SUPPORTING EFFECTIVE TEACHING WITH DISCIPLINARY INQUIRY

Introduction....1

A: QUALITY OF THE PROJECT DESIGN....2

A.1 An exceptional approach to Absolute Priority 1.2 *(Providing Teachers with Evidence-Based PD)* and Competitive Preference 1 *(Increasing the Number of Educators Adequately Prepared to Deliver Rigorous Instruction in STEM Fields)*....2

A2. PD Services Are Sufficient Quality, Intensity and Duration to Lead to Improvement....7

A3. SETDI Involves the Collaboration of Appropriate Partners for Maximizing the Effectiveness of Project Services....11

A4. SETDI Services Focus on Those with Greatest Needs and....12

A5: SETDI is Appropriate For and Will Successfully Address the Needs of the Target Population or Other Identified Needs....12

B. SIGNIFICANCE....15

B.1 The Importance or Magnitude of the Results or Outcomes Likely to be Attained by the Proposed Project, Especially Improvements in Teaching and Student Achievement....15

B2. The Extent to Which the Costs are Reasonable in Relation to the Number of Persons to be Served and to the Anticipated Results and Benefits....17

B3. The Potential for the Incorporation of Project Purposes, Activities, or Benefits into the Ongoing Program of the Agency or Organization at the End of Federal Funding....18

B4. The Extent to Which the Results of the Proposed Project are to be Disseminated in Ways that Will Enable Others to Use the Information or Strategies....20

C. QUALITY OF THE MANAGEMENT PLAN....21

C1. The Extent to Which the Goals, Objectives, and Outcomes are Clearly Specified and Measurable....21

C2. The Adequacy of the Management Plan to Achieve the Objectives of the Proposed Project on Time and Within Budget, Including Clearly Defined Responsibilities, Timelines, and Milestones for Accomplishing Project Tasks....23

C3. SETDI Procedures for Ensuring Feedback and Continuous Improvement....33

D. QUALITY OF THE PROJECT EVALUTION....34

D1. Purpose and Extent of the Evaluation....35

D2. Research Questions....36

D3. Evaluation Design....37

Introduction

The Strategic Literacy Initiative at WestEd (SLI) is pleased to submit this proposal to increase the number of highly effective secondary teachers, and thereby improve students' academic literacy proficiencies and achievement, particularly in science and engineering. The proposed project, *Supporting Effective Teaching with Disciplinary Inquiry (SETDI)* will accomplish this by providing evidence-based Reading Apprenticeship professional development to 1,500 middle and high school teachers from schools in seven states. Five hundred of these will be science and engineering (Sci/Eng) teachers. The cross-disciplinary teams of teachers will teach in schools serving high needs students in seven states: California, Georgia, Michigan, New York, Oklahoma, Texas, and Washington. Five hundred of these teachers will be science and engineering (Sci/Eng) teachers, joined by 1,000 teachers from across disciplines in their schools who can together build a coherent, systemic approach to literacy development. SLI will also leverage resources and knowledge from prior work to engage Sci/Eng teachers in designing and using text-based inquiries and text-sets to support rigorous science teaching and learning. Participating teachers will serve over 100,000 middle and high school students. We anticipate the impact of these activities will extend the reach of the project to thousands more teachers during the project period through open source dissemination and teacher leadership development. This work addresses **Absolute Priority 1.2** (Providing Teachers with Evidence-Based Professional Development) and **Competitive Preference 1** (Increasing the number of educators adequately prepared to deliver rigorous instruction in STEM fields).

In accordance with the notice of application for this SEED competition (CFDA 84.423A) and the What Works Clearinghouse (WWC) definitions for effectiveness, the proposed project meets the **strong evidence base required for Absolute Priority 1**. Multiple research studies with strong experimental designs have demonstrated the effectiveness of Reading Apprenticeship to improve teacher practice and student outcomes in literacy across the disciplines (Greenleaf, et al., 2009; Greenleaf, et al., 2011a; Greenleaf, et al., 2011b; Kemple, et

al., 2008; Somers, et al., 2010; Fancsali, et al., 2015). In particular, Kemple, et al. (2008) and Somers, et al. (2010) conducted a large-sample, multi-site randomized controlled trial of Reading Apprenticeship that met WWC standards without reservation (WWC, 2009; 2010). Strong positive impacts on science teachers' instructional practices, resulting in students' improved science *and* literacy learning have also been a highlight of the evidence base for Reading Apprenticeship professional development (Fancsali, et al., 2015, Goldman, et al., 2017)

A: QUALITY OF THE PROJECT DESIGN

A.1 **An exceptional approach to Absolute Priority 1.2** *(Providing Teachers with Evidence-Based PD)* **and Competitive Preference 1** *(Increasing the Number of Educators Adequately Prepared to Deliver Rigorous Instruction in STEM Fields)*

Our proposed approach is exceptional because it disseminates an evidence-based intervention, Reading Apprenticeship, which is proven to simultaneously improve student literacy and subject area learning across the academic curriculum and particularly in secondary science classrooms. The proposed project builds on over two decades of work designing, studying, refining and disseminating instructional approaches that engage adolescents in rigorous intellectual work with challenging subject area materials, thereby advancing their subject area and literacy achievement and building their confidence and dispositions toward learning. Furthermore, it builds on SLI's leadership in integrating literacy and science learning to engage science and engineering teachers in the iterative design and testing of innovative curricular resources to support literacy and science/engineering integration. These Design Groups will develop new resources for the field that deepen teaching and learning for science and engineering: topically aligned text-sets and tasks coupled with inquiry teaching guides that are open sourced and widely disseminated. The Design Groups will enable teachers to orchestrate science and engineering tasks with authentic forms of texts – including the graphs, diagrams, visual models, and explanations characteristic of these disciplines – to support the development of discipline-specific reading practices for their students, leading to deeper student learning, thus

disseminating best practices and building capacity for continuous improvement in Sci/Eng teaching.

SETDI instantiates this work in partnerships of teachers, teacher leaders, literacy and STEM experts, and regional support partners to create layers of support for ongoing professional development and instructional inquiry to transform participating teachers' classroom practices. Teachers learn to implement new literacy practices that focus on challenging, collaborative inquiry routines which apprentice students into ways of learning and knowledge building that are shaped by fields of study such as science and engineering. Our three main goals are to:

- Increase the number of highly effective middle and high school teachers serving high needs students by engaging 1,500 teachers in Reading Apprenticeship professional development and Sci/Eng Inquiry Design Groups
- Improve middle and high school students' reading comprehension and science achievement by increasing opportunities to collaborate and engage with more varied and challenging Sci/Eng tasks and texts
- Build local capacity for sustained implementation and dissemination through teacher leader development, regional support and new tools

Reading Apprenticeship: A Proven, Unique Approach to Teacher and Student Learning

Reading Apprenticeship (RA) is an internationally recognized approach to changing teacher practice in deep and lasting ways (Alvermann, 2002; Snow & Biancarosa, 2003; Greenleaf, Schoenbach & Murphy, 2014). This inquiry-based and subject area focused instructional framework and professional development (PD) approach transforms teachers' understanding of their role in adolescent literacy development and builds enduring capacity for literacy instruction in the academic disciplines (Greenleaf & Schoenbach, 2004; Greenleaf, et al., 2011b; Greenleaf, Litman & Marple, 2018). The Reading Apprenticeship instructional framework focuses teachers' attention on four interacting dimensions of teaching and learning: social, personal, cognitive, and knowledge-building, with a central practice of metacognitive conversation to make thinking visible during learning tasks (see App. I, Framework). Reading Apprenticeship teachers engage in carefully designed inquiries to help them unlock their own

disciplinary literacy expertise and to collaborate on new teaching approaches with their colleagues. They learn to identify the features of disciplinary texts that might present stumbling blocks to learners.

Current understandings of *'texts'* include multiple forms of communication beyond the printed word, such as graphs, models, maps and diagrams (Kress & Van Leeuwen, 2001; Lemke, 2004; Tang & Moje, 2010). Multiple forms of communication are especially prevalent in science and engineering but also in history and social studies. In addition, digital and visual technologies keep increasing the range and demands on literacy learning for today's students. For students to be successful in science and engineering in secondary school and in college or the workplace, they need to learn how to read and reason with these varied forms of texts and to carry out complex problem-solving tasks using them. Building disciplinary literacy proficiency of this kind means that subject area teachers must support students in gaining these skills, because they are the most knowledgeable and experienced with disciplinary forms of reading and reasoning (Goldman et al., 2016). At the same time, subject area teachers, particularly in science and engineering, are the least prepared to integrate reading instruction into ongoing classroom learning (Lee & Spratley, 2010). Through its novel approach to professional development, SLI has been successful in increasing teacher effectiveness across the disciplines, particularly in science.

In professional development sessions, teachers practice classroom routines that build student engagement, support student collaboration, and foster authentic discussion and problem solving around course texts. Science teachers, for instance, inquire deeply into what they do to derive meaning with complex science texts, including explanation and exposition in scholarly journals, as well as the diagrams, data arrays, mathematical expressions, and graphs that convey information. Teachers experience and practice classroom routines for engaging students in active inquiry and sense-making with such texts—routines for mentoring students in productive reasoning processes, for fostering metacognitive awareness of comprehension problems and problem-solving processes, and for promoting collaborative discussions of science and

PR/Award # U423A180020

engineering texts. They use these varied texts in disciplinary tasks to build awareness of the role of advanced scientific reading in successful Sci/Eng learning. For example, they work to develop models and explanations of scientific phenomena or to engineer solutions to design problems and unpack their own explanation and construction processes to learn how to support students in doing the same (Greenleaf & Brown, 2017).

Exceptional PD Resources that Support Quality, Fidelity, Dissemination and Sustainability

SETDI draws on codified, tested and widely disseminated RA resources. The following resources support implementation fidelity, provide an educative curriculum designed to shift teachers' instruction, and include tools for developing teacher leadership.

- Two core books developed to support academic literacy and in wide use across the country: *Reading for Understanding: How Reading Apprenticeship Improves Disciplinary Learning in Secondary and College Classrooms* (Schoenbach, Greenleaf, & Murphy, 2012) and *Leading for Literacy: A Reading Apprenticeship Approach* (Schoenbach, Greenleaf & Murphy, 2017). This latter text supports leadership teams as they build cultures of on-going academic engagement and improvement, adapted for their local contexts (see Table of Contents in Appendix I).
- *Online learning courses* on a platform with tools for synchronous video meetings, a-sync interaction, and digital resources for teachers, teacher leaders, partners, and facilitators.
- *Exemplar Sci/Eng investigation*s including text sets, inquiry routines and teacher guides openly available on project websites (http://www.readingapprenticeship.org/research-evidence/readi-curriculum-modules; http//www.projectreadi.org).
- *RA facilitation and PD materials* including detailed facilitator agendas and participant binders that have been carefully developed and continuously improved to document and standardize evidence-based PD practices (sample agendas in Appendix I); this includes blended PD agendas and materials for secondary science domains.
- *RA resource materials* including sample texts and text sets drawn from varied subject areas; student case studies, work, and interviews; assessment tools and rubrics, videos of classroom disciplinary literacy interactions; lesson models and demonstrations of RA teaching approaches.

