_R_ural _O_pportunities through Literacy, _O_bservation, _T_utoring, and _S_TEM (ROOTS)

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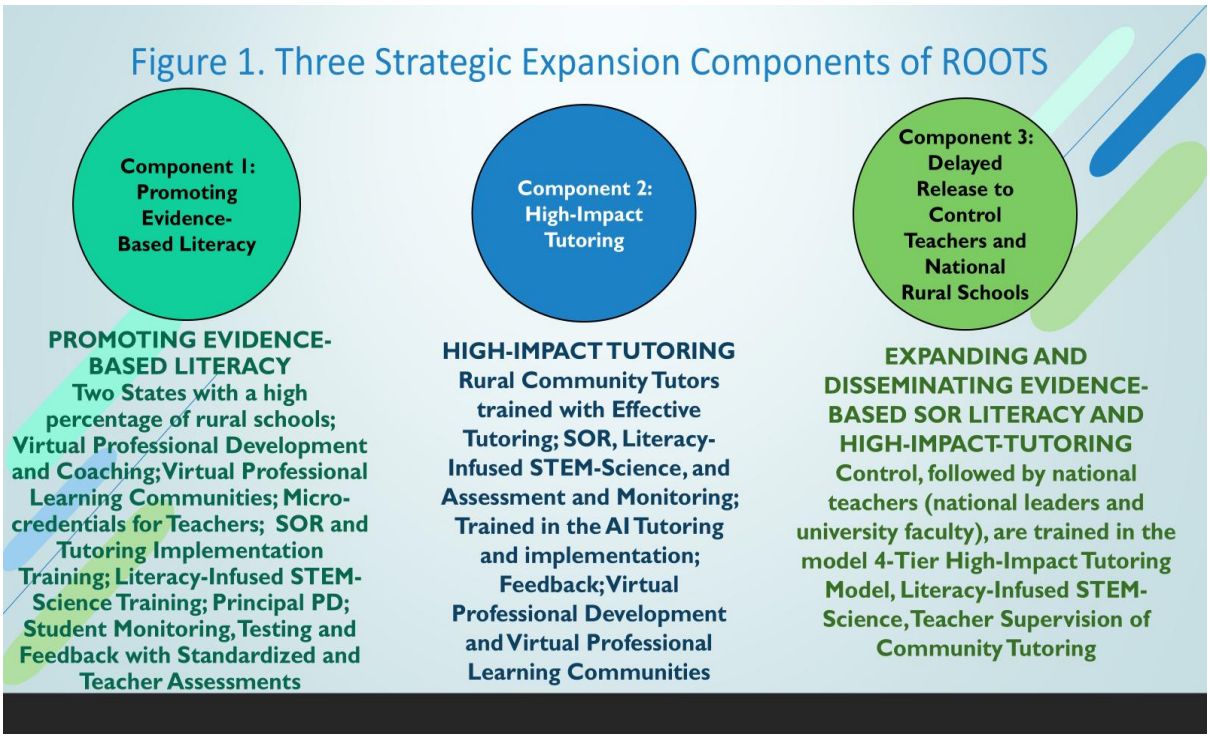
Project ROOTS is submitted as an EIR Expansion grant by the Texas A&M Research Foundation (TAMRF) in partnership with Texas A&M University (TAMU), the TAMU College of Education and Human Development (CEHD), the Center for Research & Development in Dual Language & Literacy (CRDLLA) and the Education Leadership Research Center (ELRC) under Absolute Priority 1 (Promoting Evidence-Based Literacy) and Competitive Priority 2 (High-Impact Tutoring), along with 100 rural Texas and Mississippi local education agencies (LEAs; RLIS-eligible with locale codes 31, 32, 41, 42, and 43), equivalent and inclusive over three years of implementation, 600 teachers, 600 tutors, and 150 preservice teachers, as we take to scale entrepreneurial, evidence-based, field-initiated innovations to improve student achievement of and expand proven literacy instruction for 4,000 high-need students. ROOTS, in partnership with the University of Southern Mississippi (USM), will lead to a practical, affordable, research-backed "edupreneurship" program that can be replicated in school-university partnerships, particularly benefiting the almost 10 million U.S. rural students. ROOTS also has supportive technology partnerships with Walmart and Amira Learning. Texas and Mississippi have significant numbers of students served in rural schools. More than 20% of all Texas public schools are designated as rural, which means that Texas has more rural schools than any other state in the country (Texas Education Agency [TEA], 2023; National Center for Education Statistics [NCES], 2023). Mississippi has one of the highest concentrations of rural schools in the United States, despite its relatively small size. More than half of its public schools are located in rural areas, which is significantly higher than the national average of approximately 28% (Showalter et al., 2023; The Hechinger Report, 2023). Texas has the largest absolute rural student population in the nation, and

Mississippi exemplifies the intensity of need with rural schools dominating the educational setting. Appendix C includes 102 Texas and 12 Mississippi school districts' letters of support and commitment to participate. (This is not all-inclusive of the final numbers we will have for random assignment). Currently, there are 186 schools that house grades 3-5 within all the currently signed 114 districts.

ROOTS will comply with both the Absolute Priority and Competitive Preference Priority 2 guidelines. Under Absolute Priority 1, ROOTS will be undergirded by literacy instruction, which is based on the science of reading (SOR) and, as noted in the EIR RFP, as explicit, systematic, and intentional instruction in phonological awareness, phonics decoding, oral and sign language, vocabulary, language structure, reading fluency, reading comprehension, writing, and knowledge-rich materials. We also use the TEA's and the Mississippi Department of Education's (MDE) definitions of the SOR, which emphasize explicit, systematic, diagnostic, and sequential instruction across all essential reading components: phonological awareness, phonics, fluency, vocabulary, comprehension, and oral and written language development. Instruction is to be intentional, data-driven, and informed by ongoing progress monitoring to ensure each student attains reading proficiency with the systematic application of cognitive, linguistic, and evidence-based practices to deliver high-quality literacy instruction (TEA, 2021a, 2021b, 2024; MDE, 2023, 2024a, 2024b). ROOTS fulfills the two priorities with three specific grant components shown in Figure 1.

Component 1 - Promoting Evidence-Based Literacy. ROOTS delivers 24 hours of professional development (PD; treatment teachers, with delayed release for control teachers), providing literacy micro-credentials for each individual teacher, an increase of 100



micro-credentialed treatment teachers each year who are better prepared to deliver evidence-based reading instruction to infuse literacy into STEM (science) content areas, and guidance on leading the ROOTS initiative, including the supervision of community tutors who provide high-impact literacy tutoring to high-need rural students in grades 3-5. All students whose parents provide consent and students who sign an assent form will be included in the study within the randomly assigned rural schools' identified classrooms and will include high-need students identified as academically at risk. The TEA (2024) and MDE (2023) have identified at-risk student indicators for our high-need student definition: a student who (a) is not meeting the requirements to advance from one grade level to another; (b) is performing below standards/grade-level peers on the state assessment; (c) needs academic literacy reading and language development, and/or (d) is supported with free or reduced lunch. ***Absolute Priority 1. Field-Initiated Innovations: Promoting Evidence-Based Literacy.*** Under ROOTS Component 1, there is evidence, and one literacy study that was found in What Works

Clearinghouse (WWC) *approached meeting the EIR criteria for supporting the ROOTS Expansion grant*, which is strong evidence that overlaps with the proposed study population and setting (i.e., for ROOTS—literacy, grades 3, 4, and/or 5, rural schools, literacy-infused content area reading in science, and at least one statistically significant positive outcome). There were no rural literacy studies shown in the Evidence for Every Student Succeeds Act (ESSA) database that met the same criteria as those in the EIR RFP. The strong evidence, longitudinal study was conducted by Connor et al. (2013; https://ies.ed.gov/ncee/WWC/Study/85765; see Evidence form and Appendix J1) and was focused on individualizing instruction for students' reading in grades 1-3 in Florida. Results indicated statistically significant positive effects on students' letter-word identification after across three years for the full sample. Statistically significant positive effects on students' passage comprehension were found only after one and two years with the full sample. The Connor et al. study included a total of six rural, suburban, and urban schools; however, the numbers for each school type were not mentioned. We share how ROOTS expands the existing base of the WWC study, which received a ***strong evidence*** rating. ROOTS takes literacy development to two states, focusing on 100 rural schools in a longitudinal study, furthering the effects from grade 3 and adding in our study grades 4 and 5. (There are other studies noted that are included in Section B1 Unmet Demand; however, they were not in ROOTS grade levels or rural settings.) Therefore, Component 1 will integrate three synergistic activities: (a) sustained virtual PD (VPD) model (synchronous and asynchronous) focused on SOR strategies related to literacy-infused STEM-science instructional methods [teachers will receive an initial three-hour VPD, then a bi-monthly VPD and three facilitated virtual professional learning communities (VPLCs), similar to collaborative communities of practice,

