

STEM, Literacy and Computation in Education for School Leaders
(SLICE-SL)

Table of Contents

0. INTRODUCTION	1
0.1 An Exceptional Approach to the Project Priorities	1
0.2 Project Inputs Based Evidence-based Research and Established Effective Work	3
A. QUALITY OF THE PROJECT DESIGN	8
A1. Sufficient Quality, Intensity, and Duration Lead to Improvements in Practices.....	8
A2. Incorporation Project Capacity and Results beyond the Grant Period	16
A3. Conceptual Framework: Connections between Research, Activities and Priorities.....	18
A4. Collaborative Partnerships for Maximizing Project Effectiveness.....	20
A5. Addressing Needs of Target Population	23
B. SIGNIFICANCE OF THE PROJECT	26
B1. Magnitude of Impact on Improvements in Teaching and Student Achievement	26
B2. Project Cost Effectiveness and Justification to the Results and Benefits	29
B3. Potential Contribution to the Ongoing Program or Organization.....	30
B4. Dissemination of Information and Strategies	31
C. QUALITY OF THE MANAGEMENT PLAN.....	33
C1. Goals, Objectives, and Outcomes are Specified and Measurable.....	33
C2 Management Plan: Responsibilities, Timelines, and Milestones.....	35
D. QUALITY OF THE PROJECT EVALUATION.....	41
D1. Methods of Evaluation Produce Evidence of Effectiveness Meeting WWC Standards ..	41
D2. Performance Feedback and Assessment of Progress Toward Achieving Outcomes	46
D3. & D4. Evaluation Methods	47
D5. Project Replication and Scalability.....	51

0. INTRODUCTION

The vision of this project, **STEM, LIteracy and Computation in Education for School Leaders (SLICE-SL)** intends to develop an evidence-based professional development (PD) opportunity for educators to increase the number of highly effective K-12 school leaders with Leadership, STEM, Literacy, Computation (STEM/L/C) and non-cognitive (social and emotional learning, SEL) knowledge, skills, and disposition in four underserved local education agencies (LEAs) in a rural Southern Appalachian area. If awarded, this will allow 40 school leaders to engage with 160 teachers to improve school-wide and LEA-wide instructional practices, enhancing 3,200 students' learning experiences and advancing their academic achievement between 10/1/2022 and 9/30/2025. The partnership involves East Tennessee State University (ETSU), Bristol City Schools, Hawkins County Schools, Johnson County Schools, Washington County Schools, Tennessee; the National Center on Education and the Economy (NCEE); one external research team, Evaluand LLC.; and one external evaluation team, East Main Evaluation and Consulting (EMEC) LLC.

0.1 An Exceptional Approach to the Project Priorities

The SLICE-SL addresses **Absolute Priority 2 (AP2)**: Supporting Effective Principals or Other School Leaders and three **Competitive Preference Priorities (CPPs)**- **CPP1**: Increasing Educator Diversity in K-12 education; **CPP 2**: Promoting Equity in Student Access to Educational Resources and Opportunities; **CPP 3**: Meeting Student Social, Emotional, and Academic Needs. The **goals** of the project address these priorities, including: **(G1)** create an effective and sustainable leadership model for 40 school leaders serving in underserved communities (addressing AP2); **(G2)** improve instructional leadership capacity of school leaders through Project-based learning (PBL) with STEM/L/C and SEL (AP2, CPP3); **(G3)** build the knowledge of school leaders in leading and improving student educational resources and

outcomes (CPP2 & CPP3); (**G4**) improve educator diversity in K12 education (CPP1). The connections between the SEED priorities and the projects goals are illustrated in the first two left columns of Figure 1.

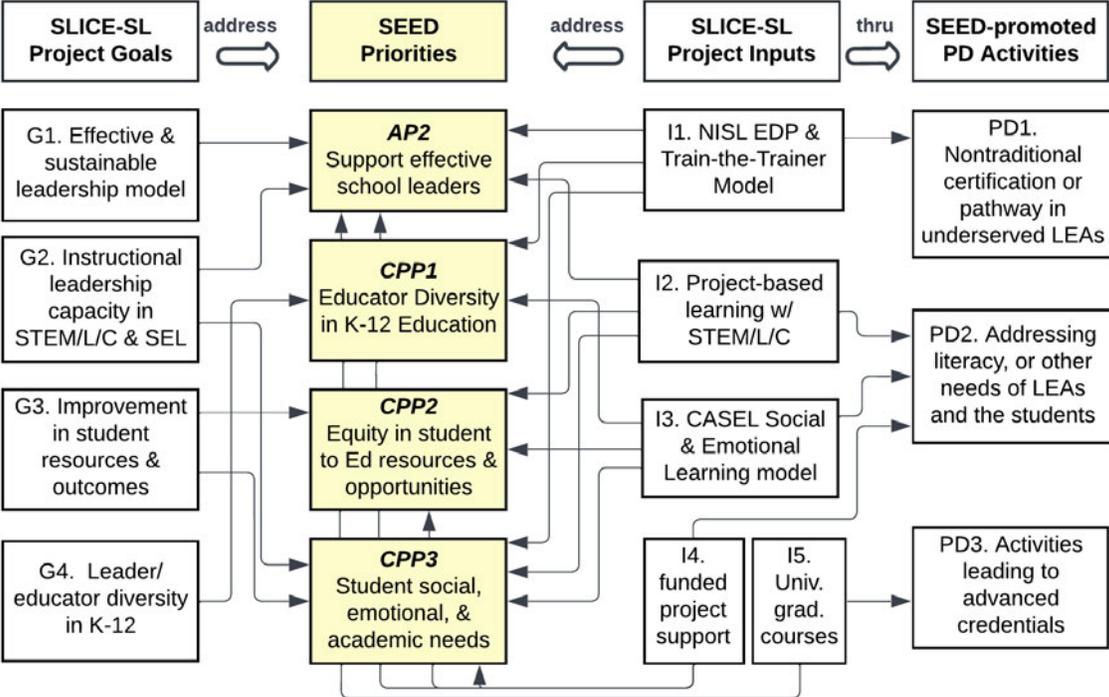


Figure 1. Connections between Priorities, Goals, Inputs, and PD Activities

In the project implementation phase, the priorities are addressed by five project **inputs** (third left column of Figure 1): (**I1**) NCEE’s National Institute for School Leadership (NISL) Executive Development Program (EDP) and Facilitator Certification Institute (i.e., Train-the-Trainer, T-T) Model; (**I2**) Project-Based Learning (PBL) with STEM/L/C; (**I3**) Collaborative for Academic, Social, and Emotional Learning (CASEL) model; (**I4**) our established current and past project support; and (**I5**) university graduate courses. The project inputs also connect to three **SEED-promoted PD activities** (last column in Figure 1): (**PD1**) nontraditional certification routes or pathways to serve in traditionally underserved LEAs (i.e., NISL EDP), (**PD2**) address literacy, numeracy, or other needs of LEAs and the students the agencies serve

(i.e., STEM/L/C and SEL), and (**PD3**) include activities that lead to an advanced credential (i.e., STEM Certificate, Ed.S., Ed.D.). The PD activities 1-3 are described in Section A1.

0.2 Project Inputs Based Evidence-based Research and Established Effective Work

The five project inputs are based on research-based evidence and our current and previous successful project experiences. The following paragraphs describe how the project inputs (**II-15**) connect to evidence-based research as well as established work deemed effective while also addressing the SEED priorities (**AP2, CPPs 1-3**) through SEED-promoted PD activities (**PD1-3**).

Input 1. NISL EDP and Train-the-Trainer to Address AP2, CPPs 1 & 3 through PD1

The project partners with the National Center on Education and the Economy (NCEE) and will implement its National Institute for School Leadership (NISL) Executive Development Program (EDP). The NISL EDP provides professional development to ensure that the participating school leaders have the knowledge, skills, and tools to effectively set direction for teachers, support their staff in improving instructional practices, and design a high-performing school organization that is rooted in professional learning (**AP2**). It meets the ***What Works Clearinghouse standards with reservations*** (Institute of Education Sciences, 2014). The EDP also offers strategies to recruit a diverse and talented teaching profession to stay in high-need schools (**CPPI**), such as how to intentionally recruit and hire a culturally, ethnically, and socioeconomically diverse group of teacher candidates who can relate to the life experiences of their students (NCEE, 2021).

Leithwood et al. (2004) found that principals are second only to teachers in their influence on student achievement. Subsequent studies have reinforced these findings (Coelli & Green, 2012; Grissom et al., 2015). Researchers found, when comparing principals based on effective principal characteristics, students perform better at schools with more effective principals than

those rated less effective (Branch et al., 2012). Similarly, teacher turn-over is lower at schools with effective principals (Boyd et al., 2011) and successful principals hire effective teachers and encourage effectiveness in teachers (Béteille et al., 2012; Loeb et al., 2012).

The EDP's successful results can be replicated in our contexts and in alignment with our project's objectives. For example, in Massachusetts, NISL's EDP focused on under-performing schools with high need student populations. School leaders were trained with skills to promote teacher growth as well as their own leadership growth, leading to a positive impact on students' English Language Arts (ELA) and math scores (Nunnery, Ross, Chappell, et al., 2011) (*CPP3*).

Input 2. PBL with STEM/L/Computation to Address AP2, CPPs 2 & 3 through PD2

Project-based Learning can significantly impact student achievement in STEM and other content areas (*CPP3*). Studies of K-12 students have demonstrated significant differences between PBL treatment groups and control groups on measures of student learning in science (Karaçalli & Korur, 2014;), math (Koparan & Güven, 2014), English Language Arts (Halvorsen et al., 2012), and social studies (Parker et al., 2013). The Buck Institute of Education (BIE) uses the framework of Gold Standard PBL which consists of seven essential design elements: challenging problem or question, sustained inquiry, authenticity, student voice and choice, reflection, critique and revision, and public product (Larmer & Mergendoller, 2015). Within BIE's theory of action, school leaders play an important role in the implementation of PBL by demonstrating their knowledge, skills, and dispositions to create school conditions that support teachers' use of PBL in their classrooms (BIE, 2019b) (*AP2*).

Computational Thinking (CT) with STEM- Introduced by Wing in 2006, CT represents an approach to problem solving grounded in computing that is valued in a wide variety of contexts.

STEM skills are increasingly important for all career paths and for all people to succeed throughout their lives

Social equity in Computation

learning in rural areas (*CPP2*)- Compared with schools in suburban districts, schools in rural areas are less likely to have computer science classes or computational learning opportunities (Warner et al., 2020). Supporting underrepresented and high-need students with CT skills needed to fill 21st-century jobs is a social justice imperative (Leonard & Martin, 2013). **PBL + CT**: PBL is commonly used to teach computational thinking to K-12 students, and the cross-domain approach of PBL is recommended to prepare students for the complex real-world problems that benefit from computing (Hsu et al., 2018). Using PBL to address CT may, in turn, have the added benefit of increasing student interest in STEM (*CPP3*).

Input 3. CASEL to Address CPPs 1, 2, 3 through PD2

The Collaborative for Academic, Social, and Emotional, Learning (CASEL) model emphasizes five competencies: self-management, self-awareness, social awareness, relationships skills, and responsible decision making (Alexander & Vermette, 2019). SEL decreases the likelihood that youth engage in risky behaviors that negatively impacts their lives while also improving the mental health and academic success of students (Taylor, 2017), its impact is amplified when used as a coordinating framework to reform all aspects of schooling (CASEL, 2022). At the heart of systemic SEL include connections between a school district and its employees, students, families, and communities (CASEL, 2022). Through these connections and framework, school leaders gain a better understanding of the district and community climate – including the gap of cultural synchronicity between staff and students (Thierry et al., 2021; Wright et al., 2017). This knowledge will allow school leaders to implement strategies in

recruiting diverse educators, with the hopes of addressing needs and improving school climate (*CPPI*).

According to the Centers for Disease Control and Prevention (CDC, 2017), schools are an ideal setting for students and families to access social-emotional related services, especially in rural or isolated areas (*CPP3*). Providing opportunities for SEL and development aides in the breaking down the stigma of mental health issues. Furthermore, schools are a neutral territory where all families can come together to receive equitable access to services that address the social-emotional needs of their children (CDC, 2017) (*CPP2*). Not only is the school a neutral territory, but when social-emotional services are provided through this system, it is a more cost-effective option for families, and students are 21 times more likely to seek out supports at school than at community-based clinics (Jones et al., 2015; Reback, 2018; Walker et al., 2010).