Exceptional New Resources and Teacher Knowledge to be Developed Via Science/Engineering Design Groups and Open Access Dissemination

While Reading Apprenticeship does not require the purchase of curriculum, participating teachers are encouraged to supplement their existing traditional textbooks with more varied texts

to support rigorous learning. Identifying, evaluating and making use of supplementary disciplinary texts can be a challenge for busy educators (Heller & Greenleaf, 2007). To address this need, SETDI will deepen the quality and intensity of support for the 500 Sci/Eng teachers served by the project by engaging a subset of them in teacher/researcher Design Groups to develop a library of *'topic-linked text inquiries'* for broad open access dissemination. We anticipate that other Reading Apprenticeship partners – RA schools, regional partners, and consultants – will immediately draw upon these tools to strengthen their work. To develop these new materials, we will draw on the approach developed and tested under a Reading for Understanding (RfU) grant from IES (Goldman et al., 2010; Goldman, Britt, et al., 2016). As Science Leads for the Project READI team that was part of the RfU grant, co-PIs Greenleaf and Brown engaged collaborating science teachers in designing, enacting, and refining text-based investigation modules linked to key science topics and addressing high level standards for both literacy and science education (Greenleaf, Brown, Goldman, & Ko, 2013). Text-based investigations included text-sets and disciplinary tasks, as well as pedagogical tools and supports for teachers and students focused on literacy and science learning. Teacher guides accompanied these resources, which were designed to be used both in the classroom and in professional development as educative curriculum for participating teachers. These text inquiries were used in a large-scale efficacy trial that drew on the Reading Apprenticeship instructional framework and inquiry-based PD model. Participating teachers were encouraged to select and implement the text inquiries as appropriate for their existing curriculum and students. The study showed positive impact on teachers' instructional practices as well as students' science literacy (Goldman, Greenleaf, et al., 2016). The library of text inquiries and the design process by which they were developed, available through open access websites, constitute a set of rich resources for initiating the current project (https://readingapprenticeship.org/research-evidence/research-resources/research-reports/; http://www.projectreadi.org/publications/).

A2. PD Services Are Sufficient Quality, Intensity and Duration to Lead to Improvement

Teacher professional development. This project is built on prior studies that show intensity and duration of Reading Apprenticeship PD and instruction are sufficient to impact teacher practice and student outcomes (Fancsali, Abe, Pyatigorsky, et al., 2015; Greenleaf et al., 2011a; Somers et al., 2010). SETDI will provide high-quality Sci/Eng PD with ongoing support for effective implementation of literacy and science and engineering inquiry practices. The project will also serve broader teaching teams from each school to build school coherence, additional academic literacy support for students, and sustainability. All participating teachers will engage in 50+ hours of PD activities over the course of the year. Much research has shown teachers need repeated opportunities to collaborate and inquire together over time for PD to impact practice (Desimone, Smith, & Phillips, 2013; Kennedy, 2016; Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009). Teachers begin their PD with an intensive summer institute and reconvene in the winter. Sci/Eng teachers will engage in PD designed specifically for their subject areas, while colleagues from their school sites who teach other subject areas meet in cross-disciplinary PD. SLI has found benefits to both subject-specific and cross-disciplinary PD for teacher learning and professional community at school sites; SETDI capitalizes on both strategies. Teacher learning and implementation will be supported over the course of the school year with multiple communities of practice and expertise focused on instructional inquiry: online small Professional Learning Communities (PLCs), on-site School Team Meetings, a Teacher Leader Course, and Design Groups. Teacher Leaders and Design Group members receive additional support and professional development hours (see Tables 1 and 2 below). Over the grant period, SETDI will engage three cohorts of teachers in this year-long course of professional development.

Table 1. Professional Development Intensity and Duration for Teachers and Teacher Leaders

Professional Development Format	When	Hours	
		Teachers	T. Leaders
Summer Opening Institute - 3 Days Sci/Eng /Cross-Disciplinary	Summer	20	20

School team meetings (monthly, on-site)	Monthly School Year	8	8
Online PLCs (6, 2 hours each)	Fall, Winter, Spring	12	12
Regional Teacher Leader Meetings	Fall, Spring	——	13
Teacher Leader Online Course	Monthly School Year	——	16
Winter Closing Institute - 2 Days	Winter	13	13
TOTAL HOURS		**53**	**82**

The monthly school team meetings facilitated by TLs and supported by RA inquiry routines and materials are critical to building teachers' collegial support and school-wide communities of practice. In these meetings, Sci/Eng teachers will come together with teachers of other subjects in their sites, further building all participants' knowledge of how literacy practices differ in their subject areas. Additionally, these meetings will promote discussion and sharing about developing and using text inquiry resources.

Text investigation design cycles. The first Design Group (DG1) will also begin in Year 1 as shown in Table 2 below, with 10 to 15 teachers; science, engineering and literacy experts; and a library science specialist to assist with identification and evaluation of open access Sci/Eng sources. DG1 will enable the team to refine the Design Cycle process and tools for subsequent implementation in multiple sites. Teachers will learn how to locate and curate a range of high quality, open source science and engineering texts from reliable university, museum, and government websites, and align text-sets to their curricular core ideas and practices. They will learn to analyze the texts with an eye to the learning opportunities and challenges they present for students (Greenleaf & Valencia, 2017), to represent a range of text types characteristic of communication in science and engineering (Tang & Moje, 2010; Wilson-Lopez & Minichiello, 2017), and to sequence texts to build students' knowledge and literacy skills through investigation and engineering tasks. Working in collaborative, grade-level teams and in both in-person and online formats, they will design, try out, and refine topic-linked text inquiries over the school year, adding teacher guides to the text-sets and learning tasks based on their implementation experiences.

The development of open source Sci/Eng text inquiries that SETDI will provide is needed because the relevant texts and text-sets currently available focus primarily on ELA skills and tasks rather than the reading and reasoning necessary in science and engineering. Additionally, they often reduce the complexity of texts and fail to represent the varied forms of communication (verbal, graphic, diagrammatic) that students will need to read and reason within these domains (Goldman, et al., 2017; Greenleaf & Hinchman, in press; Hiebert, 2017). Instead, our strategy is to develop necessary support for high needs students to work with authentic and complex texts. DG1 will include Sci/Eng teachers from New Haven Unified School District, which serves a high needs population of students similar in achievement to other partnering sites. This will help ensure that the text inquiries will be useful for similar high needs populations nationally.

Beyond deepening the teaching and learning expertise of the participants themselves, Design Group activities will result in two products: 1) a set of ~40 topic-linked text inquiries composed of classroom-tested text-sets and tasks and accompanied by teacher guides to support the integration of literacy instruction in science and engineering courses at middle and high school grade levels; and 2) refinement of the processes and tools, criteria and rubrics, through which science and engineering teachers learn to design high quality curriculum resources. WestEd and our research partners will carry out ongoing formative assessment of the Design Cycle to refine and improve the tools and processes by which we engage teachers in text inquiry design and to develop criteria and rubrics to ensure the quality of resulting text inquiries.
In Year 2 of the project, we will disseminate both products to support teacher implementation and development of quality open education resources. We will engage Design Group 2 in the Design Cycle while carrying out ongoing formative assessment of this dissemination. Teams will be composed of 40 middle school science and engineering teachers, along with science leaders and library science specialists in two project sites. We will disseminate the resulting text inquiries on multiple open access platforms, including our own website as well as through the web resources of partnering states, districts and schools. Finally, in Year 2, we will also carry out

formative assessment of the dissemination of these new materials through the PD for the larger teams of middle and high school Sci/Eng teachers.

Table 2 – Professional development and Duration for Design Group

Design Group (2 to 4 Cycles)	When	Hours
		Sci/Eng Teacher Designers
Summer Kick Off - Learning to Design (2 days face to face)	Summer	13
Design Cycle Sessions, async & online PLCs	Monthly School Year	18
Enact & Refine Cycles (at school sites & online async & PLCs)	Fall, Winter, Spring	18
Reflection, Assessment, Planning (2 days face to face)	Winter, Spring	13
TOTAL HOURS		**62**

Teacher Leader Development. Each school participating in SETDI identifies a Teacher Leader (TL) who participates in additional PD and commits to leading from practice – they are responsible for convening their school Reading Apprenticeship teams on a monthly basis to inquire into practice together. This collegial collaboration supports building the capacity at local sites and further develops teachers' understanding of literacy routines in other content areas. TLs participate in a **Teacher Leader** online course that capitalizes on the tools and implementation tips laid out in *Leading for Literacy* (Schoenbach, Greenleaf, & Murphy, 2017). This book draws on the experience of schools and districts across the country, offering detailed advice for effective ways to start and sustain a whole school literacy improvement effort; how to build robust leadership teams; and how to develop site capacity for sustained literacy improvement. Further, the book lays out the rationale for the program of professional development and includes abundant tools and protocols for organizing and leading school team meetings as well as assessing progress in Reading Apprenticeship implementation. See Appendix I for the List of Team Tools that TLs will explore in the leadership course. TLs will read and discuss this core text, try out and reflect on the team protocols and meeting tools, and work with

their school teams to deepen their knowledge and support of the project in face to face meetings designed specifically for TLs as well as in the online Leadership course. In their second year, as described above, TLs will support their teams in exploring and analyzing the text inquiries and planning for their use in instruction.

A3. SETDI Involves the Collaboration of Appropriate Partners for Maximizing the Effectiveness of Project Services

SLI has a long history of involving educators in partnerships for innovation and continuous improvement. SLI developed and refined the Reading Apprenticeship instructional framework and PD model through iterative research and development processes in collaboration with practitioners around the U.S. serving varied populations, thus developing and expanding resources, tools, and approaches to an ever-growing set of circumstances (Schoenbach, Greenleaf, Cziko & Hurwitz, 1999; Schoenbach, Greenleaf & Murphy, 2012). SETDI's focus on providing follow-up support for schools as teacher teams and TLs work together to build strong Sci/Eng and academic literacy support across their school sites, creates greater likelihood that practices will be institutionalized by the participating schools (Coburn, 2003; Coburn & Russell, 2008). Ongoing exchanges among SLI staff, facilitators and school teams will guide the implementation work of the project. These exchanges result in innovation and problem solving to support implementation, in ways that cannot be anticipated fully in advance (Schoenbach, Greenleaf & Murphy, 2017).

Participating schools will acquire a strong foundation for comprehensive academic literacy improvement through a set of coherent, local capacity-building activities and support structures: cross-disciplinary school teams; team meetings facilitated by TLs and joined at times by administrators; TLs leading from their own RA classroom practice and supported by a community of other TLs; the SLI national office, and Partners (Districts, Educational Service Agencies) who have solid track records of working closely with schools on instructional improvement (See Table 3 below and letters of support, Appendix D). Participating schools and districts will receive curriculum resources aligned to science, engineering, and literacy standards,

resources which will support ongoing implementation of STEM/literacy integration to increase both STEM and literacy achievement.

