to determine project effectiveness. Small subsets of this team will meet bi-weekly in years 1-3 to design professional development content and adjust based on feedback and data collected from participants.
Tier II: Professional Development and Coaching Implementation Team (#)	Meet bi-weekly to discuss professional development and coaching implementation, progress towards goals and objectives, and to reflect and adjust based on feedback and data collected from participants.
Tier III: The Advisory Committee (&)	Composed of representatives from the ISC and its district partners from CASPIR, will meet twice yearly to discuss progress towards project goals and sustainability beyond the life of the project. Provide recruitment assistance, ensure access to data necessary to inform the project's continuous improvement plan and external evaluation.

D.2 On Time and Within Budget

In order to ensure the project is implemented efficiently, on time, and within budget, we have brought together a team of professionals and experts in the field as described in Section C.

Project leaders will work closely with the Advisory Committee to identify cost efficiencies to increase return on investment and ensure sustainability. The Business Manager of UIC's Learning Sciences Research Institute (LSRI) business office will monitor the monthly budget to ensure the project stays within budget. LSRI has successfully administered various grants exceeding $100M over the past 10 years.

Table 3. Project objectives, timeline, and activities

	Year 1			Year 2			Year 3			Year 4			Year 5		
	Sp	Su	Fa	Sp	Su	Fa	Sp	Su	Fa	Sp	Su	Fa	Sp	Su	Fa
Goal 1. Develop, Test in Pilot District															
Objective 1.1. Formalize partnership agreements; apply for IRB approval															
Objective 1.2. Develop data collection system															
Objective 1.3. Develop materials															
Objective 1.4. Provide training, coaching to 5 principals															
Objective 1.5. Provide training, coaching to 20 teacher leaders															
Objective 1.6. Provide group coaching															
Objective 1.7. Collect implementation data															
Objective 1.8. Refine LTL-Math components															
Goal 2: Implement, Evaluate in Treatment Districts															
Objective 2.1. Recruit 4 school districts; formalize partnership agreements															
Objective 2.2. Randomly assign districts to treatment and control for impact evaluation															
Objective 2.3. Provide training, coaching to 10 principals															
Objective 2.4. Provide training, coaching to 50 teacher leaders															
Objective 2.5. Provide group coaching															
Objective 2.6. Assess the implementation, impact of LTL-Math															
Goal 3. Examine Sustainability, Offer Delayed Treatment															
Objective 3.1. Offer postponed treatment to control districts in final year															
Objective 3.2. Analyze principal/teacher leader implementation data to examine sustainability.															
Goal 4. Disseminate Findings															
Objective 4.1. Complete ED annual and summative reporting															
Objective 4.2. Disseminate findings															

D.3 Feedback and Continuous Improvement

LTL-Math will employ a result-oriented continuous improvement process, informed by regular data collection and feedback loops, across the design and implementation of the principal, teacher leader, and group coaching learning components. This process is powerful for developing the capacity of partners to work together around LTL-Math improvement. The process will involve five steps:

1. Examine gap between the vision and current reality; collaboratively decide which goal(s) provide greatest levers and indicators of process
2. Establish plan of action breaking down yearly goals into achievable quarterly objectives; determine allocation of time, resources, and actions to achieve goals
3. Implement plan with fidelity
4. Establish regular habit of using data to make sense of results; identify what is working and address barriers to reaching goals
5. Reflect on progress made to create momentum to repeat cycle

As discussed in Section E.3 below, a main goal of the evaluation is providing frequent performance feedback to project staff and assessment of progress toward intended outcomes that will power this cycle to promote continuous improvement of the LTL-Math program and its implementation. As evaluation lead, [redacted] will be responsible for overseeing data collection and WestEd communication with UIC and UGA around project progress. As continuous improvement lead, [redacted] will be responsible for ensuring that data informs LTL-Math throughout all years.

E. Quality of Project Evaluation

WestEd will lead an independent evaluation of LTL-Math, including process, implementation, cost, and impact data, to address evaluation questions that prioritize the Institute for Education Science's Standards for Excellence in Education Research (SEER). The evaluation will include studies of (1) the impact of LTL-Math on confirmatory outcomes, using a design

meeting WWC 5.0 standards with reservations, preregistered in Registry of Efficacy and Effectiveness Studies (REES) (SEER1); (2) fidelity of implementation (FOI) (SEER3, SEER4); and (3) an implementation study to inform the development of LTL-Math about FOI and factors that facilitate or impede program development, scaling, and potential replication (SEER8).

E.1 Evaluation Questions

The evaluation will address questions concerning the implementation of key program components, and confirmatory and exploratory impacts on intermediate and final outcomes.