Input 4. Current and Established Grant Work to Address AP2, CPPs 2 & 3 through PD2

Our previous six Tennessee Improving Teacher Quality and Math and Science Partnership projects (1/2015-9/2018) and current US ED Teacher Quality Partnership project (10/2018-9/2023) have enabled grades K-12 STEM and Literacy teachers to advance STEM, Literacy, Computation education through standards-based and STEM-Literacy-Computation integrated learning environments (Tai et. al., 2018; Robertson et. al., 2019). Teachers have acquired effective instruction to provide meaningful learning for their students, improve their students' academic performance, and advance their pedagogical skills. The project will use a regional lead teacher team from these established projects (See Section C2.1) to join the university faculty members to support the participant school leaders and teachers in supporting: (1) STEM/L/C instructional practices and strategies for school leaders and their educators (*AP2*), (2) education resources and opportunities for high-needs students and schools (*CPP2*), and (3) academic needs

in partner classrooms (*CPP3*). Specifically, they will offer (1) **best practices** in classrooms focused on assisting teachers to advance their content instruction and pedagogical skills aligned with the academic standards and (2) **STEM, Literacy and Computation integration** addresses how cross-subject practices can be integrated and implemented through a collaborative effort in English Language Art (ELA), Math, and Science classrooms.

Input 5. University Graduate Courses Address AP2 through PD3

Supported by ETSU School of Graduate and Continuing Studies, the SLICE-SL project will offer six tuition-waived graduate courses in leadership, STEM, and Counseling (Table 1) to the 40 school leaders and 160 teachers in summers 2024 and 2025 (i.e., Years 2 and 3). The courses can lead to advanced credentials (*PD3*) for leaders and educators in STEM Certificate, ED.D. in Leadership, ED.S. in Leadership, ED.S. in Counselor Leadership.

Table 1. ETSU Graduate Courses

Categories	Leadership	STEM	Counseling
Courses	ELPA 6452 Creating School Cultures That Support Teaching and Learning ELPA 6954 Educational Program Evaluation	SCED 5600 STEM Theory and Pedagogy SCED 5620 Bridging STEM in Education and Business	COUN 6563: Advanced Social/Cultural Foundations COUN 6956: Supervision in Counseling and Leadership

A. QUALITY OF THE PROJECT DESIGN

A1. Sufficient Quality, Intensity, and Duration Lead to Improvements in Practices

To accomplish the project goals, the SLICE-SL uses a strategic action plan illustrated in Figure 2. The success of the project is evaluated by how school leaders increase efficacy in administrative and instructional leadership as noted **(A) Effective School Leadership**. If this is achieved, the participant leaders will have the capacity to reach four sequential outcomes: (B) improve school conditions, (C) strengthen teacher practices, (D) improve student experiences and, (E) advance student academic outcomes. The strategic plan is part of our logic model (stated in A3.2 and Figure 3) and aligns with the project priorities, inputs, research objectives (see A3.1), and research questions (Section D).

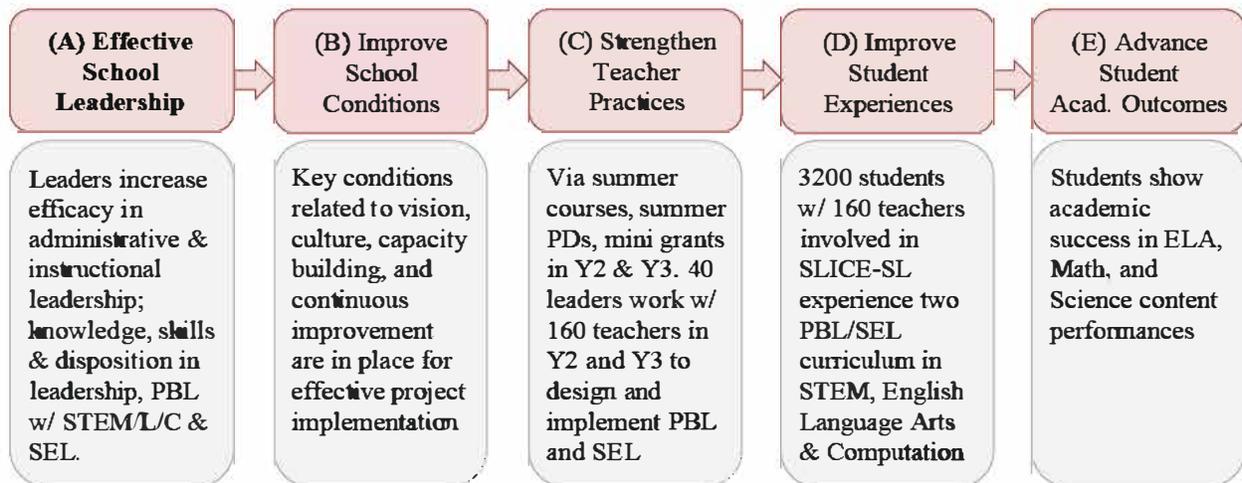


Figure 2. SLICE-SL Strategic Action Plan

Leader recruitment aligned with the strategic plan: Consistent with the demographic characteristics and needs within the proposed service areas, a tailored recruitment plan has been established, in consultation with LEA members of the Project Management Team (PMT). As stated on the LEA Letters of Support (Appendix D), the project personnel at LEAs will be responsible for recruiting school leaders, particularly for those are in high-needs or low-income communities. The project will build up a three-year (1/1/2023-12/31/2025) Leadership Academy

with 40 school leaders recruited from Bristol City Schools (n=4), Hawkins County Schools (n=17), Johnson County Schools (n=2), and Washington County Schools (n=17), Tennessee. To promote educator diversity, a recruitment priority will be given to school leaders of color. A lottery process will be applied if the number of applicants exceeds the project quota. Also, the PMT will identify 8 alternates to replace any leader(s) that might drop out of the program.

Timeline for the Strategic Plan: In Year 1 (10/1/22-9/30/23), the Leadership Academy will primarily work on (A) leadership effectiveness and (B) school conditions. Then, in Years 2 & 3 (10/1/23-9/30/25), each school leader will bring a team of four STEM and Literacy teachers from her/his school, i.e., 160 (= 4x40) teachers to form an educator cohort. The Leadership Academy will work closely with the teacher cohort to (C) strengthen teacher practices, (D) improve student experiences, and (E) advance student academic outcomes.

Table 2 provides a summary of our SLICE-SL PD services to the school leaders and teachers. The PD services include a variety of activities through the project timeline (also see C2.2) and connect to SEED-promoted PDs. The following paragraphs describes *quality, intensity, and duration* of project services that lead to improvements in practices among the recipients of those services.

Table 2. SLICE-SL PD Services

SLICE-SL PD Services		Time	Participants	SEED-promoted PD
<i>National Institute for School Leadership Training</i>				
1	NISL EDP	1/1/23-12/31/23	40 leaders	Nontraditional certificate (PD1)
2	NISL Train-the-Trainer	1/1/24-4/30/24	10 leaders	Nontraditional certificate (PD1)
<i>Professional meetings to advance leadership, STEM/L/C and SEL knowledge and skills</i>				
3a	Quarterly professional meetings	1/1/22-12/31/23	40 leaders	Support school needs (PD2)
3b	Monthly professional meetings	1/1/24-9/30/25	40 leaders	Support school needs (PD2)
<i>Graduate courses and PBL/SEL PD in Summer Year 2</i>				
4a	ELPA 6452: leadership course	6/17/24-6/21/24	40 leaders	Support school needs (PD2) To advanced credentials (PD3)
	SCED 5600: STEM/L/C course		120 teachers	
	COUN 6563: SEL course		40 teachers	
4b	1 week PD for PBL/SEL curriculum development	6/24/24-6/28/24	40 leaders & 160 teachers	Support school needs (PD2)
<i>Graduate courses and PBL/SEL PD in Summer Year 3</i>				

5a	ELPA 6954: leadership course	6/16/25-6/20/25	40 leaders	Support school needs (PD2) To advanced credentials (PD3)
	SCED 5620: STEM/L/C course		120 teachers	
	COUN 6956: SEL course		40 teachers	
5b	1 week PD for PBL/SEL curriculum development	6/23/25-6/27/25	40 leaders & 160 teachers	Support school needs (PD2)

Service 1 NISL EDP and Service 2 Train-the-Trainer

Curriculum, instruction, and assessment should be supported by state and national standards and evidence-based practices. NISL Training integrates these standards and provides a foundation for school leaders to effect change in their schools and improve student outcomes. NISL Master Instructors will provide a 12-month training to 40 school leaders and 2 ETSU faculty members.

NISL EDP is delivered via the equivalent of 24 days of cohort-based instruction, divided into 12 units spread over approximately 12 months, followed by approximately four months of action learning support. All NISL units are 12 hours of contact time, either face-to-face or virtual, with content and curriculum accessible online through the NCEE Portal. The units are distributed over three thematic courses and 12 units as summarized in Table 3. The participants will earn a NISL EDP certificate from the NCEE after completing the program (PD1).

Table 3. NISL EDP Courses

Courses	World-class schooling: vision and goals	Research on learning & implications for teaching, leadership, & school organization	Sustaining transformation through capacity and commitment
Units	1: Educational Challenges 2: Principal as Strategic Thinker 3: Elements of Coherent and Aligned Learning Systems	4-6: How People Learn and Implications for Teaching, Leadership, and School Organization: Parts 1-3 7: Promoting the Learning Organization	8: Leading for Effective Teaching 9: Teams for Instructional Leadership 10: Ethical Leadership for Equity 11: Driving and Sustaining Transformation 12: Final Case Simulation and Presentations

In addition, 10 school leaders and 2 ETSU faculty members will attend the Train-the-Trainer Program after completing the 12-month EDP to facilitate and support future years' efforts. The

selected leaders will receive extra guidance on facilitation with opportunities to lead portions of training and receive feedback during a six-day facilitation unit.

Service 3a & 3b Quarterly and Monthly Professional Meetings

Throughout the grant period, the ETSU faculty will work with the Leadership Academy through a variety of professional meeting sessions (2 hours/session) to advance their knowledge, skills, experiences, and strategies in leadership, educator diversity, PBL, SEL, computational thinking, STEM/L/C integration, digital innovation in school, curriculum development support, equity in education, student SEL and academic needs, curriculum implementation sharing, etc. Quarterly meetings will be offered between 11/1/22 and 12/31/23 (due to the intensity of the NISL EDP training in Year 1) and monthly meetings will be offered between 1/1/24 and 9/30/25.

Table 4 summarizes an arrangement of the professional meetings.

Table 4. Professional Meeting Arrangement

	mm/yy	Topics of Professional Meetings
1	11/22	Project introduction, expectations, goals, and logistics
2	02/23	STEM and Literacy integration- case studies
3	04/23	Diversity, equity, inclusion in education: theories and case studies
4	09/23	Social and emotional learning: theories and case studies
5	11/23	Support educator diversity: theories, status, and strategies to improve
6	01/24	Project based learning: theories and case studies
7	02/24	Computational thinking and how it connects STEM and Literacy
8	03/24	Relational trust between leaders, teachers, and students in the school community
9	04/24	Support teachers to design PBL STEM/L/C and SEL curriculum
10	08/24	Design and support a digital learning and teaching environment
11	09/24	Address student social, emotional, and academic needs
12	10/24	Share curriculum implementation, update implementation status, address school needs
13	11/24	Equity in student education resources and opportunities
14	01/25	Share curriculum implementation, update implementation status, address school needs
15	02/25	Share curriculum implementation, discuss project sustainability
16	03/25	Share curriculum implementation, update implementation status, address school needs
17	04/25	Share curriculum implementation, update implementation status, address school needs
18	08/25	Share curriculum implementation, update implementation status, address school needs
19	09/24	Project conclusion

Service 4a & 5a Graduate Courses

Courses for leaders: The 40 leaders will take a graduate course: *ELPA 6452 Creating School Cultures That Support Teaching and Learning* in the third week of June of Year 2 and another course: *EPLA 6954 Educational Program Evaluation* in Year 3. The ELPA courses focus on program evaluation, strategic planning, data analysis, and leadership for teaching and learning, all of which reinforce and build upon their NISL EDP training in Year 1.