The project also capitalizes on relationships with **regional partners and Reading Apprenticeship Consultants (see Table 3 and Section C: Management Plan)** who host PD institutes and provide support for program implementation. Under this grant several regional organizations will build their capacity to support literacy development as partners in this program (for example, the Oklahoma State Department of Education, the Onondaga-Cortland-Madison BOCES in New York, and the Region 18 Texas Center for Educator Effectiveness. Over the past several years, SLI has seen increasing stakeholder support at higher levels of the educational system, such as county offices of education, intermediate units and state departments of education. Through its prior dissemination grants, SLI has been able to expand its reach significantly, thanks to the support and commitment of key stakeholders at the school, district, county, and state levels. While these groups are not always directly involved with the implementation of RA in the classroom, they are able to use their own resources to convene teachers across multiple districts to build learning communities, provide technical assistance to schools and districts, and disseminate information.

A4. SETDI Services Focus on Those with Greatest Needs and

A5: SETDI is Appropriate For and Will Successfully Address the Needs of the Target Population or Other Identified Needs.

As noted in the September 25, 2017 Presidential Memo to the Secretary of Education and numerous labor reports (e.g. http://www.esa.doc.gov/sites/default/files/stem-jobs-2017-update.pdf), our county has a growing need for a workforce equipped with strong STEM skills. Additionally, STEM workers make higher wages, drive innovation, and moreover have the flexible, problem-solving skills needed in today's economy. However, many U.S. students lack access to high quality STEM education, and many secondary science and engineering teachers lack the preparation and ongoing support needed to shift their practice to engage their broad range of students in the kinds of problem solving and literacy tasks required to be college- and

STEM career-ready. Low academic literacy compounds students' risk of failure in science and other subject area classes (O'Reilly & McNamara, 2007). When students cannot read well enough to learn from academic texts, their risk of academic failure in all subjects is heightened. SLI has worked successfully with diverse school districts and populations of high need students across the country, and as pointed out in Significance (Section B below), multiple studies show RA has a positive, strong impact in varied settings and with students who are below proficiency levels. Moreover, through work with science teachers in multiple large-scale projects, RA has made significant positive impacts on students' literacy and science learning simultaneously.

For the SETDI project, SLI will partner with school districts and regional partners in seven states who have written letters of support and committed to cost sharing. The participating schools and districts: 1) serve concentrations of high needs students with low levels of literacy and science achievement; 2) have large populations of groups underrepresented in science and engineering fields, including students living in poverty; 3) need to increase student achievement in both literacy and science; and 4) need workforce development in science and engineering to support economic redevelopment. While we do not have enough space to list all the district and regional needs in detail, Table 3 below includes highlights. See Appendix F for demographics. By supporting Sci/Eng teachers and their cross-disciplinary colleagues to develop effective literacy instruction across the academic curriculum, the project is designed to prepare high needs students to meet the academic and workforce needs summarized below.

Table 3: Targeted Populations. Academic and Workforce Needs

California	Coordinating Partner: SLI Consultant and Facilitator, Gayle Cribb Select Districts: Fresno COE, Dinuba, Los Angeles, New Haven, Winters
Academic and STEM Workforce Needs: California public schools serve some of the highest percentages of ELLs in the nation and Spanish is often L1. Our select districts serve small rural communities as well as large urban areas. Because of its thriving agricultural, energy, and tech industries, the state has a well-documented need for scientists and engineers. For example, in Fresno County, 40% of students are long-term ELs with low graduation rates. Just 55% of middle school and only 42% of high school students meet CA proficiency standard in Science and ELA proficiency levels hover in the low 40%ile. In LAUSD for example, only 39.6% of	

students reach proficiency on ELA tests. The average Hispanic/Latino population of participating CA schools is 73% and the EL population average is 26%. More than 66% of the students are low SES.	
Georgia	Coordinating Partner: SLI Consultant and Facilitator, Gayle Cribb District: Atlanta Public Schools
Academic and STEM Workforce Needs: Atlantic Public Schools serves high needs African American and low SES students. Georgia's Workforce 2024 report and the Georgia 2024 Occupational report show that almost all the jobs of the future require bachelor's degrees, and most require STEM skills. High-tech industries are projected to add over 10,000 jobs by 2024; management, scientific, and technical services which will grow by over 8,000 jobs; and architectural and engineering services which will add nearly 5,300 new jobs in this period. Driven by the Governor's charge to improve student achievement and college readiness to meet the demands of new industries in the State, the Georgia DOE has identified literacy as a significant issue and has targeted districts, including Atlanta Public Schools, for improvement. In Atlanta Public Schools, only one third of 8th grade students are proficient in ELA and Math. Only 21% meet the state standard for Science proficiency. Atlanta's student population is predominantly African American, and 75% are low SES.	
Oklahoma	Coordinating Partner: Oklahoma State Department of Education
Academic and Workforce Needs: Oklahoma serves a high needs population of low SES students and the OK DOE has identified 9 districts for potential participation in SETDI to build literacy, science and engineering skills. An Oklahoma Employment Security Commission report (2016) states that STEM occupations are becoming an increasingly vital part of Oklahoma's economy. Projected job growth for STEM occupations between 2014-2024 is 11%, compared to the overall growth of 9% projected for all occupations. During this 10-year time period, Geosciences, Environmental Science, and Life Sciences are expected to grow by 13%, 12%, and 12% respectively. In 2017, 41% of Oklahoma's 8th graders met proficiency levels in science, and 35% of 8th graders met proficiency levels in ELA. For the same year, 35% of 10th graders in Oklahoma met these levels in science, while 36% tested at the same levels in ELA. Targeted districts serve as much as 95% low SES students with proficiency scores in ELA as low as 15% and in science as low as 16%	
Michigan	Coordinating Partner: SLI Michigan State Coordinator, Dr. William Loyd Select Districts: Berkley, Charlotte, Lakewood, Milan, Waverly
Academic and Workforce Needs: The deindustrialization of Michigan has had a significant impact on economic prosperity, population size, and urban vitality in the state over several decades. Michigan is currently ranked 32nd in technical education skills, 30th in educational attainment, and 31st in per capita income (Business Leaders for Michigan, 2018). Michigan ranks in the lower 1/3 of all states' performance on the 2017 NAEP for 4th grade reading (35th nationally), 4th grade math (38th), 8th grade reading (30th), and math (33rd). Michigan is one of only five states where reading scores declined between 2003 and 2015.	
New York (Central and Upstate)	Coordinating Partner: Jenifer Spong, Assistant Superintendent for Instructional Support Services at Onondaga-Cortland-Madison BOCES Select Districts: Baldwinsville**,** Cortland, Lafayette**,** Lansing**,** Potsdam, Solvay Union
Academic and Workforce Needs: The regions of Central and Upstate New York served by the Onondaga-Cortland-Madison BOCES are some of the most economically depressed areas in the country, despite nearby medical and engineering industries seeking a highly skilled workforce. The NY State Plan for STEM specifically calls out STEM/Literacy connections and the need for focused	

professional development in order to meet projected job growth in science and engineering over the next several years. In this region, ELA and science proficiency levels reach only ~50% of students for most participating schools, and science proficiency drops to only ~30% by high school. In these regions of New York, almost 40% of districts are categorized as rural, including Lafayette City School District which also has a large American Indian population. The participating schools average 47% low SES.	
Texas	Coordinating Partner: Daryl Michel, Director of School Improvement at Region 18 Texas Center for Educator Effectiveness (TXCEE) Select Districts: Beaumont & Harlingen
Academic and Workforce Needs: TXCEE serves a number of districts in Texas with large high-needs populations, and the state has a well-known need for skilled scientists and engineers to work in its energy and agricultural industries. In two of the districts, 75% of the students are low SES, and in one school 42% of students are classified as ELLs. The state has set goals for science and literacy learning articulated in the Texas Essential Skills and Knowledge Standards -- 30% of Hispanic and 40% of African American students are not meeting STAAR Level II proficiency standards.	
Washington	Coordinating Partner: SLI Consultant and Facilitator, Gayle Cribb District: Highline Public Schools
Academic and Workforce Needs: Washington State is expected to create 740,000 new jobs nationally over the next five years and over 240,000 of these will be STEM-related. Yet Washington ranks 49th in the nation in the production of engineers. Equally concerning is the lack of school supports to help underrepresented groups of students pursue pathways to science and engineering fields. In 2013, House Bill 1872 established "a comprehensive initiative to increase learning opportunities and improve educational outcomes in science, technology, engineering and mathematics through multiple strategies and statewide partnerships." As of 2019, all high school students will be required to successfully complete three high school science classes. Almost half (48%) of Highline's students are below proficiency level in Science; 72% are low SES; 15% are Special Ed; and, 26% are ELL.	

B. SIGNIFICANCE

B.1 The Importance or Magnitude of the Results or Outcomes Likely to be Attained by the Proposed Project, Especially Improvements in Teaching and Student Achievement.

Reading Apprenticeship is one of very few professional development models that have been able to show a clear correlation between changes in teacher classroom practice and impacts on students' learning and social engagement (see www.evidenceforessa.org; CASEL, 2015). We expect the importance and magnitude of this project's results to be significant based on prior strong evidence that met WWC standards without reservation (WWC, 2009; 2010). Since 1995, over a dozen research studies have been conducted to evaluate the effectiveness of RA, including

several that utilized an external evaluation team and a strong experimental design to gauge program impacts (Greenleaf, et al., 2009; Greenleaf, et al., 2011a; Greenleaf, et al., 2011b; Kemple, et al., 2008; Somers, et al., 2010; Fancsali, et al., 2015). These studies targeted high needs populations including ELLs, low SES, and low achieving students. They collectively demonstrate that the RA intervention proposed in this application effectively improves student achievement on state-mandated norm-referenced tests in English language arts, reading comprehension, history, and science. These studies have also demonstrated strong positive effects on teacher practice resulting from RA professional development. They also show positive effects on students' literacy achievement, motivation, and engagement and demonstrate that English learners benefited disproportionately from RA instruction. Thus, prior experimental studies represent considerable evidence that RA strengthens literacy instruction and improves student achievement in both literacy and content area skills and knowledge, with effect sizes for achievement that constitute educationally meaningful gains. The multiple studies also demonstrate external validity, in that RA has been tested in multiple contexts with diverse student and teacher populations, moderately large sample sizes, and different subject areas.