all facilitated by certificated instructional coordinators, supervised by the PI [redacted] and Co-I [redacted], (b) classroom action research that includes reflection (using the [redacted]) while instructing and collecting data on students, trained and supervised by Co-PI [redacted] and Co-I [redacted], and (c) supervision of community-based literacy tutors aligned with the classroom SOR and literacy-infused science (LIS) curriculum and instruction (supervised by Co-PI [redacted] and Co-I [redacted]). The tutors will be observed by a trained preservice teacher using the Applied Pedagogical EXtra Imaging System (APEXIS) which includes virtual observations and real-time feedback. For teachers, we will record four 20-minute segments of a lesson using the strategies that have been incorporated in lessons followed observations and feedback with virtual mentoring and coaching (VMC; [redacted]) sessions for improvement using a researcher-developed, field-tested feedback rubric that includes items related to SOR and LIS using the Pedagogical Observation Protocol (POP) tested in rural schools as well as the Science Teacher Observation Record (STOR; [redacted]). We will also collaborate with our contracted partner, the School of Education at the University of Southern Mississippi, in implementing these activities. **Component 2 - High-Impact on Literacy Infused Science (LIS) Tutoring.** ROOTS will engage community tutors in rural schools to deliver high-impact literacy tutoring (Robinson & Loeb, 2021), supported by strong evidence from studies. ***Competitive Preference Priority 2: Expanding Education Choice (High-Impact Tutoring).*** There were two studies found in WWC, with each approaching meeting the *EIR criteria for supporting the ROOTS Expansion grant*, with having strong evidence that overlaps with the proposed study component of personalized tutoring, along with the population and setting (i.e., person-to-person, live tutoring, SOR big six components (phonemic awareness, phonics, vocabulary,

fluency, and comprehension), literacy-infusion in content reading, grades 3, 4, and/or 5, and rural schools in multistates, plus AI-supported tutoring). In the WWC strong evidence study, Markovitz et al. (2022; https://ies.ed.gov/ncee/WWC/Study/90652; see Evidence form and Appendix J4) studied the impact of the AmeriCorps live tutoring program in Minnesota and Wisconsin with K-3 students. The study included 14 rural schools and yielded statistically significant results in reading fluency in grades 2 and 3 for the Minnesota students. The Markovitz et al. study did not include any type of web-based tutoring. There was also a study found in WWC that was noted as a web-based approach to tutoring, but with no person-to-person live tutoring, related to text structure patterns to support reading comprehension. ROOTS is inclusive of an artificial intelligence (AI) tutoring platform to complement the person-to-person community tutors; therefore, we include this technology component of tutoring as strong evidence. Wijekumar et al. (2012; https://ies.ed.gov/ncee/WWC/Study/77453; see Evidence form and Appendix J2) used a multi-site cluster randomized trial (CRT) design with grade 4 students in 60 rural and 71 suburban classrooms. There were six significant positive findings related to text structure/patterns of content-area reading. In the Evidence for ESSA database, to meet the same criteria required in the EIR RFP, there was only one study found for tutoring. Neitzel and Storey (2024; https://www.evidenceforessa.org/program/air-reading/; see Evidence form and Appendix J3) reported on Air Reading, which included high-dosage student tutoring (live, synchronous, virtual tutors) with individual/small groups with a highly trained tutor, grounded in SOR, in a rural school district for grades 1-6. We will enhance tutor PD by integrating literacy and content-area learning, particularly in STEM-science, to improve students' understanding of the academic language and literacy skills with SOR ([redacted];

[redacted]; Wolf et al., 2018), and we will use the Amira AI Tutor support platform.

ROOTS includes a ***Four-Tier High-Impact Literacy-Infusion Tutoring Framework*** (Figure 2) to help rural school students in reading literacy by providing (a) community-based

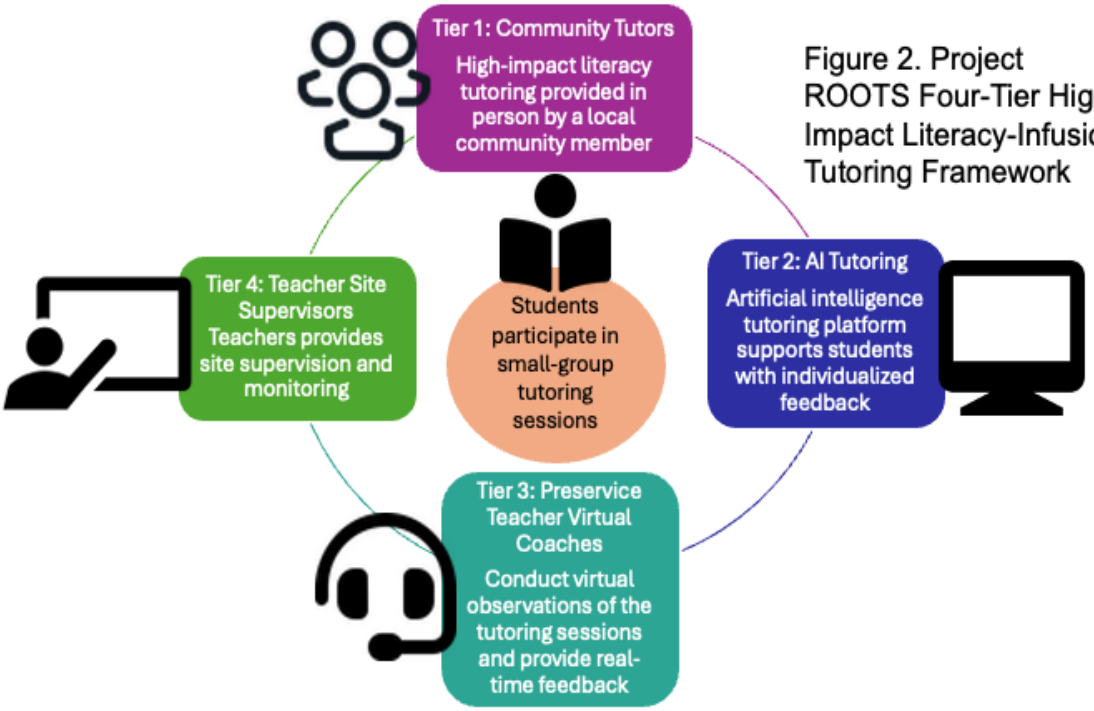


Figure 2. Project ROOTS Four-Tier High-Impact Literacy-Infusion Tutoring Framework

tutoring [we will adhere to evidence-based design principles, including high frequency, small group or one-to-small group ratios, alignment with classroom curriculum, and robust tutor supports (Robinson et al., 2021), (b) adaptive AI tutoring, and (c) VMC from university preservice teachers' virtual observations of the community tutors with real-time feedback, and (d) face-to-face supervision of the tutors from the teacher. Each tier contributes to helping students strengthen their literacy skills while also understanding unique academic vocabulary in the content-reading area of science. **Tier 1: Community Tutors (tutoring in person).** We will recruit (with the principal and with background checks) local rural community tutors with a college degree and train them in SOR, structured literacy, LIS, and aligned intervention protocols. (Note: The principal will be involved from the start of all recruitment and training.)

We will pair each tutor with one to five students at a time to build good relationships and trust, meeting for 20 weeks, three times a week for 30 minutes per session. A tutor will be assigned to tutor groups meeting at separate times. The tutor will use instructional materials (hands-on) that are synchronized with LIS and the integration of SOR. They will be trained in SOR (TEA, 2024; MDE, 2023) and LIS ([redacted]) strategies from the teacher and the research team, per each student's needs. These strategies encompass systematic instruction in phonics, fluency, and vocabulary, along with the application of scientific methodologies, including reading with pre-reading skills, academic vocabulary development, and academic oral and written language ([redacted]). Each tutoring session's plan will be informed by ongoing formative assessment with online records, and the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good et al., 2011) will be given to the tutees, with data input into a database. As researchers have demonstrated, being close to the community helps create trust and interest, which are two crucial pieces of high-impact tutoring (Nickow et al., 2020). Training will enhance the fidelity of tutoring across the ROOTS schools. **Tier 2: AI Tutoring (assistance with technology that adapts to the user**). Tutors will leverage the Amira Learning AI Tutor as a scaffolding assistant. Amira will provide adaptive practice during tutoring time as a part of flexible tutoring, where the tutor may be working with a pair of students or with an individual student, while the other tutees are engaged with the AI Tutor. Amira will provide training for the tutors (and teachers) and will analyze student error patterns and recommend focus areas for the next in-person session. This blended model fosters leverage with tutors guiding and with AI supporting. This approach supports personalized tutoring by utilizing high-dosage/impact principles, including consistent tutor-student pairing,