Table 4. Evaluation Questions and Data Sources

Evaluation Question	Data Sources
Are fidelity of implementation thresholds reached?	Principal & teacher leader surveys, program records, logs, classroom observations (using the IQA observation form), LTL-Math Fidelity Checklist (to be developed)
What are the barriers and supports to successful implementation?	Principal, teacher leader and developer surveys and interviews
What is the achieved treatment-control contrast?	Principal, teacher leader surveys and logs regarding core LTL-Math implementation in both conditions
Confirmatory Impact Question	
Is there a positive intent-to-treat impact of LTL-Math, relative to business-as-usual (BAU), on: (a) Principals' leadership practices and support for active teacher learning routines (b) math teacher leaders' facilitation of teacher team meetings (c) math teachers' instructional practices (d) math teachers' self-efficacy (e) students' math achievement	Principal measures to be developed and based on survey protocols, Math teacher leader logs, measures to be developed based on survey protocols, Instructional Quality Assessment (IQA) observation form, Math Teacher Self-Efficacy Scale survey, 5Essentials Survey-Academic Engagement NWEA Measures of Academic Progress (MAP)-Mathematics test, Illinois Assessment of Readiness (IAR)-Mathematics test
Exploratory Impact Questions	

Impacts on potential mediators Does implementation fidelity, teachers' instructional practices, teacher leader facilitation or principal leadership practices mediate the impact of LTL-Math on students' math achievement?	LTL-Math Fidelity Checklist (to be developed)
Moderating/differential impacts Is there a differential impact of LTL-Math on students' math achievement depending on race/ethnicity, gender, disability status and specific disability, English Learner status, or free/reduced-price lunch status?	Student demographic data

Note. Each key data source is described fully in Appendix J.

E.2. Impact Evaluation That Meets WWC Standards with Reservations

The confirmatory and exploratory research questions address key program components, main proximal outcomes, and final student-level impact outcomes from the logic model. The confirmatory research question is as follows: Is there a positive intent-to-treat (ITT) impact of LTL-Math relative to business-as-usual (BAU) on principal's leadership practices and support for active teacher learning routines, math teacher leaders' facilitation of teacher team meetings, math teachers' self-efficacy, math teachers' instructional practices, and students' math achievement? The evaluation will provide impact estimates for both educators and students.

E.2.a. Samples. The impact study will examine the effects of LTL-Math on outcomes for 9,472 students in grades K-8 in 28 elementary schools in 4 school districts in Illinois.

E.2.b. Establishing Equivalence. We will work with schools in four school districts. Two districts will receive the LTL-Math professional development and coaching and two will not. Two school districts will be assigned to the LTL-MATH condition (treatment) and two

school districts will be assigned to a business-as-usual (BAU) condition. Analyses will focus on impact estimates at the school-level.

WestEd will use one-to-one propensity score matching (PSM) at each unit of analysis (principal, teachers, students) to create baseline equivalent comparison groups from principal, teachers, and students in the comparison condition. We will estimate propensity scores using logistic regression following procedures outlined by Leite (2016). We describe the procedure for matching students below but note that we will use the same PSM procedures for teachers and principals. We will code principals, teachers, and students in treatment or comparison condition schools using a dichotomous indicator. This indicator will then be used as the dependent variable in a logistic regression model. The logistic regression model will include all available principal-, teacher-, or student-level covariates, including demographics (e.g., race/ethnicity) and all available pre-test data. The propensity score is then the predicted probability of a principal, teacher, or student being assigned to the treatment or comparison condition based on model covariates. This approach reduces selection bias by establishing equivalence on the included model covariates. Next, WestEd will use each estimated propensity score to match principals, teachers, and students using the one-to-one optimal matching method, minimizing global propensity score distance (i.e., predicted probability of being in treatment or comparison condition) to a principal, teacher, or student in the comparison condition by finding the smallest average absolute distance across all matched students. We will use the one-to-one optimal matching algorithm in the *matchit* (Ho et al., 2017) and *optmatch* (Hansen et al., 2016) packages in *R*. To confirm covariate equivalence, we will calculate standardized mean

difference effect sizes (g), where equivalence is defined as g < .25 standard deviation units (WWC, 2022). The quasi-experimental design study is designed to meet WWC 5.0 standards with reservations.

E.2.c. Statistical Power. WestEd estimated the minimum detectable effect size (MDES) for confirmatory impacts on proximal principal, teacher, and student outcomes. For the power analysis, we used the school as the intervention unit because district supports will flow down to schools. We assumed 28 schools, 8.57 teachers/school, and 20 students/teacher. We explored multiple scenarios based on these sample sizes, with plausible assumptions about attrition, ICC, and variance accounted for. We assumed 80 percent power, 5 percent Type-1 error rate, and varying specific values of sample size, ICC, R-squared described in Appendix J. At the student-level, the MDES is .23. MDES for teacher-level outcomes .40. MDES for principal outcomes ranged from .60. Principal and teacher outcomes appear underpowered; therefore, students will be the confirmatory sample.

E.2.d. Impact Measures. Impacts will be assessed on outcomes listed in Table 4 (see full description in Appendix J). Instruments to address research questions are in Table 5.