Course for teachers: 160 teachers working with their school leaders will take two summer graduate courses in the same timeline. 120 teachers will take *SCED 5600 STEM Theory and Pedagogy* in Year 2 and *SCED 5620 Bridging STEM in Education and Business* in Year 3. The two SCED courses offer teachers the opportunity to learn how to teach STEM/L/C through PBL using the BIE framework of Gold Standard PBL (Larmer & Mergendoller, 2015). The teachers will explore the theory and pedagogy of PBL as well as performance-based assessment, creativity, and 21st century skills. They will also analyze and evaluate STEM curricular resources. Also, additional 40 teachers will take *COUN 6563 Advanced Social and Cultural Foundations* in Year 2 and *COUN 6563 Advanced Social and Cultural Foundations* in Year 3. They will be guided on the development of the five core SEL competencies expected for students—self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (CASEL, 2020) as well as self-integrity, locus of control, self-motivation, conflict resolution, leadership styles and personality, ethics in decision making, effective relationship skills and management.

The six graduate courses will be taught by ETSU faculty members, and the tuition will be waived by ETSU School of Graduate and Continuing Studies. The earned graduate credits can

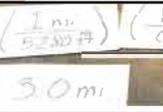
lead to advanced credentials for leaders and educators in STEM Certificate, ED.D. in Leadership, ED.S. in Leadership, ED.S. in Counselor Leadership.

Services 4b & 5b 1-week PBL/SEL Curriculum PD

Followed by the summer weeks of graduate courses, the 40 leaders and 160 teachers will work with 15 faculty members from ETSU College of Arts and Sciences and College of Education, and 12 K-12 regional lead teachers to develop PBL with STEM/L/C and SEL curriculum which can be tested and implemented in the partnered schools in the following academic years. The curriculum includes: topic, PBL question, learning objectives, standards, elements of computational thinking and SEL, curriculum integration etc. For example, Table 5 shows an abbreviated description of a lesson with the topic of energy that integrates biology, chemistry, math, ELA, and computational thinking in 9th and 10th grade. It consists of seven essential design elements of PBL: challenging problem or question, sustained inquiry, authenticity, student voice and choice, reflection, critique and revision, and public product (Larmer & Mergendoller, 2015).

Table 5. iSLICE-SL Lesson Example: Energy- How Does Energy Flow Through A System?

Overarching Topic: Energy; Essential PBL question: How does energy flow through a system?		
Learning Objectives: Students in 9 th or 10 th grade will be able to:		
<ul style="list-style-type: none"> • Defend a conclusion based on scientific evidence both verbally and in writing • Cite strong and thorough evidence to support analysis of what the text says explicitly as well as what it infers. • Present information, findings, and supporting evidence clearly, concisely, and logically. • Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance the understanding of findings, reasoning, and evidence and to add interest. • Analyze energy changes to explain and defend the Law of Conservation of Energy. • Contrast the concepts of temperature and heat flow in macroscopic and microscopic terms-- understand that heat is a form of energy and temperature is a measure of the average kinetic energy of a molecule or atom. • Use units to guide and justify methods for solving a literal equation (an equation that consists primarily of variables that represent quantities, such as a formula), or one of its variables. • Interpret expressions representing products, quotients and sums of quantities. 		
Science (Content/Practices)	ELA (Content/Practices)	Mathematics (Content/Practices)
BIO1.LS1.9 Create a model of aerobic respiration demonstrating flow of matter and energy out of a cell. CHEM1.PS3:Energy.1 Contrast the concepts of temperature and heat flow... Understand that heat is a form of energy and temperature is a measure of average kinetic energy of a	9-10.RL.1 Cite strong and thorough textual evidence to support analysis.. 9-10.SL.4 Present information, findings, and supporting evidence clearly., 9-10.SL.5 Make strategic use of	A1.N.Q.A.1 Use units as a way to understand problems & to guide the solution of multi-step problems; choose & interpret units consistently in formulas; choose & interpret the scale and the origin in graphs & data displays. A1.N.Q.A.3 Choose a level of accuracy

molecule. CHEM1.PS3: Energy. 4. Analyze energy changes to explain and defend the law of conservation of energy	digital media in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.	appropriate to limitations on measurement when reporting quantities. A1.A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context.		
1. asking questions. 2. developing & using models. 3. planning & carrying out investigations. 4. analyzing & interpreting data. 5. using math & computational thinking. 6. Constructing explanations. 7. Argument from evidence. 8 communication.	1. close reading & interpretation. 2. collaborative discussion & communication. 3. argumentative writing. 4. comparative/expository writing technology usage to enhance presentations	1. reason abstractly & quantitatively. 2. model with mathematics. 3. look for & make use of structure. 4. selecting, sequencing, & connecting. 5. anticipating & monitoring. 6. look for & express regularity in repeated reasoning. 7. use appropriate tools strategically.		
Computational Thinking: <input checked="" type="checkbox"/> Decomposition <input checked="" type="checkbox"/> Patterns <input checked="" type="checkbox"/> Abstraction <input checked="" type="checkbox"/> Algorithmic solution				
SEL: <input type="checkbox"/> Self-management <input checked="" type="checkbox"/> self-awareness <input checked="" type="checkbox"/> social awareness <input type="checkbox"/> relationship skills <input type="checkbox"/> responsible decision making				
Curriculum Integration				
	Topics	Science	ELA	Math
Instructional pacing ↓ ↓	Energy flow through the human body (system)	 A metabolic rate lab discussion of the body as a system	 Novel: <i>Night</i> close read; discussion of novel as a system	 Explore Literal equations with Elvira's equations activity
	Heat, conservation of energy	 A Chemistry Calorimetry Lab Discover conservation of energy	 Novel: <i>Fahrenheit 451</i> close read; discussion of novel as a system	 Dimensional analysis with note cards activity by AACT
	Energy Systems in real world	 South Holston Dam discussion of the neighboring dam as an energy system	 Downstream close read, learn local stories	 Bristol Motor Speedway discussion of the engine as a system; math in car racing at a local speedway
CLASS COLLABORATION- SOCRATIC SEMINAR ON SYSTEMS				
Final project: examining systems	students examine a system of energy in the real world; argue about what that system says metaphorically about that society/culture; students examine a system of energy in a story; use scientific concepts to support claim about the story's theme(s); all students present their arguments in a documentary			

CT-integration: To prepare school leaders to support teachers in integrating CT, the instructional plan will follow Mannila and colleagues' (2014) recommendations to first clarify for teachers each of the concepts of CT and then provide examples of activities that integrate CT. The proposed project adopts Barr and Stephenson's (2011) practical approach to embedding CT into K-12 education through active problem solving and by linking CT to what teachers already do in their classrooms (Yadav et al., 2016).

Mini grants in Services 4b and 5b:

School leaders will collaborate with teams of teachers during Years 2 and 3 in an internal mini grant competition to support gold standard PBL units (see Appendix G.2 for the mini grant proposal template). Each team will consist of one school leader and four teachers and submit a

mini grant proposal between 7/1-8/15 in Year 2 and Year 3. Grant funds will be used to support the time of team members to design curricular materials and the purchase of instructional materials needed for the PBL STEM/L/C curriculum. For each awarded mini-grant, school teams will design and implement two PBL units, one in the fall semester and one in the spring semester. To meet the criteria of gold standard PBL, units will incorporate the seven criteria identified by BIE, and each of the PBL units will address STEM, literacy, CT, and SEL. STEM and literacy will be met through relevant Tennessee learning standards in science, math, and ELA (see an example in Table 5). The PBL units will incorporate at least one specific connection to CT, as defined for K-12 education (ISTE & CSTA, 2011b), and SEL related to the CASEL model (Alexander & Vermette, 2019). Within their grant proposal, teams must describe their implementation plans and proposed expenses. They will also propose management of the plan and dissemination of their results with parents, administrators, and colleagues. Project faculty and the lead teacher team (Section C2.1) will advise and support teams on their plans.

Strategies to support leaders and schools for educator diversity

In the services of NISL EDP (Service 1), professional meetings (3a & 3b), and graduate courses (5a & 6a), the ETSU faculty in the Departments of Leadership, Curriculum and Instruction, Counseling and Human Services, and Special Education will work with school leaders to seek practical strategies to improve educator diversity in their schools and LEAs. Many researchers have identified the need for more teachers of color (Higgins, et al., 2017; Noonan & Bristol, 2021; Carver-Thomas, 2017). All students, but especially students of color, have benefited from having exposure to teachers of color (Carver-Thomas, 2018; Carver-Thomas & Darling-Hammond; Dillard, 2019; Haddix, 2017). The project will use multiple promising practices to recruit and retain teachers of color in partnered LEAs.

First, ETSU teacher preparation programs will seek to improve admission services (e.g., provide ACT and/or Praxis tutoring) and financial aid needed so that teacher candidates of color can access these programs. These teacher candidates will also be potential teachers recruited by the LEAs. **Second**, teacher residency partnerships between the partnered LEAs and ETSU can improve teacher training for needed schools and in-demand subjects. These residency programs provide beginning teachers with opportunities to serve as apprentices to experienced teachers, with financial support and tuition assistance as a commitment to teaching in the district. **Third**, ETSU will use “high-touch recruitment methods,” (Carver-Thomas, 2018) which entails building relationships with potential students of color and actively offering them support upon entry to teacher education programs. **Fourth**, the partnered LEAs will use Tennessee Grow Your Own Programs to assist districts in recruiting non-traditional students who are more likely to reflect the diversity in their communities. Tennessee has developed the Teacher Preparation Report Card in 2016. Teacher education programs must report on the diversity of teacher candidates. States can work toward increasing teachers of color by monitoring data and utilizing strategies to meet the unique demands of LEAs.

The partnered LEAs will also schedule hiring for earlier in the academic year and use feedback on hiring from current teachers of color to attract more diverse hires. Strong school leadership support leads to greater retention of teachers of color and districts can provide school leaders with professional development to assist them in providing appropriate support to teachers of color (Carver-Thomas, 2018).

A2. Incorporation Project Capacity and Results beyond the Grant Period

A major asset of our established LEA-IHE partnerships has been to build and maintain ongoing and sustained professional development in STEM/L/C teaching and learning.

Additionally, this project seeks to build leadership capacity at the LEAs and strengthen its partnership with our leadership and teacher preparation programs in the Departments of Counseling and Human Services, Curriculum and Instruction, Educational Foundations and Special Education, and Educational Leadership and Policy Analysis. Many of the components of the proposed project are permanent and thus represent a sustained change for each partner. **First**, the concept of collaborative action through the Project Management Team (PMT) is an extension of previously funded programs and will continue to be embedded in the work of the existing partnership long after funding has ended. **Second**, the PMT will continue its work and institutionalize collaborative efforts between school leaders, teachers and higher education faculty. For example, three ETSU department chairs involved in the project will revise their education preparation and residency programs to meet the needs of the LEAs. **Third**, K-12 STEM/Literacy teachers, school/ district leadership, and higher education faculty from the College of Arts and Science and College of Education will continue to meet and plan ways to work toward the improvement of STEM, Literacy and Computation education in the region's schools. The ETSU faculty will continue to provide their expertise to teachers through classroom visits and various collaborative efforts. The materials and resources in the project will continue to be used by the school leaders, teachers, and their colleagues. The project activities will be **sustained** in these specific ways (Table 6) after funding has ended:

Table 6. Methods of project sustainability
<ol style="list-style-type: none"> 1. The project team will continue to meet and plan on-going PD activities and sustain the partnerships. 2. ETSU leadership and teacher preparation programs better address LEA needs. 3. The project will align project learning and curriculum materials with existing K-12 resources 4. The project will translate the professional learning into open courses. 5. The school leader participants will be situated in their schools and districts to refine their leadership knowledge and practice. 6. The PI of the project will work with the partner and other LEAs in revising K-12 STEM, literacy and computer science curricula and align learning activities with state standards. 7. NISL-trained school leaders will mentor and train other school leaders at the LEAs.

8. The project PI and Co-PIs will continue to work in potential target schools to support teachers' STEM/L/C instruction.
9. Additional funding (e.g. NSF, EIR, IES) and new partnerships with schools and businesses will be pursued to support a scaled-up implementation.
10. The model of the integrated STEM-Literacy-Computation instruction will continue to be shared and studied through new grants and additional teacher professional developments.

All activities will be presented in the context of how leaders and teachers can implement them effectively in their own schools and classrooms. Also, the project school leaders will work with their teachers to design and implement STEM/L/C in PBL curriculum. Each school leader in the SLICE-SL will organize and coordinate mini grants in their respective schools. They will play the role of sensitive facilitators to establish a climate in which they can build mutual trust and share what they have done in their schools. Specifically, they will share with their colleagues the activities and lesson plans they developed and learned about as a result of participation in the SLICE-SL project.

Project faculty will continue to support school leaders. Through this program, school leaders and teachers will earn credits that may be applied to ETSU advanced degrees. Also, NISL-trained school leaders will continue to train and mentor other school leaders at these LEAs, ensuring a continuous leadership pipeline and further developing the partnership between the LEAs and ETSU Leadership and Educator Preparation programs.