Reading Apprenticeship Addresses Student and Teacher Needs for Science Literacy

SETDI will provide approximately 500 middle and high school science and engineering teachers as well as 1000 teachers from other disciplines in their schools with evidence-based PD, impacting ~100,000 students. While RA PD has been shown effective in subject areas such as ELA and history, for the purposes of this proposal we highlight the fact that several studies funded by NSF and IES and conducted by external evaluation teams found RA PD to have a positive impact on science teachers' literacy instruction, students' opportunities to learn, and students' achievement of academic literacy in science classrooms (Fancsali, Abe, Piatigorsky, et al., 2015; Goldman, Greenleaf, et al., 2016; Greenleaf, et al., 2009; Greenleaf, et al., 2011b; Somers et al., 2010). These studies focused on achievement in reading and science content learning. Based on this prior evidence of success, we anticipate the project will demonstrate similar gains in student literacy and science achievement as well as add important knowledge to

the field about the efficacy of online and face-to-face professional development to improve teacher effectiveness and support student literacy achievement. The project promises to build deeper understandings about varied formats of PD delivery (blended) as well as the potential of teacher leadership and material support for increasing teacher effectiveness and sustainability. We anticipate that participating teachers will gain greater capacity to integrate literacy practices into ongoing Sci/Eng teaching, leading to positive impacts on student literacy and science achievement. The project is thereby expected to increase the number of effective teachers in middle and high school subject area classrooms serving high needs students.

B2. The Extent to Which the Costs are Reasonable in Relation to the Number of Persons to be Served and to the Anticipated Results and Benefits.

High quality professional development must be both accessible and cost-effective to be feasible at scale. A report comparing RA to other literacy programs for adolescents concluded that the overall cost of RA "is relatively modest because no additional personnel, materials, or facilities are needed" (Levin, Catlin & Elson, 2010). In addition, because RA has been shown to increase students' literacy and subject area achievement simultaneously, RA provides a great deal of competitive advantage and efficiency. Prior studies of RA at scale have entailed 10 days of face-to-face PD for discipline-specific groups or combinations of face-to-face and online learning. For this SEED grant, we propose a model of professional development for 1500 middle and high school subject area teachers that includes 5 days of face-to-face PD accompanied by 12 hours of synchronous and asynchronous online learning. In addition, Sci/Eng Design Group members will receive 62 hours of support in similar, blended learning venues and develop topic-linked text inquiries for dissemination and use by participating science and engineering teachers to support their implementation of RA. Though it is hard to estimate the cost-savings of the proposed Design Group resources, they would undoubtedly represent a valuable resource and enormous efficiency for Sci/Eng teachers. A recent study of CCSS implementation documented that secondary ELA and math teachers spend many hours every week searching for standards-aligned texts and developing lessons (Opfer, Kaufman, & Thompson, 2016). If each teacher were

to develop their own text inquiries rather than putting to use the curriculum developed proposed here, they would spend many hours doing so, with less guarantee of high quality results (Hiebert, 2017). Finally, to build capacity and yet provide sufficient and high-quality support for sustained instructional improvement, the proposed project builds in strong support for teacher leaders and school teams led by TLs to provide ongoing implementation support for participating teachers. By testing the impact of this model on student outcomes, we will be providing an important existence proof of implementing high quality PD in a cost-effective and sustainable manner.

B3. The Potential for the Incorporation of Project Purposes, Activities, or Benefits into the Ongoing Program of the Agency or Organization at the End of Federal Funding

In implementing fundamental instructional change, teacher buy-in and ownership are key (Elmore, 1996; Dolle et. al., 2013). The report by Levin, Catlin & Elson concluded that "involving administrators and situating [RA] implementation in the subject areas has created collaborative cultures of literacy with extensive administrative support" (Levin, Catlin, & Elson, 2010). RA leadership development draws on recent understandings of the vital roles played by deep internalization of new practices by teachers (Coburn, 2003) and local buy-in and ownership in sustaining reform (Bryk & Schneider, 2002; Spillane, Reiser, & Reimer, 2002). With SETDI's focus on providing follow-up support for schools as teacher teams, TLs and site administrators work together to build strong academic literacy support across their schools, creating greater likelihood that practices will be integrated into instruction and sustained in participating schools.

Teacher Benefits and Sustainability of Practice Change. Because the aim of SETDI is to improve teacher practice while at the same time building ongoing capacity through TLs, cross-disciplinary school teams, and open source curriculum materials, our main focus, **teachers**, will continue to implement new teaching routines and have support for ongoing inquiry well beyond the grant. In a recent study, we found that teachers continue to implement Reading Apprenticeship years after they first experience the PD (Greenleaf, Litman, & Marple, 2018).

Teacher Leadership Development and Support. TLs will carry out a range of activities—from supporting development of strong school literacy teams to regularly making

connections between the focus of the RA approach and other local reforms, pressures, and opportunities. The project builds teacher leadership through ongoing reflection on practice and by offering a range of PD opportunities specifically designed to build teacher ownership of the initiative. Team meetings are designed to reduce the isolation of teachers, and to create the necessary space, time and autonomy for teachers to collectively improve instruction at the school. Team meetings and TL support, in turn, have been shown to build increased teacher satisfaction and collaborative relationships, foster teachers' growth and development, and develop cultures of shared self-assessment and accountability (Saunders, et al., 2017).

Potential for District-Wide Scale. Because RA is not dependent on textbook or scripted curriculum adoption, it often serves as the vehicle for district coherence around instructional change, helping administrators and teachers focus their change-management structures such as five-year literacy plans, Instructional Leadership Teams, peer observation routines, teacher evaluations, and professional learning communities. Many cases in which RA became a school or districtwide focus for reform are documented in *Leading for Literacy*. The time limit of this grant opportunity does not allow for SETDI to measure district-wide change, but we think it is very likely, based on what we have observed in schools and districts that participated in prior large-scale dissemination grants, that many of the SETDI districts will take up this lasting systemic-change work and leverage local resources to support it. See the attached one-page description in Appendix I, *A Systemic Approach to Disciplinary Literacy*, for an outline of the structures that most often make transformative literacy reforms a lasting feature of school sites.

Regional Support Capacity Building. By working with regional partners who connect with participating administrators and teacher leaders on a regular basis, SETDI builds local knowledge and capacity needed to support instructional change through ongoing inquiry and deeper literacy instruction in the content areas. SLI convenes partners from each state regularly to deepen their own knowledge of RA and share best practices. In addition, partners build relationships with schools centered on supporting instructional change -- they problem-solve local implementation issues with TLs, work with administrators to build coherence with other

initiatives, inform the evaluation and formative assessment by sharing local context with project leaders and evaluators, and serve as key ambassadors for disseminating information and knowledge gained from the project.

B4. The Extent to Which the Results of the Proposed Project are to be Disseminated in Ways that Will Enable Others to Use the Information or Strategies

As an organization that develops networks among practitioners, researchers, and policy makers, WestEd has highly regarded, stable outreach structures that ensure new knowledge and resources reach thousands every month. These include: an award-winning website (www.wested.org), Comprehensive Centers which serve large numbers of teachers and districts (e.g. https://macc-atwested.org/), a strong social media presence, and print products that disseminate information about its projects to a broad range of audiences, including email lists of 80,000 contacts. In addition, SLI leaders distribute information about literacy practices, teacher practice change, and student learning through our own ongoing publication program in books, chapters, and refereed journal articles (see vita of key personnel in Appendix A), through social media, and via webinars and presentations at educator conferences such as NSTA, AERA, the International Literacy Association, and the National School Board Association. SLI's dynamic website and social media outlets are also venues for dissemination and RA resources (www.readingapprenticeship.org; www.facebook.com/readapprentice). Our website offers freely available downloadable resources from *Leading for Literacy* as well as *Reading for Understanding* to support ongoing implementation of RA. Videos of classroom instruction integrating literacy and subject area teaching offer attainable visions of supportive inquiry learning cultures teachers can emulate.

As a recipient of several U.S. Department of Education research grants, SLI has been invited to present our findings in multiple venues, and our work is featured on the Doing What Works adolescent literacy website. In addition, as a prior SEED grantee, every 6-8 weeks SLI program leads co-facilitate an online community of practice (CoP), designing and co-leading webinars for the SEED Teacher Feedback and Coaching CoP. In this capacity, SLI staff recently

collaborated with Mathematica-MPR on writing a SEED Insights Brief, "Implementing Online Professional Learning Communities: Insights from WestEd's Blended Professional Development Model," summarizing RA's unique blended learning model. The brief was launched at a national SEED-sponsored webinar on May 9, 2018. SLI staff also regularly participate in a variety of meetings of the TQP TA Center Virtual CoP to support collaborative efforts among members.

In addition to this strong track record for exemplary dissemination of knowledge and services to advance academic literacy and teacher effectiveness, SLI will broadly disseminate the curriculum resources that emanate from SETDI grant activities. SLI will make the topic-linked text inquiries available on the readingapprenticeship.org website, on the websites of participating schools and districts, and through partnering agencies that provide technical assistance to schools. We will also seek to disseminate these topic-linked text inquiries to state departments of education and key educator groups such as the National Science Teachers Association. Because these text inquiries will be built from high quality, freely available open sources via the websites of scientific government agencies and universities, all curriculum resources will be open sourced and freely available. Further, because the text inquiries will be field tested and informed by Sci/Eng teachers, STEM leaders, literacy researchers and library science experts, they will meet rigorous criteria for quality and feasibility.

Finally, with each of our innovation and research projects, SLI integrates new knowledge, strategies, and materials and dissemination structures into its RA service line. New sequences, teaching routines, and subject area tools are incorporated into PD agendas; these agendas are the focal point in our Facilitator Training program, and then disseminated through our ongoing fee for service work (see www.readingapprenticeship.org). Each year, SLI works with about 2000 educators from all over the country via contracts with districts. All of these future participants would thereby benefit from the work and lessons learned in this grant.

C. QUALITY OF THE MANAGEMENT PLAN

C1. The Extent to Which the Goals, Objectives, and Outcomes are Clearly Specified and Measurable.

SLI has successfully managed many national projects and research studies supported by federal grants, and our organization has strong, stable human and fiscal resources to assure the success of SETDI. Table 4 below outlines SETDI goals, objectives, projected outcomes, and measures. Measures are defined in the evaluation, Section D.