curriculum alignment, data use, and frequent, intense practice (Robinson et al., 2021). By having teachers and tutors infuse literacy into the content area of science, rural students will have the opportunity to acquire academic language, a key component for success in school and beyond ([redacted]; [redacted]). **Tier 3: TAMU Preservice Teacher Virtual Coaches (provide real-time feedback for VMC of the community tutors).** TAMU preservice teachers will help the community tutors by being virtual coaches. Preservice teacher virtual coaches will use observation and bug-in-the-ear (BITE) technologies ([redacted]) to watch tutoring sessions and give immediate, evidence-based guidance. This type of coaching not only helps tutors become better at their jobs and makes their tutoring sessions more accurate, but it also affords preservice teachers a chance to acquire hands-on experience in tutoring and LIS. National research on high-impact tutoring shows that consistent, data-driven, and relationship-based instruction leads to big gains in reading and content-area achievement (Kraft & Falken, 2021; Nickow et al., 2020). **Tier 4: Teacher Site Supervisors (teachers provide supervision and monitoring.)** Classroom teachers will supervise and monitor the tutors as they tutor and track student progress. The teacher will meet weekly with the tutors to discuss the tutees' advancement and make data-driven decisions about rotating students into and out of tutoring. Field notes will be kept in the TAMU secure database, as will all the project data. These four levels work together to produce a complete tutoring system that includes personalized learning, technology that adapts to each student, extra aid, and coaching. This is a sustainable model that can be adapted for other university-school partners or for schools to work with the first two tiers in their schools. The SOR is the basis for literacy instruction in ROOTS. The TEA (2021) and the MDE (2022) independently apply a research-based view of SOR. The framework suggests utilizing knowledge-rich texts and fostering

substantial spoken language development to enhance students' prior knowledge and verbal ability (MDE, 2022) and underlines the importance of keeping track of students' progress over time so that teachers can make changes to their lessons as needed to ensure that all students succeed (TEA, 2022). Evidence-based academic literacy instruction is the deliberate, organized, and clear teaching of reading, writing, language, and vocabulary skills, backed by strong, moderate, or promising research (TEA, n.d.). ROOTS will be implemented (a) across 100 Texas and Mississippi rural schools with 200 teachers annually and 4,000 rural elementary students; (b) with treatment classes compared to control/comparison classes; (c) to determine the degree of impact of innovations on students' reading literacy and science; and (d) to facilitate scalability across broad geographic rural regions by using technology to bring the innovations to these populations. **Component 3 - Delayed Release to Control and National Rural Schools** ROOTS will implement a delayed release method for the control and national rural schools that do not receive the intervention during treatment. This will provide universal accessibility to the program implementation guidelines, SOR literacy strategies and LIS throughout the entire nation. The Centers' teams are adept at marketing and providing large statewide face-to-face institutes and national webinars. The delayed-release strategy facilitates access to more rural sites in Year 5 by providing districts in Texas and Mississippi and beyond with a structured implementation package that encompasses asynchronous training modules, online credentials for educators and tutors, and preservice teacher experiential learning coaching guidelines. The ROOTS project ensures the implementation of the delayed-release technique. This outreach ensures ROOTS' sustainability, expands opportunity for all students, and facilitates the implementation of a validated, high-impact model in more schools located in rural and underserved regions nationwide.

***A. Significance*.** The need for students to possess strong literacy skills cannot be understated. Literacy is the foundation of future learning ([redacted]). For the individual, literacy impacts academic achievement and a range of personal and professional outcomes, such as future earnings, health, and well-being (Hughson, 2021). In terms of society, a literate citizenry means a strong economy, healthier families, safer communities, increased civic engagement, and opportunities to break multigenerational cycles of poverty (Barbara Bush Foundation for Family Literacy, n.d.). Despite the essential nature of literacy skills, the United States is falling behind — both for adult and K-12 readers. According to the National Literacy Institute (n.d.), in 2024-25, 21% of U.S. adults were illiterate, and 54% of adults had a sixth-grade reading level; worldwide, the United States ranked 36th in literacy. On the most recent National Assessment of Educational Progress (NAEP), approximately 40% of U.S. fourth graders scored below NAEP basic in reading, the largest percentage since 2002, and one-third of eighth graders scored below basic, the largest percentage *ever* (Harris, 2025). In Texas, 43% of fourth graders and 39% of eighth graders failed to reach the NAEP basic threshold (Texas 2036, 2025). There are many factors contributing to these abysmal numbers for K-12 students, such as changes in education policy, lower funding, contention over literacy curricula and approaches, as well as persistent effects from the pandemic (Roberts & Smith, 2025). However, one major culprit is outdated methods of teaching literacy, according to a recent government report (Senate Committee on Health, Education, & Pensions, n.d.). The report emphasized the importance of teachers utilizing the SOR in their classroom instruction. The magnitude of severity of the problem to be addressed in ROOTS rests in five major issues with imbedded or related implications: (a) numbers and concerns of rural schools, (b) teacher quality and literacy, (c) the need to build instructional capacity for in-service teachers in SOR

and literacy-infusion in content-reading areas, (d) the necessity of cultivating student interest early in STEM while emphasizing literacy within the subject, particularly in rural schools, and (e) what ROOTS will do. **Numbers and Concerns of Rural Schools.** About 42% of all public school districts in the United States are rural, though rural schools enroll a disproportionately small number of the nation's public students (Urban Institute, 2023). With over 470 rural school districts, Texas has the highest count of rural districts in the country (TEA, 2022). Mississippi is one of the 13 states with a high number of rural schools, with an estimated 50% (Hartman et al., 2023). Approximately 16% of U.S. school-age children live in poverty (The Annie E. Casey Foundation, n.d.), and more than 75% of students are eligible for free or reduced lunch (NCES, 2022). For the 2023–2024 school year, approximately 62.9% of Texas public school students were identified as economically challenged (TEA, 2024). The Federal Reserve Bank of St. Louis (2024) reported that Mississippi has one of the highest rates of child poverty in the United States (26.4%). In Mississippi, 23.5% of students who live in rural areas are in poverty (Farrigan, 2018). Access to education, literacy, and poverty are all linked in rural areas.. **Teacher Quality and Literacy.** Students in rural schools have limited access to teachers with content-area expertise (Beesley, 2011; Monk, 2007), much less those who have expertise in infusing literacy into science. Teachers with SOR-based literacy infusion are practically non-existent. Virtual PD platforms are now recognized as a viable option for delivering effective and equally engaging professional learning experiences to rural teachers (Chandran et al., 2021) with collaboration in VPLCs ([redacted]). [redacted] asserted that a scientific intervention incorporating reading and writing facilitates improved science performance among students in a rural, low-income area. Meta-analytic

research indicates that the simultaneous instruction of literacy and content significantly influences vocabulary acquisition, comprehension, and mastery of subjects (Hwang et al., 2021). Research employing both mixed methods and randomized controlled trials (RCTs) demonstrates that content-integrated literacy significantly benefits high-need students (Esparza, 2023; Relyea et al., 2022). The latest 2024 average grade level passing rate for EC students on reading at GR. 3 was 38%, GR. 4 was 41%, and GR, 5 was 44% (TEA, 2024). For Mississippi (MDE, 2025), in 2025, GR. 3 students at a basic passing rate in reading was 26.3%; GR. 4 was 25.7%, and GR. 5 was 27.6%. For 2024, in Texas, in the content reading area of science, the rate was 18% (tested at GR. 5), and in Mississippi, in 2025, the science basic passing rate was 19.5%. **Building Teacher Instructional Capacity.** Elementary teachers often view reading and science as incongruous disciplines and frequently focus on reading comprehension skills without including genuine learning experiences (Cervetti et al., 2020). Researchers have indicated that scientific education incorporating reading and writing significantly enhances students' comprehension of subjects, vocabulary, and general academic performance ([redacted]; Cervetti et al., 2012). Programs that integrate inquiry-based science with systematic reading and writing regarding scientific phenomena have improved academic performance among English learners and students from low-income backgrounds (Lee et al., 2023; Lawrence et al., 2022). **Student Interest in Science.** EC students are less likely to enter STEM fields than their peers from more advantaged family backgrounds (Chen & Weko, 2009; Hatfield et al., 2023). Potvin and Hasni's (2014) systematic literature review indicated that student interest in science declines over the course of K-12 education. The authors noted that this drop is sharper in *rural and pedagogically traditional* classrooms. Teachers are key to nurturing student motivation and self-efficacy in

science (Redding & Walberg, 2012; Teplá & Distler, 2025; Urdanivia Alarcón et al., 2023).