A3. Conceptual Framework: Connections between Research, Activities and Priorities

A3.1 Research/Evidence-based Project Approach and Project Research Objectives

The research-based and evidence-based project approach, i.e., the first three project inputs: (1) NCEE NISL EDP and Train-the-Trainer, (2) PBL with STEM/L/C, and (3) CASEL is used to achieve the project goals and is measured by five project *research objectives* (RObj) which are introduced below.

The **first** objective, to increase participant School Leaders' skills in **observing and providing effective feedback** to STEM and literacy teachers, aligns with TN's Leadership Standards (TILS) and will be addressed through PD (Services 1, 3a & 3b) and course work (Services 4a & 5a). School leader PD programs such as NISL (EDP) support instructional leadership practices that lead to positive effects on student achievements. The **second** objective, to increase the ability to **use data to plan instruction and professional learning** is an essential aspect of TILS. A key expectancy for the NISL-trained principal is the ability to use "data to produce continuous improvements in instruction and student achievement" (Nunnery, Yen, & Ross, 2011, p. 6). The **third** objective is to increase participants' ability to **utilize evidence-based PD or retrain strategies for educators** in PBL and SEL. This objective will be addressed through PD sessions and coursework. Studies have shown that principals' actions as instructional leaders can assist STEM teachers develop professionally, and ultimately, principals' roles as instructional leaders in STEM fields demonstrated by positive impacts on student achievement (Allensworth, 2011; Byrk et al., 2010; Colby et al., 2010; Nelson & Sassi, 2005). A recent 10-year study found that principals' support of teachers in helping students with socioemotional needs has become an increasing part of their workload and reflects a need for PD in this area (NAESP, 2018). The **fourth** objective, to increase **relational trust** in participant's school communities, will be supported by school leaders taking courses in curriculum instruction, counseling, and school leadership, as well as engaging in PD activities. The NISL EDP will provide opportunities for leaders to develop a vision to inspire others in the school communities and to build a professional learning community for school faculty and staff (Nunnery, Ross, Chappell, et al., 2011, p. 8). The **fifth** objective, to increase **educator diversity** in participant's school communities, will be supported by school leaders taking PD sessions and courses in

school leadership. The courses provide knowledge, skills, strategies for leaders to increase their educator diversity, strengthen representations of teachers of color associated to their student population, and promote a diversity, equity, and inclusion school culture.

A3.2 Project Logic Model

The SLICE-SL project is supported by a logic model (Figure 3, p 21) illustrating how the SEED priorities (AP2, CPP 1, 2, & 3) are addressed through the project inputs, strategic plan, project research objectives as stated in the above sections. The proposed logic model applies a theory-based evaluation design approach (Chen, 1990; Christie & Alkin, 2003) consisting of 14 research questions to illustrate how professional development (PD) for school leaders is anticipated to ultimately meet the needs of the project participants and the service area. An efficacy study of the research questions is detailed in Section D.

The theoretical relationships among the strategies and outcomes illustrated in the logic model can also be viewed as unpacking how the NISL leadership model impacts students' English language arts and math scores (the dashed arrow in the model; Nunnery, et al., 2011) might act through school leaders and the teachers with whom they work.

A4. Collaborative Partnerships for Maximizing Project Effectiveness

Building on more than two decades of work in STEM education, the Center for Excellence in STEM Education (CESE) at ETSU has collaborated with neighboring LEAs for over \$10M K-12 education projects (Tai et. al., 2018a, 2018b). The collaborative partnerships and established resources intend to maximize the effectiveness of project services and outcomes. The partnership involves ETSU, 4 LEAs in Tennessee (Bristol, Hawkins, Johnson County, Washington), the National Center on Education and the Economy (NCEE), one external research team, Evaluand LLC., and one external evaluation team, East Main Evaluation and Consulting (EMEC) LLC.

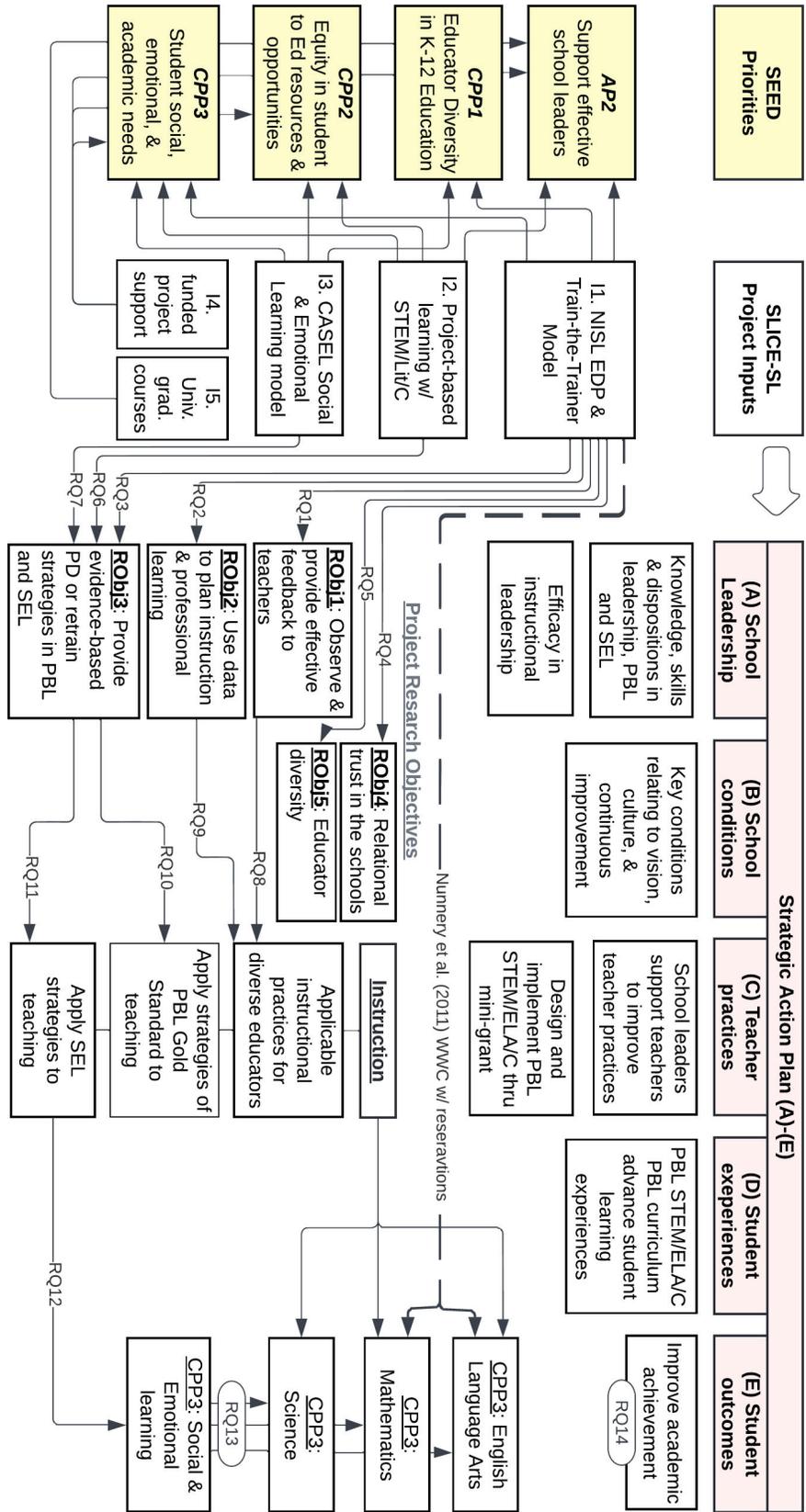


Figure 3. SLICE-SL Logic Model

Fifteen ETSU faculty members from 8 academic departments (Leadership, Curriculum and Instruction, Counseling, Special Education, Biology, Chemistry, Geosciences, and Language) will provide a variety of professional enhancement services (Services 3a, 3b, 4a, 4b, 5a & 5b) to the school leaders and their teachers.

The partner LEA members will advise the PMT about the needs of the LEAs, provide project feedback, support a professional learning community within the districts, and assist the PMT by identifying leaders, teachers, and providing students' performance data.

Also, the project is partnered with the National Center on Education and the Economy (NCEE) to provide evidence-based leadership training programs (Services 1 & 2). The project team engages Evaluand, LLC (Reston, VA) to provide comprehensive research support examining the SLICE-SL model, including (1) an impact evaluation, testing the innovation's effectiveness using methods meeting *What Works Clearinghouse* standards; (2) formative evaluation support for performance feedback and periodic assessment of progress; and (3) the collection and analysis of objective measures aligned with defined program outcomes to support both purposes. In addition, the project includes an independent and external evaluation firm, EMEC LLC., as a third-party evaluator to provide a critical, comprehensive evaluation of the SLICE-SL model.

The current and previous initiatives related to the SLICE-SL project include a US ED Teacher Quality Partnership project, *integrating STEM and Literacy with Computation in Elementary Education* (2018-2023), three TN DOE Math and Science Partnerships projects (2015-2018) and three TN Improving Teacher Quality project (2015-17) in *STEM and Literacy Education*. The project will leverage the established experiences and infrastructure and create a broader impact of the project outcomes in the service area.

A5. Addressing Needs of Target Population

A5.1 Needs assessment

Learning opportunities in underserved communities- The SLICE-SL project will be implemented in four high-need rural LEAs in rural Southern Appalachian Highlands: Bristol City, Hawkins County, Johnson County, and Washington County, Tennessee. This rural area has three education-related disadvantages: (1) poverty, (2) achievement gap, and (3) low education attainment. The latest demographic statistics from the targeted LEAs indicate that a significant number of students (age 5-17) are identified as living in poverty (see Table 7, US Census Bureau, 2022). Noticeably, three LEAs have significantly lower percentages in education attainment (24.8, 11.9%, and 16.7%, respectively) compared to state and national averages (28.2% and 32.9%, respectively).

Researchers found that the academic performance gap between low and high Social Economic Status (SES) students has grown substantially over the past few decades (Reardon, 2011). The imbalance between low and high SES families may result in fewer low SES students completing college (Bailey & Dynarski, 2011).

Table 7. LEAs' Poverty and Education Attainment Status

	Bristol	Hawkins	Johnson	Washington	TN	US
# of students ages 5 to 17 years	3,797	7,427	2,245	10,050	1,106,003	53,974,507
# of students ages 5 to 17 in families in poverty	794	1,574	527	1,169	187,030	80,467,12
% of students ages 5-17 in families in poverty	20.9%	21.2%	23.5%	11.6%	16.9%	14.9%
Education attainment (Bachelor's degree or Higher)	24.8%	11.9%	16.7%	32.3%	28.2%	32.9%

STEM and Computation Education in rural education- Preparing students in the United States with the STEM+C skills needed to fill 21st-century jobs is a national priority (Committee on STEM Ed, 2018). The US Department of Labor indicates that employment of computer and information technology occupations is projected to grow 22 percent from 2020 to 2030, much faster than the average for all occupations (Bureau of Labor Statistics, 2021); however, a shortage of qualified graduates to fill C+STEM jobs is predicted (Yadav et. al., 2017). Compared

with schools in suburban districts, schools in rural areas are less likely to have computer science classes or computational learning opportunities (Warner et al., 2020). Supporting underrepresented and high-need students with CT skills needed to fill 21st-century jobs is a social equity issue in rural areas (Leonard & Martin, 2013).

Leadership and Educator Diversity:

Table 8 summarizes the ethnic data in administrators, teachers, and students in four partner LEAs and Tennessee and shows a low minority teacher-student ratio in partner LEAs (14.0%, 8.2%, 0.0%, and 24.3%, respectively). A diverse educator workforce plays a critical role in ensuring equity in our schools, while also supporting intercultural experiences and competencies in our education system that will benefit and improve the opportunities for all students.