Table 4: Measurable Goals & Objectives in Support of Abs. Pri. 1 & Competitive Preference 1

Goal 1: Increase the number of highly effective middle and high school teachers serving high needs students by engaging 1,500 teachers in Reading Apprenticeship professional development.	
Objectives	Outcomes, Documentation, Measures
Objective 1: Refine blended science PD model for Sci/Eng and assure quality of facilitation. WestEd and facilitators enact formative assessment for continuous program improvement	Sci/Eng PD prepared for use in Year 1, refined in Years 2 & 3 based on formative assessment. • 20 experienced Reading Apprenticeship facilitators well prepared to provide Sci/Eng and Cross Disciplinary PD • *Facilitator Attendance; Facilitator agendas with rationales, goals, and timing; Facilitator PD reports and reflection protocols*
Objective 2: Recruit 1,500 middle and high school teachers for engagement in project. Secure agreements with 50 schools for research study to examine the impact of the program	1500 middle and high school teachers commit to participate in PD, of which 500 teach science or engineering • *MOUs with districts and schools serving high need students: low achieving, rural, low SES, ELL, and underrepresented groups* • *50 schools sign MOUs agreeing to random assignment and other research study requirements* • *1500 teacher applications & commitment forms*
Objective 3: 1,500 teachers participate in Reading Apprenticeship Summer Institutes and online professional development; Subset of Sci/Eng teachers participate in Design Groups	Teachers experience, understand and practice Reading Apprenticeship literacy and content area learning inquiries • 1500 Teachers participate fully in the PD • *Attendance logs* • *Topic-linked text inquiries include open source text sets, tasks and teacher guides for Sci/Eng classes*
GOAL 2: Improve middle and high school students' reading comprehension and science achievement by increasing opportunities to collaborate and engage with more varied and challenging Sci/Eng tasks and texts	
Objective 1: Teachers provide effective instruction for discipline-specific reading comprehension by implementing Reading	RA teachers increase use of student collaboration strategies and reading with varied texts • *T Measures: Surveys, Observations for subset* RA students gain in literacy and science achievement on standardized tests

Apprenticeship in science and engineering classes	• *S Measures: GISA test of literacy in science; State ELA and science test scores; Surveys for subset*
GOAL 3: Build local capacity for sustained implementation and dissemination through teacher leader development, regional support and new tools	
Objective 1: Prepare, facilitate, implement and refine Reading Apprenticeship Teacher Leader Course	Articulated goals, rationale, materials and activities for TL development • *High quality facilitation guides & materials* • *Online course and digital materials*
Objective 2: Teacher leaders show strong levels of RA implementation, attend PD and hold regular school team meetings to inquire into practice, share learning, and support one another's continuous growth.	380 teacher leaders have the experience, knowledge and tools to support colleagues at their site • *TL Meeting agendas and attendance data* • *TL Surveys & Focus Group Interviews*
Objective 3: Prepare, refine and disseminate Design Group processes and topic-linked text inquiries	Refined processes, criteria and rubrics • *Text Inquiry Teacher Guides* New knowledge about how science and engineering teachers learn to design high quality curriculum resources • *Grant reports, SLI & researchers' publications* Topic-linked inquiries and teacher guides are available on open access web-based outlets, RA.org, etc. • *Download reports*

C2. The Adequacy of the Management Plan to Achieve the Objectives of the Proposed Project on Time and Within Budget, Including Clearly Defined Responsibilities, Timelines, and Milestones for Accomplishing Project Tasks

SLI and partners will meet the project goals through timeline, activities and responsibilities detailed in Table 5 below. To do so, project directors will convene both phone and video conferences and face to face meetings, utilize online & cloud tools such as Box, Smartsheet, Salesforce, Zoom and Canvas to organize and distribute information and manage logistical details and develop courses to build needed knowledge about the program and framework for partners in varied roles (teachers, teacher leaders, administrators, regional partners, evaluators, facilitators of professional development). SLI's operations staff will skillfully use project management tools to track recruitment, participation, and logistics for event planning; they regularly support high quality delivery of services to thousands of teachers per

year. Subgroups will meet regularly to manage project activities and ensure their timely completion. The PD design team develops professional development agendas for face to face and online learning components, develops online courses for teacher leaders and administrators, trains facilitators and ensures the quality of professional development through ongoing Facilitator Learning Communities, develops agendas for regional Teacher Leader meetings, disseminates site team meeting agendas to support the work of teacher leaders, collects ongoing formative responses to professional development sessions from participants, and works with the research and management teams to build shared understandings of program activities, logistical arrangements, and goals. Their expertise in designing and enacting online and in-person professional development for teachers, teacher leaders and partners in varied administrative roles is key to the success and longevity of SLI's 25+ year program of work. The evaluation team composed of external evaluators and project directors will meet two times per month in the early stage of the project to finalize evaluation plans, complete recruitment and consent processes, and develop communications and logistics for the collection and management of formative and summative data. Thereafter, the team will meet monthly to ensure data collection proceeds as planned for the randomized controlled trial. The formative research team will collect and analyze formative data from additional scale up sites not involved in the randomized study to inform program improvement, alert project directors to challenges or needs in particular sites, and enable contextual factors and innovations supporting strong implementation to spread beyond individual sites. Formative research team members and university partners will also document and study the implementation and outcomes from the text inquiry Design Groups. All partner management will be carried out by the project directors, together with the professional development design lead, through quarterly online meetings across all LEA coordinators and through individual monthly phone meetings. These meetings enable SLI to communicate efficiently regarding program activities and partner roles, to hear from partners about their contexts and challenges, and to support partners and sites to develop teacher leadership, document program activities, facilitate data collection, and implement and sustain Reading

Apprenticeship in Sci/Eng and other content area classes. SLI's financial analyst will work closely with the project managers to track and report all expenditures.

Leadership, Track Record and Field Recognition. WestEd has extensive experience and capacity to carry out the proposed SEED project. Our Reading Apprenticeship leadership, organizational infrastructure, human capital and material resources assure that the proposed scope of work will be well executed. The project will be overseen by SLI Co-Director, Dr. Cynthia Greenleaf. Greenleaf has published and presented research on the RA model broadly, thereby influencing the fields of adolescent and disciplinary literacy (see Resumes, Appendix A). RA has received widespread recognition for its unique characteristics and effectiveness by leaders in the field, as the many publications citing it attest (e.g. Biancarosa & Snow, 2004; Deschler, et al., 2007; Lee & Spratley, 2010; Snow, Griffin, & Burns, 2006). Additionally, Greenleaf's experience as PI and Co-PI on federally funded research studies and three current Office of Innovation grants attest to her qualifications.

Intervention Fidelity and Quality. Also, key to the execution of this proposed work are over 50 certified consultants around the country who have deep RA experience and expertise. Sixteen of these consultants have secondary STEM teaching experience. Most are active classroom teachers, assuring credible leading from practice; their continual growth is supported by participation in "Facilitator Central," an online learning program managed by SLI. To support RA consistency and quality of implementation, SLI has an extensive materials library that includes assessment tools, curriculum examples, online course materials, videos of RA teachers in varied, real classroom settings, and facilitation guides. SLI's social media channels and website, www.readingapprenticeship.org, make many resources available to a wide audience.

Table 5: Project Timeline with Milestones and Roles

Goal 1: Increase the number of highly effective middle and high school teachers serving high needs students by engaging 1,500 teachers in Reading Apprenticeship professional development.			
Objectives	**Dates**	**Activities/Roles**	**Milestones**
Objective 1: Refine blended Sci/Eng PD model and assure quality of facilitation	Year 1	SLI refine Sci/Eng PD	Completed facilitation guides & agendas for all face-to-face PD
		SLI refine online components for Sci/Eng	Completed online components for PD
		SLI lead Sci/Eng facilitator training/facilitator learning communities	16+ well-prepared Sci/Eng facilitators
	Year 2	SLI-led Sci/Eng facilitator learning communities continue	16+ Sci/Eng facilitators deliver PD
Objective 2: Recruit 1,500 secondary school teachers for engagement in project. 500 of these are Sci/Eng teachers participating in Sci/Eng PD. 1000 are teachers of other academic subjects participating in Cross-Disciplinary PD. Secure agreements with 50 schools for research study to examine the impact of the program	Year 1	SLI & partners recruit RCT and non-RCT sites for Cohort 1	400 Ts recruited. ~150 are RCT Ts
		IMPAQ randomize by cluster, assign treatment (Tx) /control (Ctrl) sites	Permissions, consents, IRB in place
	Year 2	SLI & partners recruit Cohort 2	An additional 550 Ts recruited
	Year 3	SLI & partners recruit Cohort 3	RCT Ctrl and Cohort 3 = +**550** Ts
	IF AWARDED ADDITIONAL FUNDING		
	Year 4	SLI & partners recruit Cohort 4	Sci/Eng teachers, Cohort 4 = +400 Ts
Objective 3: 1,500 teachers participate in RA Summer Institutes and online professional development. Subset of Sci/Eng teachers participate in Design Groups	Year 1	SLI & Facilitators provide PD Days 1-3 for Cohort 1 Sci/Eng teachers	150+ Sci/Eng teachers & admins participate in institutes
		SLI & Facilitators provide PD Days 1-3 for Cross-Disciplinary teachers	~250 teachers & admins participate in PD
		SLI Sci/Eng PD Lead recruit Design Group 1	10-15 Sci/Eng Ts and librarian in Design Group 1
		SLI Sci/Eng PD Lead develop text inquiry design cycle	Design Group 1 meets 2 days, online grade level & course specific teams

		SLI Sci/Eng PD Lead facilitate inquiry design cycle for Design Group 1; Formative assessment research team perform formative assessment of text inquiry design cycle	Design Group 1 develops topic-linked text sets and tasks for open-source dissemination
	Year 2	SLI & Facilitators provide PD Days 4-5 for Cohort 1; Days 1-3 for Cohort 2	950+ teachers & admins participate in PD
		SLI & Facilitators provide Cohort 1 Sci/Eng & Cross-Disciplinary online learning	950+ teachers & admins participate online learning
		Formative Assessment (FA) research team perform formative assessment of PD: surveys, classroom observations	Formative assessment informs ongoing program improvement
		SLI Sci/Eng PD Lead & Researchers recruit Design Group 2	40 Sci/Eng Ts, Sci/Eng leads, librarians in Design Group 2
		SLI Sci/Eng PD Lead apprentice Design Group 2 at two sites	Design Group 2 begins in two sites
		FA research team perform formative assessment of text inquiry design cycle	Design Group 2 develops topic-linked text sets & tasks for open-source dissemination
		SLI Sci/Eng PD Lead continues working with Design Group 1; FA research team continues	Design Group 1 develops, tests & refines topic-linked text sets & tasks for open-source dissemination
	Year 3	SLI & Facilitators provide PD Days 4-5 for Cohort 2; Days 1-5 for Cohort 3	950 teachers participate in PD
		FA research team performs formative assessment of PD: surveys, classroom observations	Formative assessment informs ongoing program improvement
		FA research team performs formative assessment of text inquiry design cycle	Formative assessment informs ongoing program improvement, produces new knowledge of teacher learning
		SLI Sci/Eng PD Lead continues Design Group 2	Design Group 2 develops topic-linked text sets & tasks for open-source dissemination
	IF AWARDED ADDITIONAL FUNDING		
	Year 4	SLI & Facilitators provide PD Days 1-3 for Cohort 4	400+ teachers participate in PD
	Year 5	SLI & Facilitators provide PD Days 4-5 for Cohort 4	400+ teachers participate in PD

GOAL 2: Improve middle and high school students' reading comprehension, and science achievement by increasing opportunities to collaborate and engage with more varied and challenging STEM tasks and texts			
Objectives	**Dates**	**Activities**	**Milestones**
Objective 1: Teachers provide effective instruction for discipline-specific reading comprehension by implementing RA routines.	Year 2	Cohort 1 Treatment teachers' first year of implementation	Treatment (Tx) Science & engineering teachers implement RA
		IMPAQ begins data collection	Interim ELA, science, and GISA tests collected in Tx and Control (Ctrl) sites
		IMPAQ analyzes formative assessment & informs ongoing program implementation and improvement	T surveys collected in Tx and Ctrl sites; classroom observations & S surveys collected in 30 Sci/Eng classes
	Year 3	Cohort 1 treatment teachers impact year	Tx Science & engineering teachers continue to implement RA
		IMPAQ continues data collection	Impact data collected in Tx and Ctrl sites: ELA and science scores, GISA tests
		IMPAQ analyzes formative assessment & informs ongoing program implementation and improvement	T surveys collected in Tx and Ctrl sites; classroom observations & S surveys collected in 30 Sci/Eng classes
		IMPAQ analyzes and reports on RCT	
		IMPAQ & FA research team report on formative assessment	