What ROOTS Will Do. In the rural schools, ROOTS will utilize SOR strategies that also integrate into LIS that supports reading skills using expository (informative) science text. The LIS Handbook, as a sample, is shown in Appendix J5, and the Table of Contents highlights the SOR-grounded concepts. Students will receive the intervention for 20 weeks, integrated into the classroom by the teachers. Teachers will receive training on instructional components to facilitate SOR for student reading and comprehension integrated into the development of science concepts, along with the 5E hands-on science model (Bybee, 1987). Teachers will learn to provide direct instruction, which includes pre-teaching the pronunciation of academic vocabulary and highlighting tricky letter-sound combinations, incorporating science academic vocabulary with student-friendly definitions and visuals, informative text features (e.g., headings, captions, text organization), strategic partner reading, and leveled comprehension questions. Students will participate using personal tablets/styluses in which they process science content as they predict, record, organize, draw, question, and reflect; writing skills will be addressed in the training, and how to integrate this into the science lessons. Each PD session will be recorded, and links will be sent to participants so they can review them later. Tutors will receive similar training, but tailored to their role as tutors. Teachers will also participate in VMC using our APEXIS. A preservice teacher will be trained as a coach (each tutor will have a coach) using APEXIS to virtually observe the teacher's instruction and provide immediate feedback. ROOTS VMC offers support to teachers and an increase in fidelity of implementation. This approach allows tutors and coaches to have a voice to express their point of view. Teachers and coaches complete feedback based on reflection of their own instruction. The APEXIS will be the platform utilized for conducting

virtual classroom observations for the participating treatment tutors. The training will focus on teaching phonological awareness, phonics, vocabulary, fluency, and comprehension in a clear, organized, and diagnostic way (Ehri, 2020; TEA, 2021). Tutors will learn how to mix hands-on scientific sessions with reading and writing. Tutors will be taught how to employ an AI tutor to make classes fit each student's needs and keep track of how well they are doing, along with modeling, and feedback. Additionally, teachers and tutors will have access to Massive Open Online Professional Informal Individual Learning (MOOPIL) in which teachers and tutors will be able to access just-in-time targeted, evidence-based VPD.

B. Strategy to Scale. **B1. Unmet Demand for Broader Implementation.** The scale of the project is informed by demonstrated unmet demand in research and service. Based on our review of the literature, we found notable gaps in the research base for effective literacy interventions and development, particularly in rural settings. **Component 1: Literacy Unmet Need —** First, only a few studies were found for rural schools and at the elementary grade levels. Additionally, no studies were found that incorporated literacy and science for rural schools. For example, there was one study in the WWC database marked as strong evidence, specifically in the area of literacy by Borman et al. (2008), who investigated Open Court Reading in grades 1-5. This included 917 students in six states and six schools, with only two of those schools being rural. The problem with the Borman et al. study was that there were no significant findings. This constitutes an unmet need to study the literacy concepts more deeply. Success for All, a whole school reform model, includes a literacy program for young readers that has been widely researched, and according to the WWC (2017), an intervention report on Success for All, the reading program yielded positive effects on alphabetics, potentially positive effects on reading fluency, and mixed effects on comprehension and general reading

achievement for students in grades K–4. Furthermore, WWC has evaluated many of studies and identified several of them as strong evidence (i.e., Borman et al., 2007; Quint et al., 2015). However, despite these positive literacy outcomes, *these studies do not include rural students*. None of the studies included literacy in a content-reading subject, like ROOTS. ROOTS is connected to another study that yielded moderate evidence (Wolf et al., 2018; https://ies.ed.gov/ncee/wwc/Study/89794; vetted by the WWC as meeting standards with reservations) from Project English Language and Literacy Acquisition—Validation (ELLA-V; Award Number U411B120047), an Investing in Innovation (i3) project that evaluated the effectiveness of two language/literacy interventions for Texas K-3 high-need students (Treatment 1- science-infused literacy curriculum; Treatment 2- science-infused oral language curriculum). Kindergarten students exhibited statistically significant growth in phonological awareness, and those in both Treatment 1 and Treatment 2 showed significant improvements in their oral English language proficiency when compared to control students. That research was carried out primarily with suburban and urban campuses, as well as with predominantly English learners. ROOTS will expand to rural schools with all students, and it will include the state-tested upper elementary grades (3-5). The external evaluation team of ELLA-V also reported that third-grade students in Treatment 1 outperformed control peers on standardized science achievement with a .27 effect size (Wolf et al., 2018). **Component 2: High-Impact Tutoring Unmet Need —** Another WWC strong evidence study, this one by Tepper Jacob et al. (2015) examined the impact of the Reading Partners program, which uses community volunteers to provide one-on-one tutoring to struggling readers in high-needs schools. This study included 1,151 tutored students in grades 2-5 in California, New York, and Washington, D.C., and had statistically significant results in word reading efficiency and reading fluency

compared to control students. *However, there were no rural schools included.* ROOTS will be conducted in solely rural schools to expand the research base on tutoring effectiveness in rural schools. Those unmet needs for rural schools, in particular, are evident.

B2. Management Plan. The broad management plan in Table 1 summarizes key actions, timelines, and responsible personnel to ensure the organized and effective implementation of ROOTS, including overall project management and component activities. The detailed budget is closely matched to project activities, supporting the efficient achievement of objectives and goals, maintaining cost control, and directing resources where they have the greatest impact. A grant milestone chart will track the major activities. An Advisory Board (AB), with members from Texas and Mississippi, 2 principals, 2 teachers, and 2 district administrators, will meet in Spring, 2026 to review ROOT's goals and objectives; then it will meet to review the progress of the project goals and provide recommendations and continuous improvement efforts annually. The PI and Co-PIs have strong experience running large research grants, as well as training initiatives at the federal and state levels. The included Centers have a marketing communications strategist who collaborates with the PI, Co-PIs, and the TAMU Division of Marketing and Communications (MARCOM) to sustain and advance ROOTS. Continuous project improvement will be achieved through regular communication with partner LEA superintendents, literacy/reading directors, principals, teachers, the external evaluation team, and other collaborators. The project staff will actively solicit feedback from both project participants and the AB. The team will meet monthly to review project progress and identify opportunities for improvement. A shared digital milestone and management chart will ensure all updates and actions are clearly documented and accessible to team members.

Table 1. ***Broad Management Plan***															
Legend: Semesters: S spring; S summer; F Fall; **Action**: √ initiate; ✓ milestone; • continuation; X checkpoint; **Responsible**: PI Principal Investigators; E Evaluators, F Faculty; PC Program Coordinators; P Partners; AB Adv Board	**Y1 2026**			**Y2 2027**			**Y3 2028**			**Y4 2029**			**Y5 2030**		
	S	**S**	**F**	**S**	**S**	**F**	**S**	**S**	**F**	**S**	**S**	**F**	**S**	**S**	**F**
MAJOR PROJECT ACTIVITIES: Overall Project Management															
Hire personnel and onboarding (PI)	✓														
Recruit participants, finalize/approve IRB, MOUs (PI, PC, P)	✓	•													
Facilitate participant consent (PC, P)			✓			✓			✓						
Establish Advisory Board, meet annually (PI, AB)	✓	X			X			X			X			X	
Communicate/collaborate with partners (PI, PC, P)	✓	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Acquire implementation materials and technology (PI, PC, P)		✓			X			X			X			X	
Distribute technology to LEA sites, ongoing tech support (PC, P)		✓	X	•	•	X	•	•	X	•					
Monitor expenditures and alignment to the approved budget (PI, PC)	✓	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Set monthly goals/assess program-wide specifics (PI, PC)	✓	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Meet with Program Officer quarterly (PI)	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Meet with External Evaluators monthly (PI, E)	✓	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Finalize and register evaluation plan in REES (PI, E)	✓	•	X	✓											
Submit annual performance report to EIR (PI, E, PC)				✓			✓			✓			✓		
MAJOR PROJECT ACTIVITIES: Component 1 - Promoting Evidence-Based Literacy															
Revise LIS strategies handbook, design and implement teacher VPD (PI, PC, F)	✓	•	✓	•	•	X	•	•	X	•					
Monitor/track teacher integration of LIS strategies via classroom observations and coaching (PI, PC)			✓	•	•	X	•	•	X	•					
Collect data via pre- and post-VPD surveys, reflection, focus groups, student assessments, district data requests (PI, PC, P, E)			✓	✓	•	✓	✓	•	✓	✓					
MAJOR PROJECT ACTIVITIES: Component 2 - High-Impact Literacy and LIS Tutoring															
Develop tutoring guide, MOOPILs, and implement VPD for tutors and preservice tutor coaches (PI, PC, F)	✓	•	✓	•	•	X	•	•	X	•					
Collaborate w/LEAs to recruit/hire community tutors (PC, P)		✓	✓			X			X						
Collaborate w/TAMU to recruit/hire preservice teacher tutoring mentors (PC, P)		✓	✓			X			X						
Facilitate preservice tutor coaching/real-time feedback (PI, PC)			✓	•	•	X	•	•	X	•					
Monitor/track implementation of high-impact tutoring, and AI tutoring (PI, PC)			✓	•	•	X	•	•	X	•					
Collect data via pre- and post-PD surveys, reflection, focus groups, student assessments, district data requests (PI, PC, P, E)			✓	✓	•	✓	✓	•	✓	✓					
MAJOR PROJECT ACTIVITIES: Component 3 - Delayed Release to Control and National Rural Schools															
Prepare outputs: publications, briefs, presentations (PI, PC, F)					✓	•	•	•	•	•	•	•	•	•	•
Deliver delayed release to control teachers via online ROOTS Institute (PI, PC, P)											✓				
Foster sustainability in TX and MS rural schools via online ROOTS Institute (PI, PC, P)											✓			✓	
Further national expansion by offering ROOTS Institutes to all rural schools nationwide (PI, PC, P)													✓	•	•