Table 8. LEAs’ Ethnic Data

	Role	Bristol	Hawkins	Johnson	Washington	TN
Black hispanic native_american%	Administrator	9.3%	3.3%	0.0%	0.0%	21.4%
	Teacher	1.5%	0.5%	0.0%	1.7%	13.0%
	Student	10.7%	6.1%	9.8%	7.0%	37.1%
	T-S Ratio	14.0%	8.2%	0.0%	24.3%	35.0%
White_%	Administrator	88.4%	96.7%	90.9%	100.0%	72.9%
	Teacher	97.4%	98.0%	98.6%	96.1%	83.9%
	Student	87.7%	93.3%	89.6%	91.8%	60.1%

A5.2 Training and Service of SLICE-SL will work to meet the needs

The training and services in the SLICE-SL project (Section A1) will address the above needs through a School Leader approach (Absolute Priority 2). Particularly, the NISL curriculum reflects aspects of instructional leadership that research suggests are critical to improved instruction and learning, including: (1) **Standards-based instruction.** Research documents the critical role of standards for student performance in instruction (Tucker & Coddling 1998) and the important ways that principals can implement standards-based reform in classrooms (Knapp et al, 2010). (2) **Formative assessment.** Studies and reviews of the literature suggest that improving formative assessment practices often yield increases in student achievement

(Anderrson & Palm, 2018; Black & Wiliam 2018). (3) **Instructional teams.** Although principals remain the chief instructional leaders in their schools, they can play this role more effectively when they form instructional teams that include teachers as leaders (Wieczorek & Lear, 2018).

(4) **Compelling school vision.** A compelling vision can motivate school communities to achieve lofty goals (Leithwood et al., 2004) and is particularly important in turning around low-performing schools (Herman et al., 2008). (5) **Differentiated instruction.** Principals facilitate teachers differentiated instruction by building a system for collecting and analyzing student level data and ensuring that it is used to place students and focus instruction (Herman et al. 2008). They can also provide professional development for teachers to improve data use and instruction (Tomlinson & Murphy, 2015). (6) **Professional learning communities.** There is substantial evidence that professional learning communities contribute to student achievement (Vescio, Ross, & Adams, 2008). A study of 1,500 schools that were undergoing restructuring found that professional learning communities led to higher student achievement, lower dropout rates, and improved behavior and attendance (Newmann & Wehlage, 1997). (7) **Instruction in the content areas.** As Hill (2002) notes, principals “... need to be able to recognize good teaching and what it means to effectively implement different teaching strategies in different learning contexts” (p. 66). (8) **Learning modalities.** Principals need to understand how children learn and how to create learning environments to maximize learning. A seminal report by the National Research Council synthesized decades of research in cognitive science and outlined the key foundations of learning (Bransford, Brown & Cocking, 1999).

B. SIGNIFICANCE OF THE PROJECT

B1. Magnitude of Impact on Improvements in Teaching and Student Achievement

Overall Impact of the Project

The SLICE-SL creates a broader impact of the project outcomes in the service area. **First**, the most important outcome of this project will be an evidence-supported model for instructional leadership development. The project will develop effective educational leaders through training for leaders and teachers while supporting the efficacy in PBL teaching and learning and socioemotional support. The project's long-term goal is to demonstrate that by introducing best practices in instructional leadership, along with PBL and SEL teaching approaches, school leader programs can increase student achievement for students in high-need schools. By designing structures and tools for school leaders, the project will disseminate a model with the potential, if implemented well, to improve student learning outcomes in K-12 schools nationwide.

Second, according to the National Association of Secondary School Principals (2020), one out of three principals are not retained after their third year of leadership and are not being replaced by qualified candidates. This project will develop 40 effective school leaders over three years with the knowledge needed to effect instructional change and innovation in four LEAs in Tennessee. Together, these leaders support the development of teachers who serve approximately 160 teachers and 3,200 students over three years. More importantly, these school leaders will meet critical human capital needs in partner LEAs, who serve a high concentration of students eligible for free- and reduced-price lunch. Investing in effective PD in school leaders has been shown to increase student achievement (Miller et al., 2016; Nunnery, Ross, Chappell, et al., 2011) and according to our model, will increase the pipeline of school leaders in partner LEAs.

The **third** significant outcome of this project will be a model for developing school leaders who have the understanding about how to support STEM and English Language Arts instruction as well as provide socioemotional support for students. Schools need effective school leaders and teachers trained to teach in the STEM and ELA disciplines and to support students' socioemotional needs. The SLICE-SL participants will be trained to hold themselves accountable as instructional leaders, responsible for student learning outcomes who help teachers respond effectively to students who do not understand content. The school leaders will develop the tools and aptitudes to continue improving their own practice while training and mentoring future school leaders at these LEAs. The project increases alignment between instructional leadership theory and practice, between pedagogy and instructional delivery, and between school leadership preparation programs and partner schools.

B1.1 Impact of Leadership Enhancement

This project's objectives align with Tennessee's Department of Education's goals for administrators as they evaluate educators and facilitate their professional growth. The **Tennessee Instructional Leadership Standards (TILS) Rubric** asks administrators to build the capacity of educators to provide rigorous education for all students, to engage in shared leadership, to leverage shared strengths among teachers and the school's leadership team, to differentiate professional learning using data and professional learning communities, to develop teacher leaders, and to engage in appropriate employee and fiscal management. The NISL EDP supports these goals and has demonstrated positive impact on students' English Language Arts and mathematics performances (Nunnery, Ross, Chappell, et al., 2011). Graduate coursework and PD in topics such as strategic planning, decision-making, instructional leadership, and educational program evaluation will reinforce and support mastery of data use to support teaching and

learning. Ultimately, the project’s evidence-supported objectives, methods, and PD will result in growth in student achievement at participating LEAs and will provide opportunities for instructional leaders’ professional growth, potentially leading to advanced degrees or a graduate certificate.

B1.2 Impact of PBL with STEM, Literacy and Computation

School leaders support for teachers adopting the model of PBL is necessary. Teachers face specific, documented challenges as they build classroom cultures that support PBL. These challenges include a shift from a director to a facilitator role and a plan to scaffold higher levels of learning and performance by students (Ertmer & Simons, 2006). By completing graduate courses and PD sessions related to PBL, STEM, Literacy, and CT, school leaders will gain the knowledge, skills, and dispositions to support their teachers in such endeavors. As school leaders collaborate with and support teachers in the design and implementation of high quality PBLs through a mini-grant process, there are anticipated outcomes on student achievement scores in science, math, and literacy. The PBLs may also impact students' attitudes toward and preparation to engage in STEM careers (Hsu et al., 2018; Tillman, 2013). Likewise, by integrating computational thinking through intentional choices in planning and instruction, teachers can “support students to develop problem-solving and critical-thinking skills and empower them for success as computer science learners and computational thinkers” (ISTE, 2019, para. 4).

B1.3 Impact of Social Emotional Learning

Social and emotional skill building can be taught by using the principles of the CASEL competencies (Alexander & Vermette, 2019). Research supports the importance of CASEL competencies in creating effective leaders, improving teacher practice, and increasing student performance. They also align with the TN Tennessee Educator Acceleration Model (TEAM)

rubrics used to assess educators, chiefly evaluating the learning environment and respectful culture expectations (including perseverance, and self-esteem), problem-solving and thinking. This proposal includes PD opportunities by professionals in human development, counseling, and family studies that will strengthen these skills and align with the established research. As school leaders participate in the program, they will gain the skills, knowledge, and opportunities to immediately apply learning. For instance, school leaders' decisions influence student achievement, recruitment, and retention of quality teachers and the effective allocation of resources to facilitate learning and instruction. Participating in developing SEL will improve collaborative relationship building to facilitate successful and cooperative communication. Through this curriculum, leaders are trained and supported as they cultivate their leadership skills as well as their ability to encourage and collaborate within working relationships. Principals and other educational leaders influence teachers, student learning outcomes, organizational policies, processes, school culture as they raise self-awareness in students and teachers by stimulating consciousness of vision, motivation, and participation in common organizational goals.

B2. Project Cost Effectiveness and Justification to the Results and Benefits

The project proposes a budget of \$5.7 M (see Budget Narrative) and will directly impact 30-40 school, 40 school leaders, 160 K-12 project teachers and their 3,200 students per year in 4 LEAs. An investment of \$596 project-related student/year ($=\$5.7M/3,200/3$) is reasonable as the project can be sustained many years beyond the 3-year proposed project. Particularly, it relies more on meaningful STEM+C educational engagement for students as STEM+C skills are increasingly important for all career paths and for all people to succeed throughout their lives. Next, purchasing technology and materials for each classroom through a mini grant adds an

additional layer of success for the project as students will not need to wait for district material budgeted and purchased materials related PBL STEM/L/C activities. Additionally, the NISL EDP program is identified as a highly cost-effective program (Nunnery, Yen & Ross, 2011).

B3. Potential Contribution to the Ongoing Program or Organization

Advancement in Educator Preparation

The project advances the field of school leader preparation by providing professional development in the form of NISL training, professional meeting sessions, and graduate courses. These will lead to advanced degrees and allow the PMT to measure the impact of these PD opportunities on student achievement. The provided PD will facilitate K-12 school leaders' holistic development, aiding in the mastery of instructional leadership skills specifically for implementation of PBL STEM/L/C teaching and learning approaches, students' socioemotional support, and best practices aligned with Tennessee's Instructional Leadership Standards (TILS). School leaders will develop skills to formulate strategic plans, manage and assess data, use data to inform educational programmatic decisions, reflect upon and assess their own leadership skills, and lead instructional initiatives.

Through the NISL Train-the-Trainer Program, ten selected participants will become NISL trainers, assisting their schools and schools within the region with instructional leadership capacity building. This aspect of the project will ensure that after the grant period, selected school leaders will continue to develop other leaders and potential leaders at these and other LEAs within the region. This unique feature may lead to future studies on principal and school leadership principal preparation, as most studies and projects (Miller et al., 2016; Nunnery, Ross, Chappell, et al., 2011; Nunnery, Yen, & Ross, 2011) focus on developing the leaders themselves rather than training them to subsequently train other school leaders in the future.

Educational Leadership personnel from ETSU and NISL have track records of success in the region and nation for providing principal PD programming. The ETSU Educational Leadership Department has developed school leaders, leading to principal licensure, for over 40 years. These experienced faculty have connections with the community and many regional school leaders. Their regional and state knowledge, combined with their subject-matter expertise and past professional experiences, will aid these LEA leaders as they continue to build instructional leadership capacity during and after the grant period. Because participants will be offered opportunities for graduate credit, they may apply these to four graduate credentials, depending on their educational goals.

Improvement in Educator Diversity

When working with the leaders and teachers, the project team including Chairs and faculty members from 4 teacher preparation departments (Educational Leadership, Curriculum and Instruction, Counseling and Human Services, Special Education) will seek to support teacher candidates of color through program admission policies and financial aid. They will be potential teachers recruited by the LEAs. Also, teacher residency partnerships between the partnered LEAs and ETSU can improve teacher training for needed schools and in-demand subjects. The LEA-ETSU partnerships can work toward increasing teachers of color by monitoring data and utilizing strategies to meet the unique demands of LEAs.

B4. Dissemination of Information and Strategies

The results of these projects, including the curriculum materials and research findings, will be disseminated through four pathways: (1) publications, (2) conference presentations, (3) social media and a web-based digital platform, and (4) outreach opportunities.

First, the project team has established a track record of disseminating findings and outcomes of grant projects through book and journal publications. Initial publications have addressed preliminary findings for the on-going and previous projects (Channing, 2020; Robertson & Moran, 2018; Tai et al., 2015; Tai, Moran, et al., 2018; Tai, Nivens, & Keith, 2018; Tai, Nivens, Robertson, et al., 2018). For this proposal, the team will report the research outcomes at various time frames. For example, preliminary findings on Year 1 will be reported in Fall 2023, a mid-term report in 2024 and 2025, and long-term outcomes report in 2025-26. Qualitative and quantitative data analysis will occur iteratively throughout the project. After analysis, data will be synthesized and reports submitted to peer-reviewed journals such as Educational Research, Educational Administration Quarterly, Journal of Leadership Education, etc. **Second**, our team will present findings at international and national conferences (e.g., The International Council of Professors of Educational Leadership Conference, National Science Teaching Association), state conferences (e.g., Tennessee STEM Innovation Summit) and regional conferences (e.g., ETSU STEM Conference) to provide successful strategies, curricula and lessons learned to K-12 education stakeholders across the region, state, and country. **Third**, we will use social media (e.g., Facebook, twitter) and a web-based digital platform (e.g., a project website) to share project news and updates as well as curriculum materials in a multimedia format. **Fourth**, we will provide outreach opportunities to K-12 school leaders and teachers in the region, state, and nation. The sharing of the effective instructional artifacts such as PBL activities and lesson plans using the creative commons will benefit other teachers and school administrators who are interested in integrated STEM-Literacy-C instruction with effective and ready-to-use resources. With these four pathways, the results of the project are to be disseminated in ways that will enable other stakeholders to use the information or strategies.

