PROJECT NARRATIVE

ABS PRIORITY 2: SUPPORTING EFFECTIVE PRINCIPALS/SCHOOL LEADERS

East Carolina University (ECU), in partnership with the Institute for Educational Leadership (IEL) and commitments to participate from multiple school districts in North Carolina (NC) and California, is pleased to submit this proposal for the project entitled *Innovate, Inquire, Iterate, and Impact: Igniting the Power of Network Improvement Communities to Enhance Professional Learning for Educational Leaders* (**Project I[4]**). Project I[4] will address:

- **Absolute Priority 2: Supporting Effective Principals or Other School Leaders**
- **Competitive Preference Priority: Promoting STEM Education**
- **Invitational Priority: Support for the use of micro-credentials**.

Project I[4] will support principals in improving student outcomes with research-based professional development programs in which principals can earn up to three professional credentials: (1) **Academic Discourse Micro-Credential** (**MC**), (2) **Academic Discourse Advanced Micro-Credential (AMC)**, and (3) **Doctorate in Educational leadership (Ed.D.).** Each includes rigorous course work and incorporates key features of two successful programs, building on these with an innovative use of improvement science to promote academic discourse particularly in STEM classrooms. A rigorous evaluation will test the impact of the MC on student outcomes and provide initial data to study the value added by the AMC. Participants continuing in the Ed.D. program will contribute to the knowledge and capacity needed to sustain and scale Project I[4] innovations. Project I[4] creates a leadership pathway to connect school leadership to improved teacher practice in service of improving student outcomes.

COMPETITIVE PREFERENCE PRIORITY

Project I[4] will **promote Science, Technology, Engineering, and Mathematics (STEM) education** by providing evidence-based professional development strategies for current

STEM principals and teachers through two major strategies: 1) principals will learn to analyze data including classroom, district, and state testing results, classroom observations, teacher and student surveys, and examples of student work to drive improvement in STEM subjects, particularly mathematics; and 2) principals will learn to improve their observations of STEM lessons and provide effective feedback to teachers focusing on content and academic discourse. Additionally, by incorporating design thinking and technological tools for collaboration and virtual learning, school leaders will become more efficacious in the use of technology for professional learning and classroom instruction.

The first strategy, analysis of data to improve instruction, is supported by a study (Carlson, Borman, & Robinson, 2011) which met What Works Clearinghouse (WWC) standards without reservations (U.S. Dept. of Ed, 2016) and found significant improvement in mathematics achievement. Data-driven decision-making is an essential element of the improvement sciences approach, including the use of Networked Improvement Communities (NICs) approach on which Project I^4 is based (Bryk, Gomez, Grunow, & LeMahieu, 2015). Our project improve principals' capacity use data to support teachers to make instructional decisions and plan professional development with their staff. The data will include results from benchmark testing, already administered in most districts but seldom used appropriately for data driven decision making. Additional data will be collected and analyzed to assess and increase equitable access to STEM instruction at the classroom and school level.

Project I^4's second strategy to improve STEM education is teaching participants how to provide effective feedback on STEM subject lessons, particularly mathematics. With evidence from the Strategic Education Research Partnership, which has developed and tested tools for classroom observation (Schoenfeld, 2012), we will address how students in math classes still

"work alone with little opportunity for discussion and collaboration...[and] they focus on low-level tasks that require memorizing and recalling facts and procedures rather than tasks that require high-level cognitive processes" (National Research Council, 2012, p. 113).To change this, students need teachers who know how to engage them in constructing and evaluating arguments, engaging in non-routine problem solving, and "develop[ing] skills in collaboration and conversation that foster mathematical proof and induction" (p. 121). In science, while instruction has generally moved toward more hands-on activities, these activities are not typically designed with clear learning goals, are not sequenced properly, and rarely incorporate time for student reflection and discussion. The instruction neglects "critical reasoning, analysis of evidence, development of evidence and written and oral discourse associated with constructing and evaluating arguments" (p. 127). Project I[4] will support principals in development of stronger knowledge, skills and dispositions so that they can, in turn, provide professional learning, observation, and coaching to teachers as a key lever for affecting student outcomes.

Both strategies will be taught within the MC program which will replicate the duration, rigor, and key concepts of the successful 12-month National Institute for School Leadership (NISL) program for principals. A study of the NISL program (Nunnery, et. al. 2011) found statistically significant improvement of student outcomes in mathematics at the elementary and middle school level for schools whose principals participated in NISL. In the Project Design section of this proposal, we discuss the evidence base for the project in more depth including the practices that foster improvement in principal and teacher practices to improve student outcomes in STEM classrooms.