B3. Relevance and Commitment of Partners. The project brings together a strong network of partners, including TAMU, USM, CEHD, CRDLLA, ELRC, Amira Learning, Walmart, and 100 school districts across Texas and Mississippi. TAMU and USM, both leading Research 1 institutions, provide access to top-tier scholars and experts in the fields of education, literacy, STEM, and educational leadership. For example, in fiscal year 2023, TAMU ranked 13th among public universities by the National Science Foundation's Higher Education Research and Development Survey with more than $1.278 billion in annual research expenditures (TAMU, n.d.). The ELRC and CRDLLA bring extensive experience delivering effective, evidence-based PD for educators both virtually and in person. USM's partnership enhances regional engagement in and capacity-building activities for our partner LEAs in Mississippi. Amira Learning will provide specialized training, ongoing technical support, and a library of asynchronous resources to support the implementation of their AI-powered tutoring designed to meet students' individual needs. Tablets will be used to support literacy tutoring activities and PD. Additionally, we have secured letters of support and commitment from 114 rural districts in Texas and Mississippi. This engagement is derived from years of the PIs building meaningful connections with rural LEAs through multiple federally funded projects, resulting in strong, lasting relationships. [redacted], a distinguished emerita scholar in literacy infusion and science education, will also be a contracted partner in ROOTS to ensure fidelity of the content reading with literacy and SOR.

B4. Efficient and Effective Service Delivery at Scale. The project is strategically designed to deliver PD services efficiently and sustainably while maintaining a strong focus on quality and impact. ROOTS integrates evidence-based practices and innovative technology tools to streamline implementation across participating schools. Educators will benefit from ongoing

coaching and training designed to strengthen and maintain high-quality instruction over time. Partnerships with schools, districts, universities, and companies will support efficient scaling. Continuous evaluation and feedback will guide improvement efforts, allowing the program to adapt to local needs and stay effective as it serves more students, educators, and communities

B5. Quality of Dissemination. The project will utilize a comprehensive and accessible dissemination strategy, via the Centers' marketing/communication strategist, to share findings, resources, and best practices with researchers, educators, community stakeholders, and policymakers. Partnerships with the ELRC, CRDLLA, and USM support broad dissemination. Research and policy briefs, open-access reports, peer-reviewed journal articles, and academic and practitioner institutes will disseminate the findings. Social media and project websites will play a key role in expanding outreach and engaging diverse audiences. The project will host aseries of online ROOTS Institutes (following implementation) where the LIS handbook and tutoring resources can be downloaded, first for control teachers and rural schools in Texas and Mississippi, and then to all 28,000 rural schools nationwide. Together, these dissemination methods ensure that valuable insights and tools will be widely shared and utilized.

C. Quality of the Project Design. **C1. Quality of Logic Model.** The Logic Model, presented in Appendix G, is organized around the key activities of each of the three project components. It outlines the relationships between resources, activities, outputs, and outcomes (short-term, mid-term, and long-term), providing a roadmap to guide implementation and achieve measurable progress. Expected outcomes include increased teacher capacity for applying evidence-based literacy strategies, improved student achievement in literacy and science, and widespread sharing of project results and resources. **C2. Goals, Objectives, and Outcomes are**

Clearly Specified and Measurable. The *overarching goal* of ROOTS is to expand evidence-based SOR strategies and literacy infusion with content reading in STEM-science undergirded by high-impact tutoring (live for students in grades 3, 4, and 5) and PD for teachers via a longitudinal RCT study to impact student growth in reading literacy and the content reading area of science. **GOAL 1. C1 Promoting Evidence-Based Literacy: To strengthen teachers' capacity to apply SOR and LIS strategies and reflect on their pedagogical practices, and determine the impact and effectiveness on literacy/reading and science achievement among grades 3-5 T students.** This component involves 100 rural schools and 600 rural teachers, following a cohort of 4,000 students from grades 3 to 5. At each grade level, 100 treatment teachers will receive ongoing PD in SOR and LIS VPD and apply these instructional strategies with 2,000 treatment students. In contrast, 100 control teachers will implement their standard instruction with 2,000 control students. ***Objective 1.1:*** To implement ongoing SOR and LIS VPD for treatment teachers for a total of 24 hours at each grade level ***as measured by*** distribution of LIS strategies handbook, VPD attendance, and engagement in synchronous sessions, and completion of VPD modules and VPLCs. **OUTCOME:** 100 T teachers per grade level will be trained on LIS strategies and receive the LIS strategies handbook for pedagogical implementation. ***Objective 1.2:*** To provide teachers feedback on their for improvement using a researcher-developed, field-tested feedback rubric and assess teacher growth in LIS strategy implementation through the facilitation of teacher reflection on how LIS strategies transform their pedagogical practice in the classroom, ***as measured by*** teacher entries in [redacted] and through a pre- and post-LIS strategy use survey. **OUTCOME:** 100 T teachers per grade level will demonstrate increased implementation of LIS strategies. ***Objective 1.3:*** To observe teacher implementation of LIS strategies by conducting

virtual classroom observations of T and C teachers, ***as measured by*** the revised Pedagogical Observation Protocol (POP; observes literacy strategies, classroom type, language of teacher/language of student, communication mode–reading, writing, speaking, listening, language content–social routines, classroom routines, light cognitive content, dense cognitive content, and activity structures, while the STOR measures observed instructional strategies, and train teachers to conduct classroom action research where the teacher will observe the tutor and a group/individual student and take data for six weeks. **OUTCOME:** Four classroom observations per teacher per grade level will be collected and analyzed with feedback to the teachers. ***Objective 1.4:*** To assess growth in literacy/reading and science achievement among all consented grades 3-5 students, ***as measured by*** standardized assessments, including state-required assessments and the Iowa Assessments (ITBS) in reading/reading comprehension and science subtests, and formative district reading progress assessments (reading fluency). **OUTCOME:** For each grade level, 4,000 consented T and C students per grade level administered annual pre- and post-Iowa Assessments facilitated by the project, and student state-assessment data will be requested annually from the 100 participating schools. ***Objective 1.5:*** To assess students' confidence and attitudes towards literacy and science resulting from program participation among all consented students in grades 3-5, ***as measured by*** MSSL (researcher-developed instrument). **OUTCOME:** 4,000 consented T and C students administered the annual pre- and post-surveys. **GOAL 2. C2 High Impact Literacy and Literacy-Infused STEM-science Tutoring: To determine the impact and effectiveness of the high-impact tutoring program on literacy/reading and science achievement among grades 3-5 T students.** This component deploys 200 highly trained community tutors across rural areas to deliver effective literacy and reading support for students in grades 3 through 5.