C. QUALITY OF THE MANAGEMENT PLAN

C1. Goals, Objectives, and Outcomes are Specified and Measurable

The SLICE-SL project proposes **s**pecific and **m**easurable implementation objectives (IObj) and research objectives (RObj, Section A3.1), supported by a set of **a**chievable and **r**elevant implementation processes in the project manageable **t**imeline (see Section C2.2 Table 11). The S.M.A.R.T. (Specific, Measurable, Achievable, Relevant, Timely) management model (Doran, 1981) is applied in the SLICE-SL project to accomplish the project goals: (G1) create an effective leadership model, (G2) improve instructional leadership capacity, (G3) improve student educational resources and outcomes, and (G4) improve educator diversity. Table 9 summarizes how the project **goals, objectives, outcomes, and measures (data)** are incorporated in the management plan. The research objectives are presented in a research question format for an efficacy study outlined in Section D.

Table 9. Goals, Objectives, Outcomes, and Measures and in SMART Management Model

Objectives	Outcomes	Measures (Data)
Goal 1. Create an effective and sustainable leadership model for school leaders serving in underserved communities (to address AP2)		
IObj1. Develop the SLICE-SL model	Completion of materials for Leadership, STEM/L/C PBL, SEL PD units and adapted graduate courses, including necessary materials and resources; by timeline target dates	Date of completion of process steps; quality of materials
IObj2. Execute a Leadership Academy	Recruitment of 40 school leaders; Building district advisory and support boards	# of leaders recruited; # of members of advisory board
IObj3. Train school leaders	Participation of > 95% of 40 leaders in > 90% of 346 hours of program activities (PDs & courses), on defined program delivery schedules	# and hours of PD provided; attendance; # of NISL EDP certificates & graduate credits completed
IObj4. Execute a comprehensive evaluation model	Completion of a quality efficacy study; use of formative feedback to improve the model and project performance	WWC standards of quality, timeline (see Section D)
IObj5. Disseminate findings of the evaluation	Development and distribution of 3 journal articles, 3 book chapters, and 6 conference presentations	# of products for dissemination; # of potential audience members reached
IObj6. Assess the cost per successful participant	Finalized cost-per-participant analysis, in time to inform ED performance reporting	Cost of delivery divided by leaders, teachers (per guidance), students served

Goal 2. Improve instructional leadership capacity of school leaders through Project-based learning (PBL) with STEM/L/C and SEL (AP2, CPP3)		
IObj7. Engage teachers w/ leaders	Engage 160 teachers w/ 40 leaders in graduate courses, summer PD in PBL curriculum developments and mini grants in Y2 & Y3; impact the teachers' classrooms with ~3,200 students per year	# of teachers/ classrooms/ students participating; # and hours of PD provided; attendance; # of PBL curriculum completed; # of mini grants implemented
RObj1. Leaders' skills in observing & providing effective feedback to teachers	RQ1: To what extent did/do the School Leaders, via NISL EDP, provide effective feedback to teachers?	Select items from <i>Tennessee Educators Survey (TES)</i> , <i>Teacher Core instrument (TC)</i> , TES Teacher Module: <i>Instructional Supports (TM_IS)</i> ; focus groups; structured interviews
RObj2. Leaders' ability to use data to plan instruction and professional learning	RQ2: To what extent did/do the School Leaders, via NISL EDP, use data to plan instruction and professional learning?	<i>Instructional Supports (TM_IS)</i> ; focus groups; structured interviews
RObj3. Leaders using evidence-based PD and/or retraining strategies in PBL & SEL	RQ3: To what extent did/do the School Leaders, via NISL EDP, utilize evidence-based PD or retrain strategies in PBL and SEL?	Evaluator-developed rubrics to measure Leader support of teachers; Buck Institute measures of quality (for PBL); CASEL measures of quality (for SEL); focus groups; structured interviews
RObj4. Leaders increasing relational trust in participant's school communities	RQ4: what extent did/do the School Leaders, via NISL EDP increase relational trust in their schools?	School climate items from TES; administrative data from <i>Tennessee School Climate Measurement System</i> ; focus groups; structured interviews
Goal 3. Build the knowledge of school leaders in leading and improving student educational resources and outcomes (CPP2 & CPP3)		
IObj8. Implement PBL/SEL-enhanced learning activities	Engagement of 160 Ts & 3,200 Ss in at least two STEM/L/C learning activities enhanced with PBL and SEL in Y2 & Y3.	# of students (by school and grade); # of projects completed
IObj9. Serve high-needs students and communities	Include > 80% of total 3,200 student participation from high-need communities	# of students in high-needs and economically disadvantaged areas
IObj10. Improve student academic performances	Improve student academic performance via the cumulative impact/interaction of PDs, courses, curriculum, and instruction	Tennessee Comprehensive Assessment Program (TCAP) in ELA, Math, and Science
Goal 4. increase leader and educator diversity in K12 education (CPP1)		
RObj5. increase educator diversity in school communities	Increase educator diversity and narrow the diversity gap between educators and students	Educator and student ethnicity data

C2 Management Plan: Responsibilities, Timelines, and Milestones

C2.1 Expertise and responsibilities of the project team and key personnel

The SLICE-SL project team consists of faculty in higher education, district-wide administrators, and a regional lead teacher team. The project represents a continuation of an established partnership and extends the collaboration to a leadership institute, National Center on Education and the Economy (NCEE), an external research team, Evaluand LLC and an external evaluation team, East Main Evaluation & Consulting (EMEC) LLC. Table 10 summarizes the personnel, their roles, and commitments in the project.

Table 10. IHE-LEA-Training-Research Personnel’s Commitment and Roles on the project

Unit	Name	Title	Commitment/ Role in Project
East Tennessee State University	[Redacted]	Asst Dir/ Prf of STEM Ctr	PI, coordinate overall management
	[Redacted]	Chair, Asst Prf of Leadership	Co-PI, lead leadership training team
	[Redacted]	Asse Prf of Literacy Ed	Co-PI, internal research lead
	[Redacted]	Asst Prf of Counseling	Sen P., SEL instruction coordinator
	[Redacted]	Asse Prf of Literacy	Sen P., Literacy instruction coordinator
	[Redacted]	Prf of Biology	Sen P., Science instruction coordinator
	[Redacted]	Chair, Prf of Curriculum/L	Sen P., Education resources coordinator
	[Redacted]	Asse Prf of Math Ed	Sen P., Math instruction coordinator
	[Redacted]	Asst Prf of Counseling	Instructor in SEL
	[Redacted]	Asse Prf of Biology	Instructor in Science
	[Redacted]	Asst Prf of Chemistry	Instructor in Science
	[Redacted]	Prf of Math Ed	Instructor in Math
	[Redacted]	Asst Prf of Literacy Ed	Instructor in Literacy
	[Redacted]	Prf of Geosciences	Instructor in Science
[Redacted]	Chair, Asse Prf of Special Ed	Research support	
	To be hired	Project manager (PM)	Support PI for overall management
Regional lead teacher team in STEM/LC education	Elementary: [Redacted] Secondary: [Redacted]		Support participant leaders and teachers to develop PBL with STEM/L/C in Year 2 and Year 3.
LEAs	[Redacted]	Grant Director, Hawkins	Co-PI, project coordinator at LEA
	[Redacted]	Grant Director, Washington	Co-PI, project coordinator at LEA
	6 curriculum supervisors from 4 LEAs		Advisory Board
NCEE	National Institute for School Leadership		Leadership Training and Resources
Evaluand	[Redacted]	Principal	Project external research
	[Redacted]	Senior Quant Evaluator	Project external research
EMEC	[Redacted]	Lead Consultant	Project external evaluation

The ETSU team has worked together on STEM, Literacy, and Computation Education since 2012. [REDACTED] (Principal Investigator, PI) coordinates this SLICE-SL initiative and has extensive experience working with educators and university faculty members through 11 state and federal grant projects to improve STEM, Literacy, and computation education in the region. He will manage the overall project and commit 40 days per year on school visits to work with the school leaders and teachers in their professional environments. Fifteen ETSU faculty members from eight academic departments (Leadership, Curriculum and Instruction, Counseling, Special Education, Biology, Chemistry, Geosciences, and Language) provide a variety of professional enhancement services to the school leaders and their teachers. [REDACTED] (co-PI), Chair of Dept. of Educational Leadership and Policy Analysis, will provide services in leadership education. [REDACTED] (co-PI, the internal research lead) and [REDACTED] will facilitate data collection, data analysis, and dissemination of findings between the IHE, LEAs, and the external researchers. The Senior Personnel team ([REDACTED] [REDACTED]) will plan, coordinate, and co-teach PBL, SEL, STEM, Literacy, Computation training and resources with the instructor team ([REDACTED]) and the 12-member regional lead teacher team for the participant school leaders and teachers. The members of the lead teacher team have been working with us since 2012 through our previous and current grant support. The Project Management Team (PMT) including PI, Co-PIs, Senior Personnel, and Project Manager (PM) will meet bi-weekly or monthly through the project period. Resumes of PI, Co-PIs, senior personnel, and instructors are in Appendix B.

The LEA members consists of two grant directors, [REDACTED] of Hawkins County and [REDACTED] of Washington County, to serve as co-PIs. They will coordinate the LEA administration team including director, curriculum supervisors, supervisor of accountability,

directors of technology and finance, book keepers etc. to support a professional learning community within the districts. They will assist the PMT by collecting names of leaders, teachers as well as provide students' performance data. Also, six members of the advisory board consists of curriculum supervisors from four partner LEAs who will communicate and collaborate with the PMT during the project period. The board will determine the effectiveness of the SLICE-SL strategies for the leaders, teachers, and students while also aligning project services with the LEAs' strategic plans and educational needs, providing logistics suggestions between the project and LEA schedules, and studying best practices that can be implemented and replicated by LEAs. The LEA commitment to the project is stated in their letters of support (Appendix D).

The project is partnered with the **National Center on Education and the Economy (NCEE)** to provide evidence-based leadership training programs (Nunnery, Yen & Ross, 2011), such as NISL Executive Development Program and Train-the-Trainer Program. The project team will engage **Evaluand LLC.** to provide comprehensive research support examining the SLICE-SL model, including (1) an impact evaluation, testing the innovation's effectiveness using methods meeting *What Works Clearinghouse* standards; (2) formative evaluation support for performance feedback and periodic assessment of progress; and (3) the collection and analysis of objective measures aligned with defined program outcomes to support both purposes. The two Evaluand staff designated to manage the study (company Principal and Senior Quantitative Evaluator), have nearly 40 years of combined experience researching education innovations. The project also includes an independent and external evaluation firm, **East Main Evaluation and Consulting (EMEC) LLC.**, as a third-party evaluator to provide a critical, comprehensive evaluation of the SLICE-SL model, led by [REDACTED] who has extensive experience in

educational evaluation. The letters of commitment from NCEE, Evaluand, and EMEC are in Appendix D.

C2.2 Project Timeline

The project personnel will ensure that SLICE-SL meets its goals, objectives, outcomes, and measures described in Table 9. Table 11 provides a timeline of project training and services, and management conveyed. **Activities in bold** repeat annually.