GOAL 3: Build local capacity for sustained implementation and dissemination through teacher leader development, regional support and new tools			
Objectives	**Dates**	**Activities**	**Milestones**
Objective 1: Prepare, implement and refine RA Teacher Leadership Course	Year 1	Partners & SLI identify TLs for each participating school	100 TLs identified
	Year 2	Partners & SLI provide TL Course for Cohort 1	~90 TLs trained face to face and online
	Year 3	SLI PD Design Team refine TL Course agendas for Year 2 to explore open source text inquiries	TL Course integrates tools from *Leading for Literacy* to use text inquiries
		Partners & SLI provide TL Course for Cohort 2	140 TLs trained
		Partners & SLI provide TL Course Year 2 for Cohort 1	~110 of TLs continue

	IF AWARDED ADDITIONAL FUNDING		
	Year 4	Partners & SLI provide TL Course Year 2 for Cohort 2	100 TLs trained in face to face and online course
		Partners & SLI provide TL Course for Cohort 3	100 TLs
	Year 5	Partners & SLI provide TL Course for Cohort 4	100 TLs
		Partners & SLI provide TL course Year 2 for Cohort 3	50 TLs continue
Objective 2: Teacher leaders show strong levels of RA implementation, attend PD and hold regular school team meetings to inquire into practice, share learning, and support one another's continuous growth	Year 2	TLs learn, practice protocols from *Leading for Literacy*	TLs lead site team meetings
	Year 3	TLs learn, practice protocols from *Leading for Literacy*	TLs lead site team meetings
	IF AWARDED ADDITIONAL FUNDING		
	Year 4	TLs learn, practice protocols from *Leading for Literacy*	TLs lead site team meetings
	Year 5	TLs learn, practice protocols from *Leading for Literacy*	TLs lead site team meetings
Objective 3: Scale up/ Disseminate Design Group topic-linked text inquiries and text-sets	Year 2	SLI Sci/Eng Lead & Partners disseminate text inquiries through TLs & open source platforms	Text inquiries downloadable from multiple open sites
		Partners & TLs support Sci/Eng teachers to use open source text-sets	TLs lead site teams exploring text inquiries
	Year 3	Partners & TLs support Sci/Eng teachers to use open source text-sets	TLs lead site teams exploring text inquiries
		SLI Sci/Eng Lead & Partners disseminate text inquiries through TLs & open source platforms	Text inquiries downloadable from multiple open sites
	IF AWARDED ADDITIONAL FUNDING		
	Year 4	Partners & TLs support STEM teams to use open source text-sets	TLs lead site teams exploring text inquiries
	Year 5	Partners & TLs support STEM teams to use open source text-sets	TLs lead site teams exploring text inquiries

WestEd Infrastructure. As a WestEd project, SLI is able to draw on the seasoned infrastructure (human resources, finance, contracts, IT, and communications) and resources of a $160+ million national organization. WestEd is a preeminent educational research, development, and service organization with over 700 employees and multiple offices across the country. WestEd has been a leader in moving research into practice by conducting research and development programs, projects, and evaluations; by providing training and technical assistance; and by working with policymakers and practitioners at state and local levels to carry out large-scale school improvement and innovative change efforts. The agency's mission is to promote excellence, achieve equity, and improve learning for children, youth, and adults.

Key Personnel: Roles and Qualifications

WestEd's Strategic Literacy Initiative is the prime applicant and will serve as the lead agency and house key staff. In this role, SLI will: 1) provide differentiated Reading Apprenticeship professional development for Sci/Eng teachers, their subject area colleagues, and teacher leaders and support local partners to lead small learning communities focused on disciplinary literacy instruction; 2) convene regional partners to assess progress, address problems and share best practice; 3) manage the budget and finances; 4) report progress to U.S. Department of Education; 5) disseminate learning nationally; and 6) participate in formative assessment and hold regular status meetings with the evaluators. SLI key staff will manage the proposed project and assure timelines and objectives are met.

Table 6. SLI at WestEd Key Personnel: Roles and Responsibilities

Person, *Title*	**Responsibilities and Qualifications**
Cynthia Greenleaf, PhD ***Principal Investigator***	Dr. Greenleaf is SLI's Co-Director and has extensive experience managing large studies funded by awards from NSF, IES and OII. As PI, Greenleaf will provide overall leadership for the project. She will meet regularly with WestEd and evaluation colleagues, manage the design team working to produce resources for the professional development, oversee the formative evaluation activities and serve as the primary liaison to the external evaluator.

Mira-Lisa Katz, PhD **Mary Stump, MA** ***Co-Project Managers***	**Dr. Katz and Ms. Stump** are Associate Directors at SLI and have managed several i3 and SEED projects. Together they will manage the partners and assist with data collection, planning and analysis of the formative assessment. **Katz** will manage Regional Partners and assist with the formative assessment, convening the group via monthly conference/video calls to plan, assess progress, collaborate and solve problems. Katz has 30 years of experience as a literacy professor, teacher educator and researcher. **Stump** will oversee internal operations, monitor and manage the project plan, reporting and finances. She has worked with SLI since 2002. She has 25 years of experience in education, research, evaluation and non-profit management.
Irisa Charney-Sirott **Heather Howlett** **Willard Brown, PhD** ***PD Design Team, STEM PD Lead***	**Charney-Sirott, Howlett & Brown** will be responsible for managing the implementation of the professional development. They will work to refine the RA model and related facilitation guides and materials, develop the online course and digital material and manage teacher technical support. They also manage facilitator quality and scheduling. **Charney-Sirott and Howlett** have led professional development design and facilitator development for three prior i3 and SEED grants. Both have extensive backgrounds in teacher learning, are expert in online design, and taught history and science at the secondary level. **Dr. Brown** holds a PhD in chemistry and served, with Greenleaf, as the science lead for Project READI team funded by IES's Reading for Understanding Initiative. He will lead the design and implementation of the science and engineering text inquiry Design Groups.
Diane Lee ***Contracts & Finance***	**Lee** has been SLI's Financial Analyst and Program Coordinator since 2011 and has successfully managed several SEED and i3 budgets and extensive contracts. She will monitor and produce budgets, contracts and financial reports, as well as work as the project's coordinator.

Evaluation Personnel: Roles and Qualifications

Our external partner, IMPAQ International, will conduct the evaluation and coordinate their work with Dr. Greenleaf. The evaluation team will report to the Office of Innovation as needed and collaborate with WestEd on reporting and dissemination from the project. Qualifications and roles of key staff are described in Table 7 below. The project will support a Formative Research Team that includes SLI leadership, Dr. Cynthia Greenleaf and Dr. Mira Katz, and two highly regarded experts in literacy development, Dr. Kathleen Hinchman and Dr. Sheila Valencia. These external literacy researchers work adjacent to partnering sites in Washington and central/upstate New York and will assist in the design, formative assessment, and iterative refinement of the science and engineering Design Cycles to study resulting STEM

teacher learning and help to ensure the quality of text inquiries. The Formative Research Team will collect data in Design Group sites, meet regularly to share, analyze and interpret information, and feed their learning back into the program to strengthen it. More detail on the formative research plans is in the Evaluation section.

Table 7. Evaluation Personnel: Roles and Responsibilities

Person, *Title*	Responsibilities and Qualifications
Mikhail Pyatigorsky, PhD ***Lead Evaluator External/RCT***	**Dr. Pyatigorsky** will lead the external evaluation, overseeing research design, management, and reporting. He has over 15 years of experience in quantitative analysis, with expertise in modeling student academic growth, experimental and quasi-experimental methods, and educator training and management. He is currently project director of a three-year randomized controlled trial of RA funded by SEED, and served as impact evaluation technical lead in two previous Department of Ed funded studies of RA.
Kathleen Hinchman, PhD **Shelia Valencia, PhD** ***Advisors***	**Drs. Hinchman & Valencia are highly experienced and well-published** researchers in the field of Adolescent Literacy who work adjacent to partnering sites in Washington and central/upstate New York. They will serve on the formative research team collecting, analyzing and interpreting data for continuous program improvement. **Hinchman** is the Associate Dean of the School of Education and a Professor in the Reading and Language Arts Center at Syracuse University. Once a middle school teacher, she teaches undergraduate and graduate classes in childhood and adolescent literacy. Her research explores youths' and teachers' perspectives toward literacy. **Valencia** is Professor of Language, Literacy, and Culture at the University of Washington, Seattle. She teaches and conducts research in the areas of literacy assessment, instruction, policy, and teacher development. Dr. Valencia studies the development of teachers' conceptual and practical knowledge of literacy and literacy instruction.

Regional Partners: Roles and Qualifications

Regional Partners and state managers recruit high-need schools for participation, convene network meetings of teacher leaders, coordinate the logistics for PD, solve problems, provide ongoing support, and build sustainability and infrastructure. Each partner participates in regular National Partner meetings (hosted via web-based video) managed by WestEd.

Table 8. Regional Partners Personnel: Roles and Responsibilities

Person, *Location*	Responsibilities and Qualifications
Jennifer L. Spong ***Onondaga-Cortland-Madison BOCES, New York***	**Spong** is the Assistant Superintendent for Instructional Support Services at the Onondaga-Cortland-Madison BOCES and will coordinate RA activities in the region. **OCM-BOCES is one of 37 Boards of Cooperative Educational Services** who provide educational programs and services to school districts within the state. Spong's division assists 23 school districts in Central New York with a wide range of services, including professional development, curriculum and instruction, school library systems, science resources, youth development, special education support, teacher evaluations, and more.
WestEd Consultants ***California Georgia, Washington, Michigan***	Reading Apprenticeship experts in CA, GA, NC, and MI and will lead coordination in their states, overseeing recruitment, program implementation and TL Conferences. **CA, GA & WA: Gayle Cribb** has 30+ years of experience teaching history and has been facilitating and designing Reading Apprenticeship PD in California for many years. **MI & NC**: **William Loyd**, PhD, has worked with SLI since 2009. Based in Ann Arbor, Loyd has been an educator and administrator in the state for 30 years. He has coordinated Reading Apprenticeship PD in MI for four prior i3 and SEED projects.
Daryl Michel ***TXCEE, Texas***	Daryl Michel is Director of School Improvement at TXCEE. He will lead recruitment, teacher leader and school support in the state. Michel has worked with SLI and other organizations to infuse best practices in classroom instruction and teacher leadership across the state of TX in a prior SEED grant. **The Texas Center for Educator Excellence (TXCEE)** created the System for Effective Educator Development framework, a district-wide professional learning system that allows for systemic practices that embed educator PD with purposeful collaboration focused on improving instruction and student learning.

The key personnel and partners listed above will assure the proposed project is executed in a timely and efficient manner.