Each teacher will identify the lower 50th percentile of students in their classroom (approximately 10 students per teacher) that will receive tutoring. At each of the 50 participating schools, four tutors will be assigned—two per teacher, with each school having two treatment teachers—providing focused tutoring to approximately 20 students per campus, totaling 1,000 students. Each tutor will be supported by a dedicated preservice tutor coach (one coach per school) and receive direct supervision from onsite treatment teachers. ***Objective 2.1:*** To recruit, hire, and train community tutors to deliver small group high-impact literacy tutoring to high-need rural treatment students via ongoing VPD for a total of 18 hours aimed to strengthen tutors' literacy instructional capacity, as ***measured by*** the number of tutors successfully recruited, hired, and trained, and by the number of tutoring sessions conducted. **OUTCOME:** 200 community tutors recruited per grade level, receive 18 hours of literacy and LIS tutoring training and implement 20 weeks of tutoring sessions (3x/week for a total of 60 sessions per grade level). ***Objective 2.2:*** To develop, review, and distribute the ROOTS tutoring guide and develop three high-impact tutoring MOOPILS, aligned to the SOR standards and support literacy and LIS strategies in content areas, as ***measured by*** the completion and distribution of the guide and completed MOOPIL modules. **OUTCOME:** 200 community tutors, 50 preservice teacher virtual coaches, and 100 teachers per grade level receive the ROOTS tutoring guide and access to the three tutoring MOOPILS modules. ***Objective 2.3:*** To recruit, hire, and provide targeted support for 50 preservice teacher virtual coaches to equip them to provide real-time feedback to community tutors, ***as measured by*** successful recruitment, hiring, and onboarding of 50 preservice teacher virtual coaches, and ongoing VPD for a total of 15 hours aimed to strengthen research-based literacy/reading instruction, and coaching and real-time feedback strategies. **OUTCOME:** 50 preservice teacher virtual coaches recruited, hired, and trained annually to

effectively provide tutoring feedback. ***Objective 2.4:*** To implement high-impact, small-group literacy and LIS tutoring sessions (3x/week, 90 minutes/week, 20 weeks per grade level) that integrate literacy reading comprehension for grades 3-5, ***as measured by*** student attendance logs. **OUTCOME:** 1,000 treatment students engage in high-impact literacy/reading tutoring. ***Objective 2.5:*** To ensure high-quality implementation of tutoring sessions by equipping preservice teacher virtual coaches to conduct weekly virtual observations of small-group literacy/reading tutoring sessions and provide RTF to tutors via bug-in-ear technology, via the APEXIS system, ***as measured by*** a researcher-developed literacy tutor observation rubric (to be co-developed and tested with the pre-service teachers, providing them voice in the research process) aligned with evidence-based best practices for reading instruction. **OUTCOME:** 50 preservice teachers observe tutoring and provide targeted RTF to assigned tutors once per week for the 20-week intervention period per grade level. ***Objective 2.6:*** To assess growth in literacy/reading of treatment students who engage in tutoring, ***as measured by*** school/district formative reading progress assessments (reading fluency and comprehension), DIBELS, and standardized assessments including state-required assessments, the Iowa Assessments in reading/reading comprehension. **OUTCOME:** Literacy/reading data collected for 1,000 tutoring students annually. ***Objective 2.7:*** To explore the impact of the Amira AI literacy/reading tutoring platform made available to 1,000 treatment students, ***as measured by*** Amira's student skills diagnostic dashboard. **OUTCOME:** 1,000 T students engage in the Amira literacy tutoring platform per year and exhibit literacy growth. ***Objective 2.8:*** To systematically monitor the fidelity of tutoring sessions, designate treatment teachers to serve as site tutoring supervisors, ***as measured by*** check-ins with community tutors, fieldnotes, and attendance tracking. **OUTCOME:** 100 T teachers meet weekly with tutors (20 weeks/grade

level), review the tutoring checklist, and collect tutoring attendance records. ***Objective 2.9:*** To elicit tutoring program stakeholder feedback from students, teachers, tutors, school leaders, and preservice teacher virtual coaches to guide adjustments and enhance program effectiveness, ***as measured by*** surveys and focus group interviews completed by stakeholders. **OUTCOME:** Annual stakeholder surveys and focus groups. **GOAL 3. C3 Delayed Release to Control and National Rural Schools: To ensure the broad sharing, sustainability, and accessibility of Project ROOTS' findings, products, and processes for sustained educational improvement.** This component further extends the project's national reach, ensuring that key strategies and resources become available to rural schools and communities throughout the country. ***Objective 3.1:*** To provide control group teachers with a delayed ROOTS Institute following the completion of the treatment phase, ***as measured by*** attendance logs and pre- and post-surveys related to content of the ROOTS Institute. **OUTCOME:** 150 C teachers will be trained on ROOTS strategies and strengthen literacy practices. ***Objective 3.2:*** To disseminate project findings nationally through publications, conference presentations, and research/policy briefs, ***as measured by*** the number of papers published in high-impact journals, practitioner and/or scholarly conference presentations, and research/policy briefs through the Centers' websites. **OUTCOME:** Four papers published, five presentations, and three research/policy briefs. ***Objective 3.3:*** To advance instructional capacity and foster sustainability in Texas and Mississippi by hosting ROOTS Institute to share project findings, instructional strategies, and implementation insights, ***as measured by*** attendance logs and a pre- and post-survey. **OUTCOME:** 250 school leaders in Texas and Mississippi will gain instructional insights and LIS implementation strategies. ***Objective 3.4:*** To advance instructional capacity and foster scaling nationally by providing access to ROOTS findings, instructional strategies, and

implementation insights via ROOTS Institutes, ***as measured by*** attendance logs and a pre- and post-test. **OUTCOME:** 28,000 invitations sent out to rural school leaders across the nation to gain instructional insights and LIS implementation strategies. ***Objective 3.5:*** To make the LIS strategies handbook accessible nationally by posting it as a downloadable resource on the Centers' website, ***as measured by*** the number of downloads of the handbook. **OUTCOME:** 1,000 downloads/distribution of the LIS strategies handbook.

D. Quality of the Project Evaluation or Other Evidence-Building. **D1. Methods will Produce Evidence of Effectiveness on Relevant Outcomes that Meet WWC Standards without Reservations.** The overall ROOTS project is characterized by a clustered randomized controlled trial design where schools will be randomly assigned to either the treatment or control condition to evaluate the effectiveness of the intervention. We plan to recruit 100 rural Texas and Mississippi schools. The rural schools will be randomly assigned (by the External Evaluators) to treatment (T=50) or control/comparison (C=50) conditions. The integrity of such an assignment will be maintained because when a school is assigned to receive T in GR. 3 in Year 1, then this school will continue to receive T in the subsequent years; the same is true for C schools. An average of two GR. 3 teachers per school will be randomly selected by the External Evaluators at the randomized campus to implement the corresponding condition. In this manner, there will be no contamination of both conditions on the same campus; therefore, we address the issues of a design flaw noted by Song and Herman (2010) by separating out the intervention from the teacher effects since the teachers will not be involved in both conditions. School-, teacher-, and student-level demographic data will be collected, including: ethnicity (teacher/student), sex (teacher/student), socioeconomic status (school/student), language spoken at home (student), certification (teacher), demographics of teachers, and students with

disability. All the measures will be administered in the same way to all participants each year, GRs. 3-5, T and C. To test the **sustainability** of this project, we implement a longitudinal design following the same GR. 3 students over three years. A total of 4,000 GR. 3 students who participated in the first year of implementation will be followed as they matriculate through GRs 4 and 5. Across those three years, treatment (T) teachers (100 teachers per year) will receive VPD on SOR and how to infuse literacy into science. In this way, the teacher effect GRs. 3-5 between T and C can be accounted for, and the only difference, if any, at the student level by the end of GR. 5 would be due to the sustained impact of the full intervention that started in GR. 3 and through in GR. 5 in the T schools. Participating students at all T and C schools will be pre-tested at the beginning of Project ROOTS as a baseline, and at the end of each school year of intervention (GRs. 3-5), respectively. **Attrition and Missing Data** — As a pure longitudinal study there will be no cohorts added after the initial one is established. We will monitor carefully the overall and differential (between T and C) attrition rates at the student level and the school level following the WWC Standards in the What Works Clearinghouse Procedures and Standards Handbook (2022). The External Evaluators will use an intent-to-treat model, following all participating students in all schools, randomly assigned at the outset. Finally, to meet WWC (2022) evidence standards, we will not impute missing outcome data in any analyses. The analysis sample is defined as all cases with non-missing outcome data. **D2. Evaluation will Provide Guidance about Effective Strategies Suitable for Replication in Other Settings. Power Analysis** — In Project ROOTS, because students will be nested in classrooms, which in turn are nested within schools, we used PowerUp! (Dong & Maynard, 2013) to determine the number of schools needed for the experiment. The ability to detect a treatment effect at a certain level of power in a hierarchical linear modeling (HLM) framework

depends on several factors: intra-class correlation (ICC, ρ), the correlation between pre- and posttests (r), and the average number of students in each school (n). In our power analysis, the parameters included an α=.05, pre-posttest correlation of .70, a target minimum detectable effect size of .25 (although the effect sizes in our experimental research have mostly been between .35 to .7, we decided to use a more conservative effect size in the validation study), a cluster size of 40 (including two teachers/classes per campus), and ICC of .10, which is quite commonly found in cross-sectional studies such as the Special Education Elementary Longitudinal Study (see Hedges & Hedberg, 2007). Using these parameters and taking into consideration the potential attrition rate over time, by the end of the project year, we can detect an effect size of 0.25 with a power of over 0.80 if we start with a school sample of 50 per condition or 100 overall. **Data Collection —** Data collection by the Evaluation Team ([redacted], Co-PI, will support in monitoring and collecting of data) will occur in Years 1-5. At the teacher level, virtual observation and field notes will be conducted three times (beginning, mid, and end) annually in all classrooms. Other data, including teacher interviews, surveys and reflections, will be collected annually. Student scores on standardized assessments such as the Iowa Assessment (ITBS) will be collected at the beginning and end of each year in GR. 3-5. Student scores on state-required assessments will be collected in the spring each year in GR. 3-5. ROOTS will address specific research questions aligned with the project objectives. There are two major confirmatory questions (Appendix J6). **Questions to Evaluate Objective 1 and the Data Analysis per Question**—**1.1(Obj.1.1).** What is the percent of T teachers' VPD attendance in synchronous sessions, and the completion rate of modules? Analysis: percent of attendance and completion rate will be calculated and reported as descriptive statistics. **1.2a (Obj.1.2).** What are T teachers' perceived effectiveness of the VPD including feedback to