Table 5. Evaluation Measures

Unit	Domain	Measure	Timing
Students	Math Achievement	NWEA MAP Mathematics	Pre and Post
Students	Math Achievement	Illinois Assessment of Readiness (IAR)	Post
Teachers	Teacher Self-Efficacy	Math Teacher Self-Efficacy Scale survey	Pre and Post
Teachers	Teacher Practice	Instructional Quality Assessment (IQA) observation form	Pre and Post
Teacher Leaders	Teacher Practice	Teacher leader meeting facilitation (to be developed)	Pre and Post

Principals	School Leader Practice	Principal's leadership practices and support for active teacher learning routines (to be developed)	Pre and Post
Domain is based on WWC Review Protocol https://ies.ed.gov/ncee/wwc/Docs/ReferenceResources/WWC-SRP50-508.pdf			

E.2.e. Impact Analysis. WestEd will use hierarchical linear models (HLM) (Raudenbush & Bryk, 2002) applied to cluster-level RCTs (Bloom, 2005) for estimating intent-to-treat impact. The standard form of the benchmark impact model (detailed in Appendix J) will include an indicator for treatment status, student-level baseline covariates (e.g., race/ethnicity, gender, disability status, grade, baseline math achievement), teacher covariates, school covariates, a fixed effect for district, and student, teacher, and school random effects. To address missing data, we will use the sequential modeling imputation approach (Grund et al., 2021), that uses Markov chain Monte Carlo (MCMC) methods to estimate parameters of the imputation models and sample imputations for missing data from conditional distributions of the variables (Gelman et al., 2014). For confirmatory impact analyses, we will follow WWC topic-area review protocols to report necessary statistics, including obtaining sample sizes at each stage in executing the study, determining baseline equivalence on demographics and pretests, and calculating covariate-adjusted standardized mean difference effect sizes.

For exploratory analyses, we will assess differential impacts on confirmatory outcomes for important student moderators (e.g., race/ethnicity, gender, disability status, English Learner status, SES, grade) and teacher moderators (e.g., years of experience). Moderation models will include interaction effects at the appropriate level (e.g., student [level 1], teacher [level 2]).

Questions of mediation will be estimated using a multilevel structural equation modeling (ML-SEM) framework. Analyses will be conducted using *lme4* (Bates et al., 2015), *Lavaan* (Rosseel, 2012), and other packages in *R*. All statistical code will be preregistered in REES.

E.3 Performance Feedback and Periodic Assessment of Progress

A primary goal of the evaluation is to provide frequent performance feedback to project staff and assessment of progress toward intended outcomes that will allow ongoing adaptation and improvement of LTL-Math and its implementation. The process and implementation study described below, and implementation of the impact study will allow the evaluators to monitor progress and serve as a critical and independent thought partner, helping the LTL-Math team refine its logic model, confirm fidelity thresholds, develop measures, and establish which program components are being implemented successfully or need refinement. Working together, the UIC and WestEd teams will identify specific questions critical to the continuous improvement of the program. The process and implementation studies provide an opportunity to evaluate key components for each implementation of LTL-Math. The WestEd team will meet with the PIs bi-weekly and provide quarterly data-based updates on implementation.

E.4 Key Project Components, Mediators, and Measurable Thresholds

E.4.a Fidelity of Implementation (FOI) Thresholds. Key components are the mechanisms that lead to successful implementation, including fidelity of implementation (FOI). During year 1, WestEd will create a FOI system. This system includes Specific, Measurable, Attainable, Realistic, Timely (SMART) goals/thresholds for monitoring objective performance measures and for integrating feedback. This system will rely on an LTL-Math Checklist (both log version and direct observation versions for principals and teacher leaders) to be developed

during the first year of the project. WestEd will assess adherence to an ongoing adaptation of the program logic model (Appendix G), including key components, outputs related to inputs, and attainment of fidelity thresholds (SEER 3 & 4). Key components and fidelity thresholds include: LTL-Math recruits 4 districts with an average of 7 elementary schools in each district for the QED; 90% of principals receive LTL-Math training and coaching; 90% of math teacher leaders receive LTL-Math training and coaching. We will add additional thresholds in Year 1. Findings will be shared quarterly with the LTL-Math project management team to decide whether key components of the program and fidelity thresholds have been met and to adjust as necessary.

During the two-year impact study (2025-2026 and 2026-2027 school years), WestEd will collect monthly teacher leader practice logs from all LTL-Math and BAU teachers regarding their facilitation practices and routines. The WestEd team will also interview 20 LTL-Math teacher leaders and 5 principals to expand on themes in survey responses. These data will provide insight into barriers and supports in LTL-Math implementation (SEER4). WestEd will report the log information to the LTL-Math implementation team quarterly to support implementation and inform the development of a replicable model.

E.4.b. Mediators and Moderators. Research questions 5 and 6 focus on moderation and mediation. We hypothesize that teachers' instructional practices and self-efficacy in teaching math will mediate treatment effects because teachers that believe they can successfully be teacher leaders in math and actualize outcomes. Key moderators include student and school characteristics, including race/ethnicity, gender, EL status, disability status, and school.