C3. SETDI Procedures for Ensuring Feedback and Continuous Improvement

Formative assessment tools and approaches are built into the professional development sequences and supported with assessment resources such as classroom practice rubrics and student learning goals detailed in the book, *Reading for Understanding*. Feedback from participants is collected at the end of each PD day and PLC meeting. Bi-annual teacher surveys measure teacher perceptions of the professional development; teacher judgments about the fit of Reading Apprenticeship to their student needs; implementation of classroom practices; beliefs about student literacy, learning, and assessment; and teacher confidence, school-level support,

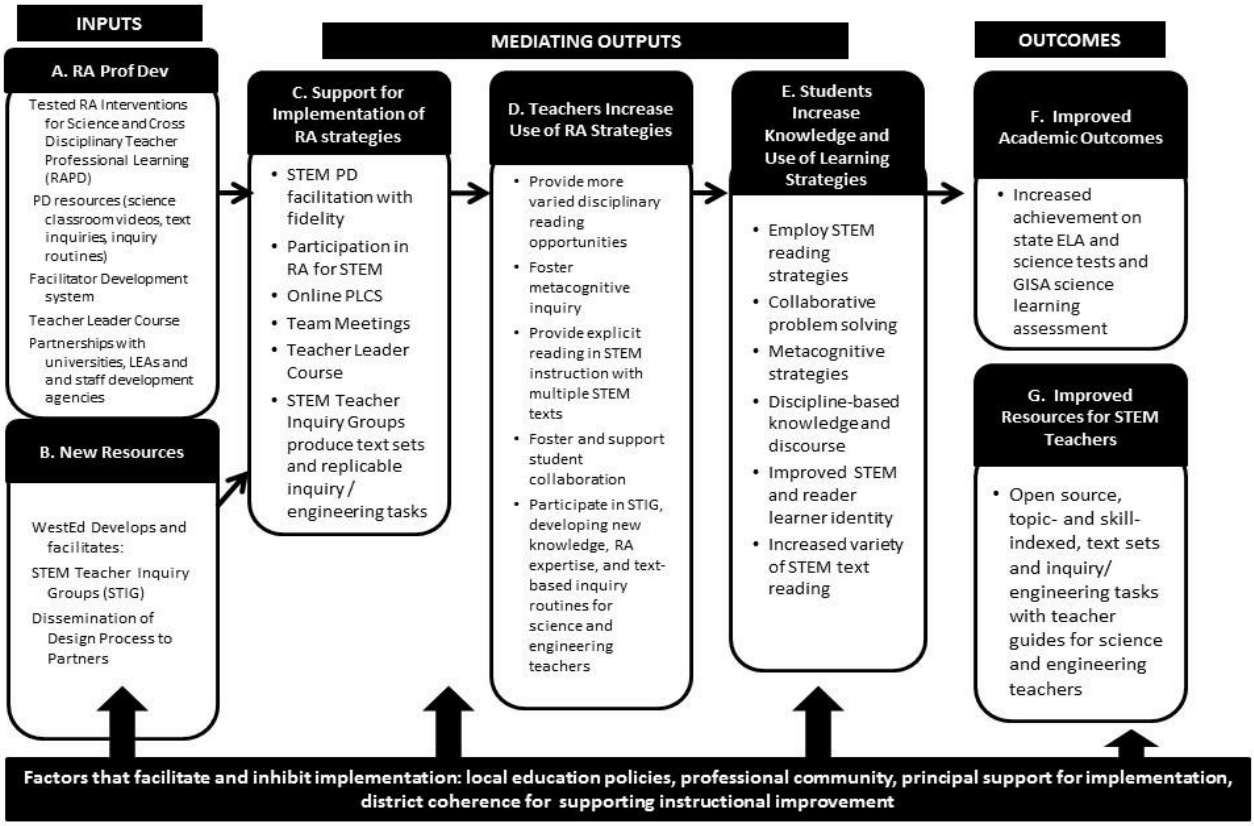
and collegiality. Bi-annual teacher leader surveys add additional information about the degree to which TLs feel prepared for their role, their perceptions of site implementation and support, and additional needs. Quarterly partner surveys gather information about partners' understanding of the project, the adequacy of support offered by SLI, and additional needs for support to improve the project and its effectiveness in particular sites. In addition, SLI's facilitators report back to the PD Design Team about the PD institutes and PLCs that they facilitate to inform the Design Team about any changes needed to the PD agendas and materials, how participants received the PD, and any contextual or policy information that may impact the implementation of RA in specific sites. In FLCs, facilitators share their observations and learning with other facilitators to develop knowledge and improve program implementation across sites. The PD Design Team convenes and participates in these FLCs, and Design Team members themselves facilitate the professional development to obtain an on-the-ground feel for how agendas and learning engagements are working for participants. These many forms of information and data are fed back into the refinement of materials from one institute to the other, and from one year of the program to the next. Thus, SLI engages in continuous improvement processes through ongoing design, enactment in multiple settings, reflection and analysis of feedback, and refinement of agendas, materials, and processes for partner engagement and teacher learning and classroom practice change.

D. QUALITY OF THE PROJECT EVALUTION

IMPAQ International, an independent social policy research firm, will conduct an independent impact evaluation of the SETDI project. IMPAQ will support the recruitment of schools in the impact evaluation, collect data for the evaluation, and execute the impact analysis. SLI staff will provide support to IMPAQ on the research design, school recruitment, analytic approach, and reporting for the evaluation. Additionally, SLI staff will conduct an internal formative evaluation to inform project design and improvement, with support from IMPAQ.

A major study is nearly complete regarding the efficacy of the cross-disciplinary PD model to be used in SETDI. Therefore, because SETDI invests in developing resources and processes to build Sci/Eng teacher effectiveness, and to ensure a robust yet cost effective evaluation, IMPAQ will assess the impact of SETDI on science and engineering teacher effectiveness as measured by student outcomes. The logic informing our project design, as shown in Figure 1, is as follows: professional development in RA, coupled with teacher leadership development and support for implementation, will enable middle and high school science and engineering teachers to integrate academic literacy instruction into ongoing STEM teaching, thereby increasing the quality of students' literacy learning opportunities, leading to increased academic engagement and achievement, especially for high-need students.

Figure 1. Logic Model: Supporting Effective Teaching with Disciplinary Inquiry



D1. Purpose and Extent of the Evaluation

The evaluation of the proposed SETDI project will serve both formative and summative goals and will provide rigorous evidence regarding both the implementation of SETDI and its impacts on teacher effectiveness. The **impact evaluation**, based on a school-level random assignment design, will focus on identifying effects of SETDI on students' science and ELA achievement. *The impact evaluation is designed to meet WWC standards without reservations as described in the WWC Handbook (v. 4.0).* The **formative evaluation** component of the evaluation will focus on implementation of the professional development and teacher supports, teachers' implementation of RA strategies, teacher instruction, and the factors that either support or hinder effective implementation. *The formative evaluation will provide performance feedback and periodic assessment of progress toward achieving intended outcomes.* It will also examine the relationship between implementation and student outcomes.

D2. Research Questions

With these goals in mind, the evaluation will address the following research questions.

Impact Evaluation

1. What is the impact of SETDI on students' **science literacy** among middle and high school students?
2. What is the impact of SETDI on students' **ELA achievement** among middle and high school students?
3. What is the impact of SETDI on students' **science achievement** among middle and high school students?

Formative Evaluation

1. To what extent do teachers participate in planned SETDI activities, such as face-to-face trainings, online PLCs, and school team meetings?
2. To what extent do teacher leaders participate in planned SETDI activities, such as regional network meetings, the online Leadership course, PLCs, and school team meetings?
3. To what extent do teachers participating in SETDI implement RA practices with fidelity?
4. What factors are contributing to or hindering teachers being prepared to implement effective literacy practices in their classrooms?
5. To what extent do participating science teachers demonstrate high quality of instruction?

6. What is the relationship between quality of instruction among science teachers participating in SETDI, fidelity of implementation of SETDI, and students' academic outcomes?

D3. Evaluation Design

Formative Evaluation

By establishing a formative evaluation team with expertise in using formative data to improve instructional innovations, the SETDI project will document and assess the influence of multiple aspects of the project to gauge their success and inform program improvement. IMPAQ will collect feedback on the professional development and supports from teachers in the target group schools via online surveys. In a subset of intervention sites, classroom observations and student surveys will be collected to provide additional data on teacher instruction and student attitudes and dispositions. Formative evaluation will also focus on teacher participation in the professional learning opportunities and document local conditions that support and/or hinder teacher leader development and, thereby, the implementation, dissemination, and sustainability of Reading Apprenticeship instructional practices. Formative data will be rapidly fed back into the design and implementation of project activities through regular meetings among SLI design staff, IMPAQ evaluators, and the formative evaluation team.

The SETDI project invests in building the knowledge and capacity of teacher leaders to support school teams in ongoing RA implementation, as well as to develop literacy leadership for dissemination at the school level. SLI's formative assessment team will collect data including teacher and TL participation records, artifacts from regional TL meetings, surveys of teachers and teacher leaders, and teacher leader focus groups (see Appendix H for details).

Additionally, the formative evaluation team composed of SLI and external researchers will study implementation of SETDI in the Design Group sites. These sites will offer in-depth documentation of teacher learning in the design/enact/refine cycles and the influence of resulting text inquiries on school teams and STEM teacher implementation of the RA framework. Data collected in Design Group sites will enable the formative evaluation team to feed insights for

improvement of the program back to SLI in a timely fashion. The expertise of the team further promises important learning about what STEM teachers learn when supported to design and implement text-rich investigation and engineering curricular resources.

IMPAQ will collect the following data for the formative evaluation. Additional details are provided in Appendix H.