improve their instructional practices? Analysis: Phenomenological study (Creswell, 2014) with data, researcher, and methods triangulation and low-inference descriptors (Johnson, 1997) reported to address credibility (internal validity). Data collected via field notes, classroom observations, semi-structured, open-ended surveys and interviews (Lincoln & Guba, 1985), and/or teacher reflections (via AI Reflection app). Data will be analyzed using the constant comparative method (Cresswell, 2014) and coded according to themes for identifying trends or patterns, with all data entered into NVivo software. Focus groups with T teachers at GR. 3-5 will be conducted; patterns will be drawn, descriptions of the relationships, both formal and informal, will be conducted, meanings both tacit and explicit will be sought, and the ability to implement and sustain such interventions within other schools will be analyzed. In addition, a survey will be developed with Likert scale to measure teachers' perceived effectiveness. **1.2b (Obj. 1.2).** Is there a significant improvement in T teachers' reported use of LIS strategies as a result of their participation in the VPD? Analysis: A paired-sample t-test will be used to test the change in the perceived use of LIS strategies for T teachers. **1.3a (Obj.1.3).** To what extent does teachers' instructional delivery differ between T and C classrooms as measured by POP annually? Analysis: To answer this **confirmatory question**, the chi-square test of homogeneity of proportion will be used to identify if the proportion of each category under every domain in POP is homogenous between T and C classrooms. **1.3b (Obj.1.3).** To what extent does teachers' instructional delivery differ between T and C classrooms as measured by STOR annually? Analysis: To answer this **confirmatory question**, a 2-level HLM will be applied with data collected at the first round of observation at the beginning of school year as pre-test, and end of school year as outcome variable. School will be the level-2 variable. **1.3c (Obj.1.3).** What is the number of action research submitted by T teachers? Analysis: The number of action research

submissions will be recorded and reported as descriptive statistics. **1.4a (Obj.1.4).** To what extent do students differ between T and C on science and literacy/reading achievement after three years of intervention longitudinally, GR. 3-5? Analysis: To answer this **confirmatory question**, we will use a 3-level HLM to analyze the treatment effects in GR. 5 after 3 years of intervention. Student is the level-1 unit of analysis, with pre-test score as covariate; teacher is level-2, and school as level-3 unit of analysis. The condition of T or C will be included as a level-3 predictor as school is the unit of randomization. A simple presentation of the model follows: $Y_{ijk} = \gamma_{000} + \gamma_{100}Pretest_{ijk} + \gamma_{001}Treatment_j + v_{00k} + u_{0jk} + e_{ijk}$. Outcome measures for this confirmatory question will be GR. 5 state assessment in science and literacy/reading. If the test is not available in Gr. 3, ITBS pre-test administered at the beginning of Gr. 3 will be used as covariate. **1.4b (Obj.1.4).** To what extent do students differ between T and C on science and literacy/reading achievement after each year of intervention annually, GR. 3-5? Analysis: Same HLM will be applied. When the state assessment is not available at pre-test, ITBS administered at the beginning of GR.3 will be used as pre-test. For GR. 4 and 5, statement assessment administered in the spring of the previous grade will be used as a pre-test for the analysis. **1.5a (Obj.1.5).** To what extent do students differ between T and C on confidence and interest towards literacy and science after three years of intervention longitudinally, GR. 3-5? Analysis: To answer this **confirmatory question**, we will also use HLM to analyze the treatment effects in GR. 5 after 3 years of intervention. Data collected from the survey administered at the beginning of GR. 3 will be used as a pre-test, and data collected from the survey administered at the end of GR. 5 will be used as the outcome variable. **1.5b (Obj.1.5).** To what extent do students differ between T and C on confidence and interest towards literacy and science after each year of intervention annually, GR. 3-5? Analysis: The same HLM will be applied, with

end-of-year survey data as outcome variable, and the data at the beginning of Gr. 3 will be used pre-test. For GR. 4 and 5, the statement assessment administered in the spring of the previous grade will be used as pre-test for the analysis. **Questions to Evaluate Objective 2 and the Data Analysis per Question**—**2.1 (Obj.2.1).** How many community tutors are recruited, hired, and trained to deliver small group high-impact literacy tutoring sessions, and how many tutoring sessions are conducted? Analysis: The number of community tutors recruited, hired, and trained will be calculated and reported as descriptive statistics. The number of tutoring sessions conducted by community tutors will be calculated and reported as descriptive statistics. **2.2 (Obj.2.2).** What is the distribution of the ROOTS tutoring guide, and the completion rate of the ROOTS tutoring MOOPILS? Analysis: The number of the ROOTS tutoring guide distributed, and the percent of completion rate will be calculated and reported as descriptive statistics. **2.3 (Obj.2.3).** How many preservice teacher virtual coaches are recruited, hired, and trained, and what is the percentage of preservice teacher virtual coaches' VPD attendance in synchronous sessions, and the completion rate of modules? Analysis: The number of preservice teacher virtual coaches, and the percent of attendance and completion rate will be calculated and reported as descriptive statistics. **2.4 (Obj.2.4).** What is the percent of students' attendance in the small-group literacy/reading tutoring sessions? Analysis: the percent of students' attendance will be calculated and reported as descriptive statistics. **2.5 (Obj.2.5).** What is the quality of small-group literacy/reading tutoring sessions as measured by the weekly virtual observations and the researcher-developed literacy tutor observation rubric? Analysis: paired-sample t-test to test the change in the tutors' tutoring strategies. **2.6a (Obj.2.6).** How do T students who receive tutoring differ from their C peers on literacy/reading, basic reading skills, and science assessment after three years of intervention longitudinally, GR. 3-5? Analysis: To answer this

confirmatory question, the same HLM will be applied as described in 1.4a. **2.6b (Obj.2.6).** How do T students who receive tutoring differ from their C peers on literacy/reading, basic reading skills, and science assessment after each year of intervention annually, GR. 3-5? Analysis: Same HLM will be applied using the procedures described in 1.4b. **2.7 (Obj.2.7).** To what extent does participation in the Amira AI literacy tutoring platform influence the literacy growth of treatment students, as measured by Amira's student skills diagnostic dashboard? Analysis: A paired-sample t-test will be used to examine T students' literacy growth. **2.8 (Obj.2.8).** To what extent do treatment teachers' implementation of site tutoring supervision practices (weekly check-ins, checklist reviews, and attendance tracking) reflect high fidelity in the delivery of tutoring sessions? Analysis: number of check-ins and attendance will be recorded and reported as descriptive statistics. **2.9 (Obj.2.9).** How do students, teachers, tutors, school leaders, and preservice teacher virtual coaches perceive the effectiveness of the tutoring program, and what feedback do they provide to inform program improvements? Analysis: Students, teachers, tutors, school leaders, and preservice teacher virtual coaches perceptions will be collected from focus group interviews and surveys. Qualitative data will be analyzed using the procedures described in 1.2a. **Questions to Evaluate Objective 3 and the Data Analysis per Question**—**3.1a (Obj.3.1).** How many C teachers' receive LIS instruction training through the delayed ROOTS Institute? Analysis: The number of attendance and completion rate will be calculated and reported as descriptive statistics. **3.1b (Obj.3.1).** What is C teachers' perceived effectiveness of the ROOTS training in their use of LIS strategies as a result of their participation in the delayed ROOTS Institute? Analysis: A paired-sample t-test will be performed to test the change in the perceived use of LIS strategies for C teachers before and after participating in the delayed ROOTS Institute. **3.2 (Obj.3.2).** How many dissemination