Table 11. Project Timeline

Activity	Timeframe	Responsible Personnel
Year 1 (10/1/22-9/30/23)		
PMT meetings	Oct-Nov: bi-weekly Dec-Sep: monthly	PI, co-PIs, Sen Ps, PM (project manager)
Leader recruitment	Oct-Nov	PI, PM, LEA co-PIs
School visits (PI commits 40 days at schools, 1-day co-leader experience w/ each leader and w/ 40 leaders)	Oct 22- Sep 23	PI, PM
Project advisory board meetings (bi-monthly)	Nov 22, Jan, Mar, May, Jul, Sep 23	PI, co-PIs, advisory board, external evaluator, PM
1 st Prof Meeting w/ leaders (an overall agenda sees Table 4)	Nov	PI, co-PIs, PM
NISL EDP training (n=40, 18 days)	Jan-Sep 23, 2 days/m.	NCEE staff, PI, [REDACTED]
2 nd Prof Meeting w/ leaders	Feb	PI, co-PIs, PM, Sen Ps
3 rd Prof Meeting w/ leaders	April	PI, co-PIs, PM, Sen Ps
Curriculum planning and preparation for Y2 summer PD	June: 2 weeks	PI, ETSU co-PIs, Sen Ps., lead teacher team
Teacher team recruitment (n=160)	Aug-Sep	Leaders, PI, PM, LEA co-PIs
4 th Prof Meeting w/ leaders	Sep	PI, co-PIs, PM, Sen Ps
Year 2 (10/1/23-9/30/24)		
PMT meetings	Oct-Dec: monthly Jan-May: bi-weekly Jun-Sep: monthly	PI, co-PIs, Sen Ps, PM
School visits (PI commits 40 days at schools w/ 40 leaders +160 teachers)	Oct 23- Sep 24	PI, PM
NISL EDP training (6 days)	Oct-Dec 23, 2 days/m.	NCEE staff, PI, [REDACTED]
Project advisory board meetings (bi-monthly)	Nov 23, Jan, Mar, May, Jul, Sep 24	PI, co-PIs, advisory board, external evaluator, PM
5 th Prof Meeting w/ leaders	Nov	PI, PM, SensPs
NCEE Train-the-Trainer (n=10)	Jan-Apr	NCEE staff, PI, [REDACTED]
6 th Prof Meeting w/ leaders	Jan	PI, co-PIs, PM, Sen Ps
7 th Prof Meeting w/ leaders	Feb	PI, co-PIs, PM, Sen Ps
8 th Prof Meeting w/ leaders	Mar	PI, co-PIs, PM, Sen Ps

9 th Prof Meeting w/ leaders	Apr	PI, co-PIs, PM, Sen Ps
Instructional team planning for curriculum development	6/10/24-6/21/24	PI, co-PIs, Sen Ps., instructor team, lead teacher team
Leaders and teachers take courses (ELPA6452, SCED5600, COUN6553)	6/17/24-6/21/24	ETSU faculty, PM
Leaders and teachers develop PBL w/ STEM/L/C & SEL curriculum	6/24/24-6/28/24	PI, co-PIs, Sen Ps., instructor team, lead teacher team
Leaders and teachers submit mini grants	7/1/24-8/15/24	PI, co-PIs, PM, Sen Ps
10 th Prof Meeting w/ leaders	Aug	PI, co-PIs, PM, Sen Ps
11 th Prof Meeting w/ leaders	Sep	PI, co-PIs, PM, Sen Ps
Curriculum implementation as schools	Aug-Sep	PI, PM
Year 3 (10/1/24-9/30/25)		
PMT meetings	Oct-Dec: monthly Jan-May: bi-weekly Jun-Sep: monthly	PI, co-PIs, Sen Ps
School visits (PI commits 40 days at schools w/ 40 leaders +160 teachers)	Oct 24- Sep 25	PI, PM
Curriculum implementation at schools	Oct 24- May 25	PI, PM
Project advisory board meeting (quarterly)	Nov 24, Feb, May, Aug 25	PI, co-PIs, advisory board, external evaluator, PM
12 th Prof Meeting w/ leaders	Nov	PI, PM, Sen Ps
13 th Prof Meeting w/ leaders	Jan	PI, co-PIs, PM, Sen Ps
14 th Prof Meeting w/ leaders	Feb	PI, co-PIs, PM, Sen Ps
15 th Prof Meeting w/ leaders	Mar	PI, co-PIs, PM, Sen Ps
16 th Prof Meeting w/ leaders	Apr	PI, co-PIs, PM, Sen Ps
Instructional team planning for curriculum development	6/9/25-6/20/25	PI, co-PIs, Sen Ps., instructor team, lead teacher team
Leaders and teachers take courses (ELPA6954, SCED5620, COUN6956)	6/16/25-6/20/25	ETSU faculty, PM
Leaders and teachers develop PBL w/ STEM/L/C & SEL curriculum	6/23/25-6/27/25	PI, co-PIs, Sen Ps., instructor team, lead teacher team
Leaders & teachers submit mini grants	7/1/24-8/15/24	PI, co-PIs, PM, Sen Ps
17 th Prof Meeting w/ leaders	Aug	PI, co-PIs, PM, Sen Ps
18 th Prof Meeting w/ leaders	Sep	PI, co-PIs, PM, Sen Ps
Curriculum implementation at schools	Aug-Sep	PI, PM
Project wrap-up	Aug-Sep	PI, PM, co-PIs, Sen Ps., instructor team

C.2b Procedures for Ensuring Feedback and Continuous Improvement

Internally, feedback will be collected from participating school leaders through an online survey. This model of feedback from participants has been used successfully by the project team in previous projects and training workshops. The feedback will be collected and reviewed frequently by senior personnel and faculty, allowing for timely adjustments to the content and pacing of training and services. School leaders' names will be removed by a senior project member prior to sharing feedback with the full team to promote candid responses.

The external research team will send informal data summaries regularly based on the formative feedback evaluation (see section D), mostly descriptive summaries from measures of implementation and immediate outcomes (e.g., School Leaders' new skills and understandings from their PD activities and coursework). These frequent summaries will allow for quick adjustments to program implementation and/or content. The PMT will meet with the external researchers six to eight times per year through web conferences. Findings and recommendations resulting from the feedback process will be shared with relevant stakeholders to ensure the project is being implemented with fidelity.

D. QUALITY OF THE PROJECT EVALUATION

The comprehensive evaluation of the project supports multiple purposes, including (1) implementing an efficacy study meeting WWC; (2) providing performance feedback and ongoing assessment of progress toward aims of the proposed project and the SLICE-SL model; and (3) utilizing objective measures of both outcomes and implementation, clearly aligned with the variables of interest, and selected to produce high quality quantitative and qualitative data. The evaluation, to be managed by a team of researchers from Evaluand LLC, is designed and will be implemented to standards defined for the profession (American Evaluation Association, 2004; Yarbrough et al., 2011).

D1. Methods of Evaluation Produce Evidence of Effectiveness Meeting WWC Standards

The proposed SLICE-SL project includes several tangible benefits for program participants (e.g., paid PD, continuing education credits, certificates, mini-grants to support teachers). We anticipate these factors to provide an incentive for program participation that will result in over-subscription (i.e., more School Leader interest than slots available through its grant-funded delivery).

If over-subscription is sufficiently large, our group study design will include random assignment of 40 School Leaders from four LEAs to the program. Further, participation incentivized by perceived value of the program is expected to result in low sample attrition. If the project is well-implemented in this scenario, **the RCT will produce evidence that meets WWC Evidence Standards without reservation.**

However, if over-subscription is not sufficient for random assignment of School Leaders to treatment and control conditions, then **the quasi-experimental design (QED) will produce evidence that meets WWC Evidence Standards with reservations**, assuming we have

adequately addressed baseline equivalence and satisfied non-design requirements (i.e., face validity, reliability, over-alignment, outcome collection, and addressing confounding factors).

Though no differences are expected due to randomization, baseline equivalence will be established for key variables prior to the period of study (e.g., teachers’ years of experience) and statistical adjustments can be made if baseline characteristics do not meet WWC equivalence requirements (e.g., alternative analyses controlling for student outcome pre-scores).

To help describe how we plan to produce rigorous evidence aligned with WWC standards, we present our research questions in three sections, based on our participant populations (e.g., School Leaders, teachers, and students), following the theoretical relationships among outcome variables (see logic model, Figure 3).

Table 12. Evaluation Plan Research Questions – School Leaders

	Research Questions	Instruments/Methods
RQ1	To what extent did/do the School Leaders, via NISL EDP, provide effective feedback to teachers?	Select items from <i>Tennessee Educators Survey (TES) Teacher Core instrument (TC)</i> , <i>TES Teacher Module: Instructional Supports (TM_IS)</i> ; focus groups; structured interviews
RQ2	To what extent did/do the School Leaders, via NISL EDP, use data to plan instruction and professional learning?	
RQ3	To what extent did/do the School Leaders, via NISL EDP, utilize evidence-based PD or retrain strategies in PBL and SEL?	Evaluator-developed rubrics to measure Leader support of teachers; Buck Institute measures of quality (for PBL); CASEL measures of quality (for SEL); focus groups; structured interviews
RQ4	To what extent did/do the School Leaders, via NISL EDP increase relational trust in their schools?	School climate items from TES; administrative data from <i>Tennessee School Climate Measurement System</i> ; focus groups; structured interviews
RQ5	To what extent did/do the School Leaders, via NISL EDP increase educator diversity in their schools?	Evaluator-developed rubrics to measure Leader support of educator diversity; focus groups; structured interviews
RQ6	To what extent did/do the School Leaders, via PD in STEM/L/C in PBL, provide evidence-based PD or retraining strategies in PBL and SEL?	Evaluator-developed rubrics to measure Leader support of teachers; Buck Institute measures of quality (for PBL); CASEL measures of quality (for SEL); focus groups; structured interviews
RQ7	To what extent did/do the School Leaders, via PD in SEL instruction, provide evidence-	

	based PD or retraining strategies in PBL and SEL?
Note: Descriptions of instruments can be found in Section D3 & D4 Evaluation Methods	

Impact Evaluation. The first seven research questions (Table 12) collectively examine what School Leaders, in the treatment condition (n=40), gain from their PD and how these skills and knowledge are translated into observable behaviors that are directed toward their teachers. We propose a concurrent triangulation mixed-methods approach (Creswell et al., 2003) using a mix of quantitative (e.g., standardized instruments used in WWC assessed studies) and qualitative (e.g., focus groups, structured interviews) methods to capture and elaborate gains in knowledge and skills acquired during three-years of PD. Due to the considerable length of time involved in PD, we will collect longitudinal data at baseline and at regular intervals throughout the project (i.e., at the end of each semester of PD training) to help identify specific skills and knowledge gained as a result of PD training, when they were acquired, participant intentions about using this information in their schools, and participant feedback on the results of their efforts.

For the comparison group (approximately 40 individuals, in either an RCT or QED group design study), similar longitudinal measures will be employed, but only at baseline and annually. The collection of data for the comparison group will be used to control for baseline differences and more accurately estimate treatment differences (e.g., observing and providing effective feedback to teachers).

Addressing WWC Standards. The use of gain scores on quantitative measures between baseline and various time points addresses the WWC requirement for baseline equivalence. The WWC requirement of addressing confounding variables will be assisted by the assessment of relevant covariates or characteristics of School Leaders, teachers, and students (e.g., years in leadership positions, years direct teaching) in subsequent regression analyses (e.g., multiple regression, hierarchical linear modeling [HLM]). If gain scores are not possible, covariates will

help verify equivalence of groups (for an RCT group design study) or to employ statistical controls for outcome analyses (e.g., for a QED group design study).

Implementation Fidelity. Capturing performance measures and qualitative data at baseline and regular intervals throughout the project lifecycle will facilitate assessment of implementation fidelity. This will be especially critical in the early stages of the project to ensure PD training results in expected knowledge and skills development of participants and that this information translates into School Leader practices that impact teachers. If expected changes do not occur on specific measures, we will examine the qualitative data for contextual explanation using a sequential explanatory approach (Creswell et al., 2003). If this is insufficient, efforts will be made to collect additional information to better understand the factors surrounding the issue. This process will be applied to the Teacher Cohort as well.

Table 13. Evaluation Plan Research Questions - Teachers

	Research Questions	Instruments/Methods
RQ8	To what extent does effective feedback from School Leaders result in teachers incorporating highly effective instructional practices in STEM, ELA, & Computation?	Select items/scales from <i>TEAM General Educator Rubric</i> ; select items from <i>Tennessee Educators Survey</i>
RQ9	To what extent does the use of data in planning instruction and professional learning from School Leaders result in teachers incorporating highly effective instructional practices in STEM, ELA, & Computation?	(TES); focus groups; structured interviews; surveys; documentation review (e.g., syllabi); observation
RQ10	To what extent does the provision of evidence-based PD or retraining strategies in PBL and SEL result in teachers applying Gold Standard PBL strategies to teaching?	Project specific rubrics (Buck) for PBL; Project specific rubrics (CASEL) for SEL; focus groups; structured interviews; surveys;
RQ11	To what extent does the provision of evidence-based PD or retraining strategies in PBL and SEL result in teachers applying SEL practices to teaching?	documentation review (e.g., syllabi); observation
Note: Descriptions of instruments can be found in Section D3 & D4 Evaluation Methods		

Impact Evaluation. Four research questions (Table 13) collectively examine what participating Teachers in the treatment condition (n=160; four associated with each of the 40 School Leaders) gain from the PD experience of their School Leaders and how well these experiences translate

into instructional practices that positively impact student performance. As with School Leaders, we propose using a mix of quantitative (e.g., *TEAM General Educator Rubric*, *Tennessee Educators Survey*; both described in section D3 and D4) and qualitative (e.g., focus groups, structured interviews, surveys, syllabi review) methods to capture changes in teacher instructional practice attributed to School Leaders.

For the comparison group (approximately 160 individuals, in either an RCT or QED group design study), similar baseline and follow-up measures will be employed to control for differences and more accurately estimate variation due to treatment (i.e., changes in instructional practice).