Reading Apprenticeship instructional practices. Instructional practices will be measured via online surveys administered to teachers four times, once in fall and once in spring during each of two implementation years. The surveys will measure fidelity of program implementation and assess differences between the practices of treatment and control teachers. Collecting four surveys from each teacher will allow us to collect multiple practice data, improve instrument reliability, and gather program feedback data closer to key points in the implementation process. The survey was developed in two SEED-funded studies of RA that successfully distinguished treatment and control teacher practices.[1]

***Quality of Instruction*.** Through classroom observations, we will gather firsthand data on the practices and behaviors of a subsample of treatment teachers participating in SETDI. This approach allows us to capture a variety of interactions in natural settings and develop a holistic perspective and understanding of the participating teachers' context. It will also allow us to examine the relationship between these behaviors, the use of RA strategies, and student outcomes. Observations will be conducted by certified observers using the Classroom Assessment Scoring System Secondary (CLASS-S). The CLASS-S is a standardized protocol successfully used to assess the quality of the teachers' social and instructional interactions with students. CLASS-S scales have been found to be reliable and predictive of student gains for

[1] The survey asks teachers about the frequency with which they employ instructional practices identified in the logic model as key indicators of implementation, including student reading opportunities, collaboration, fostering metacognitive inquiry, and providing instruction, modeling and time to practice comprehension strategies. It also includes items on implementation challenges and supports that will help to improve the scaling up of RA to other districts and schools. The survey scales have internal reliabilities ranging from 0.70 to 0.95, from a single administration.

middle and high school professional development (Allen, Pianta, Gregory, Mikami, & Lun, 2011).[2]

Student Behaviors and Attitudes. Student mediating outcomes will be measured in a subset of classrooms via an online survey that successfully distinguished student attitudes, behaviors, dispositions, and learning opportunities between treatment and control conditions in prior studies of RA.[3] The survey is based on validated and reliable scales that include items from the Metacognitive Awareness of Reading Strategies Inventory (Mokhtari and Reichard, 2002) and the BEL-S survey of socioemotional learning factors (Farrington et al., 2012).[4]

Impact Evaluation

The impact evaluation will employ a school-level randomized controlled trial to identify the effects of SETDI on teacher effectiveness in improving student outcomes. The impact evaluation is designed to meet WWC standards without reservations with procedures in place to minimize attrition, ensure baseline equivalence, and use reliable and valid outcome measures that are not over-aligned with the intervention and are collected in the same manner for both intervention and comparison groups. A sample of 50 schools serving middle and high school students will be recruited from districts in California, Georgia, Michigan, New York, Oklahoma, Texas, and Washington. IMPAQ will implement a blocked design, in which half of the schools within each block (typically, a school district or a set of districts within a state)[5] will be randomly assigned to a treatment group and half to a control group. Random assignment will

[2] To collect the data, we will utilize TORSH Talent classroom observation and data management platform, which allows teachers to easily record their lessons using standard (and low cost) video and audio equipment and to securely transfer and store the recordings, in full compliance with FERPA regulations. We will collect recordings from two time periods in each implementation year (one in fall and one in spring of the 2019/20 and 2020/21 school years) from at least one science teacher in each of the participating treatment schools.

[3] The survey will take no more than a class period to complete and will be collected in the spring of 2020 and 2021 from students in at least one science classroom in each of the participating treatment schools.

[4] The survey includes attitudes about the malleability of ability (i.e., "growth mindset") and the payoff to effort, as well as student reports of positive academic behaviors. Previous research indicates that these self-reported academic behaviors, as well as attitudes about intelligence and the value of effort, are significant predictors of academic success. They are also key targets of the RA intervention.

[5] Within each district/group, schools will be further blocked by level, middle vs high school.

occur prior to the 2019-20 school year. It will incorporate most recent baseline data (such as student demographics and student academic achievement in ELA and mathematics). Treatment schools will implement SETDI during the 2019-20 and 2020-21 school years, and control schools will delay implementation until summer 2021. IMPAQ International, the proposed evaluator, has successfully conducted randomized evaluations of RA using similar designs.

The goal of the impact evaluation is to identify the effects of SETDI on students' science achievement, ELA achievement, and science literacy after two full years of implementation. An interim analysis after the first year of implementation will also be performed. The evaluation will focus on participating science classrooms in grades 8 through 11 at each school.

Teachers who are willing to participate in the evaluation will be identified prior to random assignment, and the evaluator will randomly select up to two classes per teacher per year for data collection and analysis.[6] Program impact estimates will be calculated by comparing average outcomes among this sample at the treatment schools to average outcomes among the parallel sample of students in the control schools. In particular, impact estimates will be based on a multi-level model estimating average outcomes as a function of both school baseline variable and student level variables (including demographics and prior performance on state ELA and math assessments),[7] with a dichotomous school level treatment indicator identifying whether or not each school is in the treatment or control group (see Appendix H for details). Table 9 below outlines the data collection timeline for the impact study.

Student outcomes. The impact evaluation will assess the impact of SETDI on several measures of teacher effectiveness that fall within the student outcome domain, as defined in the WWC Review Protocol for Teacher Training, Evaluation, and Compensation (version 3.2). Student performance on state science assessments – end of grade tests administered in grade 8 and end of course assessments (e.g., Biology) in high school grades – in each implementation

[6] Selected classrooms will be compared to grade-wide student populations in order to assess their representativeness.
[7] See Appendix H for details on student records data.

year will be the basis of the estimated SETDI impacts on science content knowledge.[8] State ELA assessments – end of grade tests administered in grade 8 and end of course assessments in high school grades – will measure students' general literacy. Lastly but crucially, we will measure student *science* literacy by administering the Global Integrated Scenario-based Assessments (GISA), developed by the Educational Testing Service (ETS). GISA measures students' ability to form a basic understanding of varied science text types through a variety of task types. Nineteen GISA forms designed for students in grades 3 through 12 have been put on a vertical scale. The vertical scale allows for comparisons of student performance across forms and grade levels and is suitable for use in pre- and post-test intervention research.[9] The reliability of the forms ranges from 0.80 to 0.88. The assessment will be administered online in the spring of each implementation year. Additional details are provided in Appendix H.

Target Population. Consistent with the goals of the intervention, we plan to conduct the evaluation at schools where a sizable student population is performing below grade level in reading, as measured by the state standardized tests. We will also focus recruitment on a mixture of rural, suburban, and urban districts in geographically dispersed locations (California, Georgia, Michigan, New York, Oklahoma, Texas, and Washington). The participating districts serve a concentration of students who are economically disadvantaged, African American (as high as 74%), Hispanic (as high as 92%), and English learners (as high as 42%). Several prior and

[8] We will use the meta-analytic approach described in May and colleagues (2009) and Somers, Zhu, and Wong (2011) to combine results across states in order to take into account differences in scoring on the tests. In effect, student scores on these tests will be translated into "z-scores" that represent each student's position in the distribution of achievement within their state.

[9] GISA forms have been evaluated for elementary (Sabatini, Halderman, O'Reilly, & Weeks, 2016), middle (Sabatini, O'Reilly, Halderman, & Bruce, 2014) and high school students (O'Reilly, Weeks, Sabatini, Halderman, & Steinberg, 2014). Collectively, these studies indicate the assessments are reliable and produce a range of scores with no apparent floor or celling effects. The GISA correlates with the prior year's English Language Arts state test scores ranging from 0.52 to 0.68 (O'Reilly et al., 2014) and correlate with measures of academic vocabulary, complex reasoning, and perspective taking (LaRusso et al., 2016). Other work has shown that GISA scores at specific grades correlate with the Gates-MacGinitie Reading Test in the range of r= 0.65-0.80, while correlations with the SARA reading comprehension subtest (Sabatini, Bruce, & Steinberg, 2013) average about r = 0.65. GISA is a computer delivered assessment that takes about 45-55 minutes to complete.

ongoing evaluations of RA have targeted similarly disadvantaged student populations. The current evaluation of Reading Apprenticeship Across Disciplines (RAAD) comprises schools in which average reading scores are 0.67 standard deviations below average and 74% of the students are economically disadvantaged and 76% are non-White. The evaluation will take place in regular public middle and high schools where the intervention is being offered. Participating schools must serve grade 8 – 11 science and engineering students during the study period, and will exclude charter, magnet, and other specialized schools and programs.

TABLE 9: Evaluation and Data Collection Timeline[10]

	Oct 2018-Aug 2019	Sept 2019-Aug 2020	Sept 2020-Aug 2021
Treatment	2019 Summer Institute	Year 1 implementation Online PLCs School team meetings Winter Institute TL meetings	Year 2 implementation Online PLCs School team meetings TL meetings
Control	Business as usual	Business as usual	2021 Summer Institute
Evaluation Activities	Collection of baseline data Random assignment of schools Collection of PD attendance data	Collection of PD attendance data 2 teacher surveys (fall, spring) 2 classroom observations (fall, spring) Student surveys (spring) Student GISA test (end of year) Collection of student demographics Collection of state test data	Collection of PD attendance data 2 teacher surveys (fall, spring) 2 classroom observations (fall, spring) Student surveys (spring) Student GISA test (end of year) Collection of student demographics Collection of state test data

***Sample Size*.** The evaluation will target teachers of regular science and engineering courses in grades 8 through 11. Teachers must have an intention to continue teaching at the study school during the two-year intervention period and express a willingness to participate in the study prior to random assignment to be eligible. At least two teachers will be recruited in each

[10] The timing of the three-year grant period does not allow for complete student data collection and

school. On average, we expect our sample will include 3 teachers per school, totaling 150 teachers across 50 schools. We will identify the student sample by randomly sampling two regular science or engineering classes taught by each study teacher, in each year of the study (i.e., two separate cohorts of students). Teachers in the study stay consistent from year 1 to year 2. Students in the study include two different cohorts: those in study teachers' science /engineering classes in year 1 and a new group of students in teachers' science/engineering classes in year 2. Assuming an average class size of 25, we expect that our sample will include an average of 120 unique students per school, for a total of 6,000 students across 50 schools in each of the first and second year samples.

Teachers in other subjects – ELA, social studies, career and technical education and mathematics – will also be invited to participate in PD (in the treatment schools) and data collection. Specifically, we will collect information about teachers' attendance of PD and use of RA instructional practices via teacher surveys. This will allow us to construct comprehensive measures of students' exposure to teachers trained in RA strategies and to adjust this metric of dosage for teachers' fidelity of implementation. We will also be able to contrast science and engineering teachers' use of reading and literacy practices to that of teachers in other subjects.

To reduce attrition, all teachers participating in the RCT will be offered incentives for participating in the professional development and data collection. In addition, the evaluation team will mitigate attrition and improve engagement in the study through regular communication with schools and participants and by providing support and assistance with data collection efforts (e.g., assisting with scheduling, providing proctors, etc.) as needed. The evaluation team's data collection methods were highly successful when used in the prior studies of RA. In these studies, the evaluation team experienced zero school-level attrition, low differential attrition between conditions, and acceptably high student and teacher response rates.

Minimum Detectable Effects. The analysis will provide regression-adjusted estimates of impacts using both individual- and school-level covariates. To improve the precision of our impact estimates, we will randomize schools into treatment and control conditions within blocks

based on district, school level (middle vs high school), and, if appropriate, school characteristics (such as percent receiving free & reduced lunch, achievement test scores, and racial/ethnic makeup of the schools). Blocking will also help ensure the schools are equivalent at baseline.

The minimum detectable effect size calculations are derived from Bloom, Richburg-Hayes, and Black (2007). Based on our assumptions,[11] the calculations yield the minimum detectable effect size of 0.207 standard deviations (for 80 percent power at the 0.05 level of significance for a two-sided test). Previous randomized trials of RA have found student level literacy achievement effects of approximately 0.2 to 0.3 standard deviations, with even larger effects for certain subgroups (Greenleaf et al., 2009, 2011; Fancsali et al., 2015). The estimated minimal detectable effect size (MDES) for this evaluation are sufficiently small to suggest that the impact analysis will detect policy relevant effects should they exist.

[11] We assume 50 students per teacher and 20 percent attrition for students and teachers (and zero attrition for schools). Based on the findings from Bloom, Richburg-Hayes, and Black (2007) and prior Reading Apprenticeship evaluations in comparable populations, we conservatively assume that our approach will yield an intraclass correlation (ρ) of 0.3, a school level explanatory power of the impact regression or R-square (R^2_c) of 0.80, and a student level explanatory power of the impact regression or R-square (R^2_i) of 0.15.