products are generated nationally through publications, conference presentations, and research or policy briefs? Analysis: The number of publications, conference presentations, research or policy briefs will be calculated and reported as descriptive statistics. **3.3a (Obj.3.3).** How many school leaders in Texas and Mississippi attend the ROOTS Institute? Analysis: The percent of attendance and completion rate will be calculated and reported as descriptive statistics. **3.3b (Obj.3.3).** How do school leaders from Texas and Mississippi perceive the effectiveness of ROOTS training related to their use of LIS strategies? Analysis: A paired-sample t-test will be conducted to test the change in the perceived use of LIS strategies for teacher leaders in Texas and Mississippi before and after participating in the ROOTS Institute. **3.4a (Obj.3.4).** How many rural school leaders across the nation attend the ROOTS Institute? Analysis: The percent of attendance and completion rate will be calculated and reported as descriptive statistics. **3.4b (Obj.3.4).** How do rural school leaders across the nation perceive the effectiveness of ROOTS training related to their use of LIS strategies? Analysis: A paired-sample t-test will be conducted to test the change in the perceived use of LIS strategies for school leaders before and after participating in the ROOTS Institute. **3.5 (Obj.3.5).** How many LIS strategies handbooks are downloaded nationally from the Centers' website? Analysis: The number of downloads will be calculated and reported as descriptive statistics. **D3. Measuring Fidelity of Implementation, Including Thresholds for Acceptable Implementation** STOR, developed and tested in a previous RCT by the research team on science and reading/literacy infusion, will be adapted to monitor the fidelity of the intervention. STOR has an internal consistency of .94. It captures the core components of intervention three times per year. In addition, virtual virtual observation using POP ([redacted]) will be conducted three times annually in both T and C classrooms also as part of the fidelity of the implementation. The four POP observational

domains are Activity Structure, Communication Mode, Language Content, and Language of Instruction ([redacted]). Data collected via POP or STOR will be incorporated as teacher-level characteristics into the exploratory analysis. **Outcome Measures** — We will compare students' achievement on the constructs aligned with the research questions as measured by both (a) state-required standards-aligned assessments, e.g., State of Texas Assessments of Academic Readiness (STAAR) and MDE Mississippi Academic Assessment Program (MAAP) science (GR. 5), STAAR/MAAP reading (GR. 3-5), (b) rigorous standardized instruments to measure reading and progress in science, pre- and post-ITBS to GRs. 3-5 students; (c) rigorous standardized instrument to measure basic reading skills using DIBELS, and (d) researcher-developed assessment of motivation and interest in literacy and science (developed and validated in a prior RCT by the research team). Among these, STAAR and MAAP measures the academic progress of all students, inclusive of EC students. ITBS reading and science assess not only students' knowledge of scientific principles and information, but also the methods and processes of scientific inquiry. At the teacher level, we will compare instructional effectiveness between T and C teachers using POP and STOR. See Appendix J6 for psychometrics of these measures. Other qualitative rubrics will be developed.

D4. Design for Implementation and Evaluation will Result in Information to Guide Replication. ROOTS employs a clustered randomized controlled trial in rural schools in Texas and Mississippi to obtain reliable and valuable evidence for future applications. The strategy includes three scalable components: science classes incorporating reading and writing, high-impact community tutoring utilizing AI, and virtual mentorship for teacher trainees. We will employ digital monitoring, validated assessments, and implementation rubrics to oversee fidelity and impact. The delayed-release model enables control schools (and national ones) to

utilize ROOTS post-testing, ensuring that the outcomes are equitable and enduring. Asynchronous training modules and implementation guides exemplify replication resources that will be disseminated nationwide. This will ensure that the insights gained from ROOTS significantly influence rural education.

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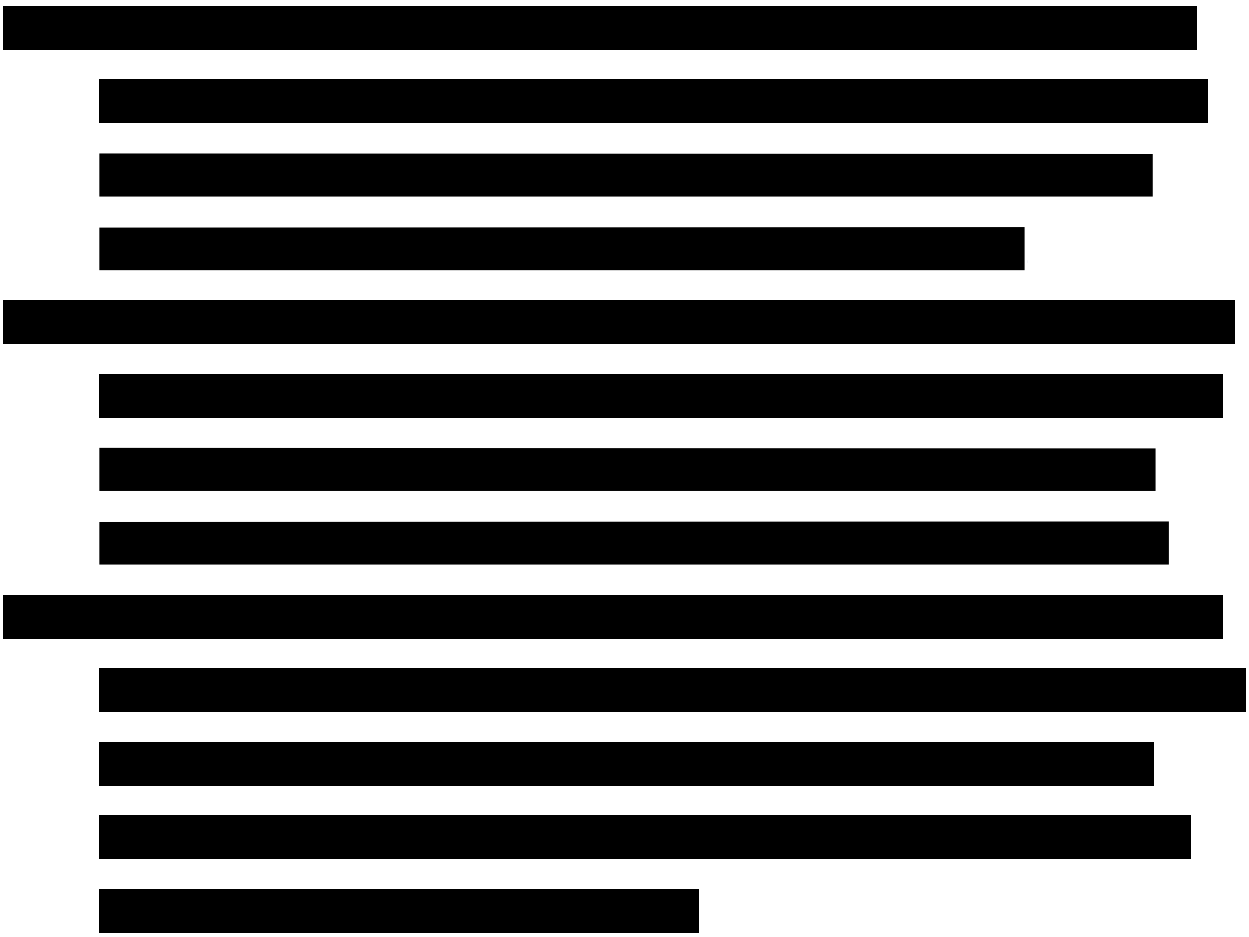

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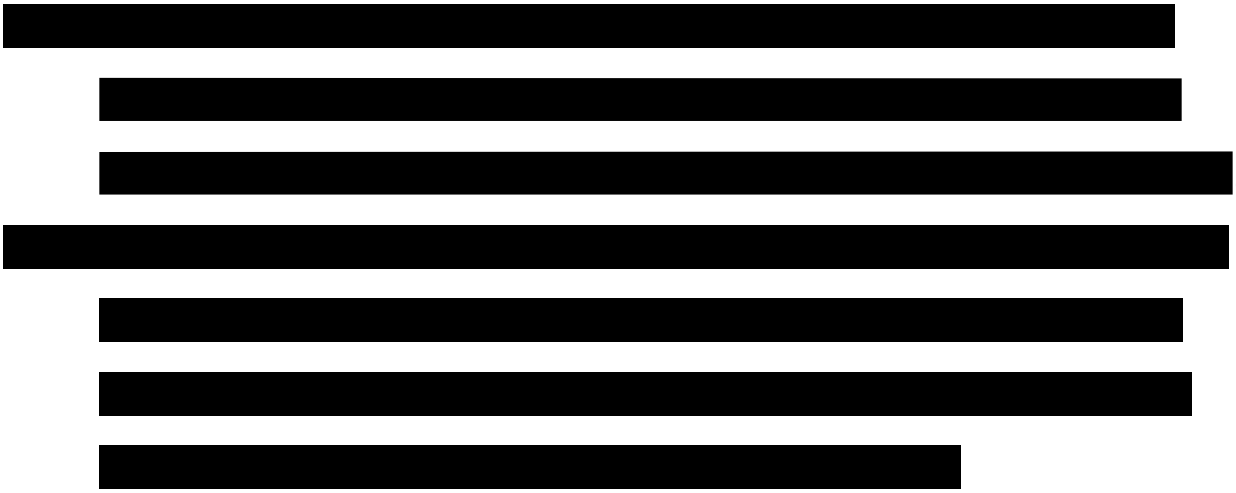

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