Table 14. Evaluation Plan Research Questions - Students

	Research Questions	Instruments/Methods
RQ12	Influence of teachers applying SEL practices to teaching on self-reported levels of SEL for students?	WCSD SEL (district wide, Grades 5-12)
RQ13	What is the interaction between teacher SEL instructional practices and student SEL outcomes on student academic performance (ELA, Math, Science)?	WCSD SEL (district wide); TCAP
RQ14	What is the (cumulative impact/interaction) of (NISL PD) and (SEL gains attributed to teachers) on student academic performance? That is, can we tease out the native SEL that students have (from our control group)?	WCSD SEL (district wide); TCAP

Note: Descriptions of instruments can be found in Section D3 & D4 Evaluation Methods

Impact Evaluation. Three research questions (Table 14) examine the impact of Education Leader PD and Teacher behavior on student outcomes (n=3,200; approximately 20 students connected to each of the 160 participating Teachers). Here, we propose using quantitative methods to explain variation in student performance (e.g., TCAP end of course grades, state assessment scores; SEL scores) measured at the end of Fall 2024 and Spring 2025 (for Teacher Cohort in Year 2) and the end of Fall 2025 (for Teacher Cohort in Year 3).

Comparing baseline with follow-up measures allows us to measure changes in student performance resulting from Teacher instructional practice, stemming from Education Leader

practices (both direct, through a Participating Teacher; and indirect, through a non-Participating Teacher under a participating Education Leader). For the comparison group (approximately 3,200 students, in either an RCT or QED group design study), similar baseline and follow-up measures will be employed to control for differences and more accurately estimate variation due to treatment (i.e., growth in SEL).

Example Regression Model. As an example, a multiple regression model may be used to predict student performance outcomes (e.g., standardized state assessment score for Mathematics) using School Leader characteristics (e.g., years in leadership), school-level characteristics (e.g., Title I status), and Teacher characteristics (e.g., years teaching). If the number of nested observations is sufficient at each level, HLM will be used to control for issues of dependence (Raudenbush & Bryk, 2002).

D2. Performance Feedback and Assessment of Progress Toward Achieving Outcomes

Ongoing performance feedback and assessment of the project team’s progress (formative evaluation) will be guided by the questions in Table 15.

Table 15. Evaluation Plan Research Questions – Formative Evaluation

1. With what quality and timeliness is the project team developing and deploying the new SLICE-SL curriculum, PD, and coursework?
2. How are Teacher Leaders mastering knowledge, skills, and dispositions targeted by these activities?
3. How are schools’ capacities to execute integrated STEM/PBL/SEL learning activities increasing?
4. How do SLICE-SL teacher PD participants persist in and complete each of the program components, including implementation of identified instructional strategies?
5. How are teachers in SLICE-SL schools demonstrating the expertise required to sustain implementation of targeted instructional strategies, particularly considering the SEED program Performance Measures?
6. How might the SLICE-SL programming be improved, in terms of implementation quality; effectiveness in realizing identified competency outcomes; accessibility; and efficiency of delivery?
7. How is the project contributing to collective understandings about aspects of the SLICE-SL model, through completion of an efficacy study meeting WWC standards and dissemination of research findings?

Data to address these questions will be used to inform iterative improvement to the SLICE-SL model, applying principles of *developmental evaluation* (Patton, 2011) or *Design and Development Research* (IES US ED & NSF, 2013); as well as for process evaluation of activities for improvement purposes (Shadish et al., 1991). Specific measures examining the quality of development and implementation of program activities are detailed in the following subsection.

Process and progress evaluation will be supported by ongoing review against the proposed project timeline and attributes of delivery quality (e.g., for School Leader PD activities). Performance data (e.g., attendance, completion of requirements, credentials earned) will be tracked for all participants over the life of the project in collaboration with project staff and district partners. Immediate learning outcomes for School Leaders will be measured using performance assessments (e.g., instructor-reviewed rubric scores of outcomes demonstrated in course or PD activities or products) embedded in those activities.

Results of analyses for this purpose (largely descriptive) will be summarized for the project team using a rapid-turnaround approach. Transmittal of data summaries will be supported with web-mediated conferences between the external research team and ETSU project team members to maximize the utility of findings for improvement purposes (Patton, 1997). Year-end formative reports will also be provided to support annual performance reporting. Finally, the research team will develop collateral materials for dissemination (e.g., white papers).

D3. & D4. Evaluation Methods

D3. Objective Performance Measures Related to Intended Outcomes

D4. Valid and Reliable Data Collection on Relevant Outcomes

Outcome data for all evaluation purposes will be collected using objective measures of both quantitative and qualitative data, as appropriate to the analyses performed. Most quantitative outcome data (i.e., for the efficacy study) will be collected using instrumentation already applied

in partner districts. Data from these sources will be secured through cooperative agreements among the PI, the research teams, and the districts, consistent with established federal standards for data security and the protection of human subjects in research.

Research objectives 1 and 2 relating to **efficacy in instructional leadership** will be assessed using selected items from the *Tennessee Educators Survey* (the TES; TN Department of Education, 2020a). Teacher-reported perceptions from the TES Teacher Core instrument (TC) and Teacher Module: Instructional Supports (TM_IS) will serve as measures of participant School Leaders' demonstrated abilities **observing and providing effective feedback to teachers** (TC_03, TC_14 , TM_IS02, TM_IS03; all 4-point Likert-type scales) and **using data to plan instruction and professional learning** (TC_11, four categorical response options) (TN Education Research Alliance, 2020a; 2020b). The final Teacher Leaders outcome (**utilizing evidence-based PD/ retain strategies in PBL and SEL**, RObj. 3) will be measured using evaluator-developed rubrics aligned with measures of quality established by the Buck Institute and CASEL (for PBL and SEL instruction, respectively). **Relational Trust in the school community** (RObj. 4) will be measured using data from other scales on the TES, relating specifically to school climate (TC_01 , TC_02 , TC_04, TC_05, TC_07; also 4-point Likert type response sets). If cooperating schools use it, Relational Trust can also be triangulated by data results from the *Tennessee School Climate Measurement System* which measures student, parent, and teacher perceptions of school climate (TN Department of Education, 2020b).

The extent to which teachers **apply highly effective instructional practices** will be measured using the *TEAM Rubric Scales*, the instruction component of Tennessee's teacher performance appraisal system. Data will be requested from partner districts for the *TEAM General Educator Rubric*, applicable to the full range of classroom teachers in the state (i.e., not

school services personnel like counselors) (TN Department of Education, n.d.). Dimensions assessed by this instrument, collected by certified observers, includes Planning (three attributes of quality), Classroom Environment (four attributes), and Instruction (12 attributes). Timing of TEAM Rubric data collection is influenced by a combination of factors (e.g., each teacher’s previous year’s LOE) but every teacher is assessed at least once per school year for each dimension (TN Department of Education, 2018). Teachers’ uses of instructional strategies related to **high-quality PBL** will be measured in a fashion similar to that applied to School Leaders’ PD, using a rubric tailored to attributes of quality of the Buck Institution for Education model (2019a). This rubric reports three-level scale data on assessed dimensions (i.e., Beginning, Developing, and Gold Standard). Teachers’ **use of SEL strategies** in their teaching will be measured similarly, with a rubric aligned with the five core competencies expected for students—self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (Collaborative for Academic, Social, and Emotional Learning, 2020). Teachers’ uses of SEL teaching strategies will be triangulated by data source, considering a limited set of TEAM Rubric dimensions that align with the CASEL core competencies—Environment and Respectful Culture, Expectations, and Problem Solving and Thinking.

Student Social and Emotional Learning will be assessed using the Washoe County School District (WCSD) *Social and Emotional Competency Assessment* in its 17-item “short” form (WCSD, 2020). The WCSD SEL assessment is a freely available student self-report instrument aligned with the five core competencies of CASEL (2020). Students rate how difficult different skills are for them, on a scale of 1 to 4 (“Very Difficult” to “Very Easy”). The WCSD instrument was developed in collaboration with the University of Illinois-Chicago (Davidson, et al., 2018).

It has been validated for use by students in Grades 5 and above in its 40-item, “long-form” version across two survey years using Rasch analyses (e.g., Crowder et al., 2019).

Student Academic Achievement will be measured using results from the *Tennessee Comprehensive Assessment Program* (TCAP) achievement tests. Student result data will be secured through data requests in collaboration with partner districts for TCAP Gr3-8 content in English language arts (4 subparts), mathematics (3 subparts), and Science (1 subpart); and for TCAP End-of-Course (EOC) assessments for English I and English II, Algebra I, Algebra II, Geometry, Integrated Math I, Integrated Math II and Integrated Math III, and biology (the only science content EOC in Tennessee). Data from the above sources will be collected on a timeline (Table 16) complementary to the training and services timeline illustrated in C2.2 (Table 11).

Additional qualitative data to inform formative evaluation and serve as implementation checks for the efficacy study, collected through targeted on-site observations (e.g., of Education Leader PD activities), includes interviews of purposeful samples of stakeholders and questionnaires of participants’ perceptions including, but not limited to, reactions to PD activities (Guskey, 2000). Products of qualitative analyses will be complemented with implementation measures to track and report on progress toward the goals and process objectives in Section IIIA of the Management Plan (e.g., quantities of PD provided, courses, and projects completed). Finally, the evaluation will document Performance Measures specifically defined for the SEED program, to support annual reporting: (1) The percentage of Leaders and teachers serving concentrations of high-need students; (2) the percentage of the educators serving those high-need students who are assessed to be highly effective (per TEAM Rubric scores); (3) the percentage of that group who serve in their districts for at least 2 years; and (4) the cost to provide SLICE-SL, per participant meeting the criteria for (3), above.

Table 16. Data Collection Timeline

	M	Leaders (n=40)	Teacher Cohort (n=160)	Data Collection
22	10-11	Recruitment		
	11-12	quarterly PD		
2023	1-5	NISLEDP, quarterly PD		TN Educator Survey (TES: various items), BIE measures (PBL), CASEL (SEL), focus groups, structured interviews
	6-7	NISL		
	8-12	NISLEDP, quarterly PD		BIE measures (PBL), CASEL (SEL), focus groups, structured interviews
2024	1-5	NCEEET-T Monthly PD		TES (various items), Buck Institute measures (PBL), CASEL (SEL), focus groups, structured interviews
	6	Graduate courses, summer PD, curriculum development		
	8-12	Monthly PD	Curriculum implementation	BIE (PBL), CASEL (SEL), TEAM General Educator Rubric, focus groups, structured interviews, documentation review (e.g., syllabi), observation, Student SEL
2025	1-5	Monthly PD	Curriculum implementation	TES (various items), Buck Institute measures (PBL), CASEL (SEL), focus groups, structured interviews, documentation review, observation, Student SEL, TCAP
	6	Graduate courses, summer PD, curriculum development		
	8-9	Monthly PD	Curriculum implementation	Buck Institute measures (PBL), CASEL (SEL), TEAM General Educator Rubric, focus groups, documentation review, observation, structured interviews, Student SEL

D5. Project Replication and Scalability

Products of the evaluation will document iterations to the model theory of action, curricula, and resources, and technical information relating to instruments used or developed for data collection (e.g., PD quality rubrics). The design for implementing and evaluating the SLICE-SL project will result in information to guide possible replication of project activities or strategies. Findings from the effectiveness study (Section D1) will include detailed descriptions of the SLICE-SL education innovation; descriptions of the study methods, sufficient to support replication of the study; reliable estimates of the model’s impact; documentation of implementation quality and supports applied, as necessary, for interpretation of results and implications regarding elaboration or iteration of the theory of action underpinning the model.

In terms of project sustainability and future scalability, the project will also add resources and benefits, easily transferrable to other rural districts in addition to 4 partner LEAs. First, the

PBL STEM/L/C curriculum modules will be available on our project website (see Section B4. Dissemination) for teachers in other districts. The ETSU Center of Excellence in STEM Education has a strong track record of partnering neighboring LEAs and STEM business partners to support STEM, Literacy, and Computation education the Northeast TN region (Tai et al., 2018a, 2018b). Using this established network, we will advocate for and make the SLICE-SL curriculum modules available for around 5,000 K-12 teachers and 85,000 students across 13 LEAs. **Second**, the tuition-waived graduate courses enable teachers to receive more PD hours than the mandatory requirement for effective teacher PD, offering cost-effective training beyond the project. **Third**, our team will leverage what we learn about the SLICE-SL model and continue to pursue grant funding (e.g., US ED EIR, NSF DRK-12) to expand collective understandings about how to best provide PD support for K-12 leaders and teachers implementing SLICE-SL, or similar instructional practices, more economically and at greater scale.

References, please see Appendix G.1.