INVITATIONAL PREFERENCE PRIORITY

The project will allow participating school principals to earn a sequence of two micro-

credentials focused on essential school leadership skills and the improvement sciences (Bryk, et al., 2015) and data-driven approaches to educational challenges. The micro-credentials include the systematic use of NICs to foster leadership collaboration for changing principal knowledge and skill in using more effective observational practices and communicating effective teacher instructional practices to improve student outcomes. MC participants will earn 9 ECU graduate level course credits; the AMC will offer an additional 21 credits towards the 60-credit requirement for the practitioner doctorate in educational leadership (Ed.D.). District partners (see letters) will recognize these micro-credentials as meeting their professional development requirements and ECU's graduate course credits may be accepted by other universities depending on their specific residency requirements.

The MC will focus on developing school leaders' skills in using the improvement sciences to observe, provide feedback to, and structure professional development for teachers teaching STEM lessons. These are teachable and coachable skills; performance mastery will be assessed through videotaping the lesson, the teacher feedback session, and professional development facilitation and use of virtual reality (VR) simulations. Principal Coaches will provide feedback to participants. Those who complete the MC will have demonstrated competency in: 1) fostering relational trust, 2) planning instruction and teacher professional development based on analysis of data, 3) observation of mathematics classes, and 4) providing effective feedback to teachers. Both micro-credentials will support principals engaging in NICs and using cycles of inquiry, called Plan/Do/Study/Act (PDSA) in the improvement sciences, to learn to more effectively use formative evidence to improve instructional leadership; the AMC will deepen the ability of leaders working with teacher NICs to use data to drive instructional improvement in STEM classes by engaging in multiple cycles of inquiry incorporating key elements of the MC.

A. QUALITY OF PROJECT DESIGN

1) Exceptional Approach to the Priorities

Consistent with the purpose of the SEED program, the purpose of Project I[4] is to increase the effectiveness of principals with professional development that significantly enhances their ability to create durable learning outcomes for teachers and students. Project I[4] offers an exceptional approach to increasing effectiveness by incorporating and building on key elements from two successful interventions and by using a networked improvement community approach to implement professional development for principals. A simplified version of our Project Logic Model (Table 1) summarizes Project I[4] key inputs, strategies, outputs and outcomes. Our goal, objectives, and detailed measurable outcomes are shown in Table 4 in Section C.1. Project I[4]

Table 1: Simplified Project Logic Model

INPUTS:	**STRATEGIES:**	**OUTPUTS:**	**KEY OUTCOMES:**
• I[4] team expertise • ECU IT platforms & technology structures • IEL networks • LEA partnerships • Grant funding	• Improvement Science/NICs & PDSA • Data-driven inquiry • Coaching • Academic Discourse • Educational Gaming • Rigorous Evaluation Design • CALL and MUSIC surveys	• MC (n=292) • AMC (n=24) • Ed.D. (n=20) • VR Simulations • Rigorous Evaluation	Participant knowledge, skills & efficacy in instructional leadership. Participant relational trust Participant skills in diagnostic observation and feedback for STEM Student mathematics achievement in MC participants' schools AMC and Ed.D. participants to sustain and scale innovation.

will achieve these outcomes by implementing evidence-based professional learning in two sequential micro-credentials: (1) the MC for 220 principals in years 1 to 3 and an additional 72 principals in years 4 and 5; (2) the AMC for a subset of 24 of the persons who complete the MC and choose to continue in the AMC. These micro-credentials can then be applied towards a doctorate in educational leadership (Ed.D.) by participants who choose, after completion of the

micro-credentials, to focus on becoming more systematic practitioner-researchers focused on STEM academic discourse (See the full sequence of courses and content in Section A2 Table 2). While Project I[4] will emphasize mathematics, examples and simulations will include academic discourse and STEM integration across STEM subjects.

Evidence-based promising practices. The Project I[4] design is based on the results of two studies of two different programs that showed promising practices as defined by the Federal Register for working with principals and other school and district leaders to improve student outcomes. The first program is the National Institute of School Leadership (NISL) Executive Development Program for principals. In a longitudinal study that met WWC standards with reservations (USDOE, 2014), Nunnery et al. (2011) found statistically significant positive effects on student mathematics achievement at the schools of principals that participated in the NISL program. Similar to NISL, our program is founded on understanding that the principal, as a visionary and strategic thinker, is the primary driver of change in schools. Key expectations of NISL participants included developing "strategic thinkers, instructional leaders and creators of a just, fair and caring culture" (p. 2). Thus, Project I[4] focuses on instructional leadership, using data, and coaching teachers; works to develop principals who use equitable and relational practices to support school improvement; and has a cohort structure to build professional support. The rigor, intensity, and duration of Project I[4]'s MC program of three graduate level courses with a mix of face-to-face and online instruction over 14 months are similar to NISL's 12-month program. According to a 2009 Report to the Massachusetts Legislature (Massachusetts Department of Elementary and Secondary Education), "NISL Participants identified three key areas of the training where their practice was changing based on the training: leadership team development, evaluating the effectiveness of instructional practice, and using student data to

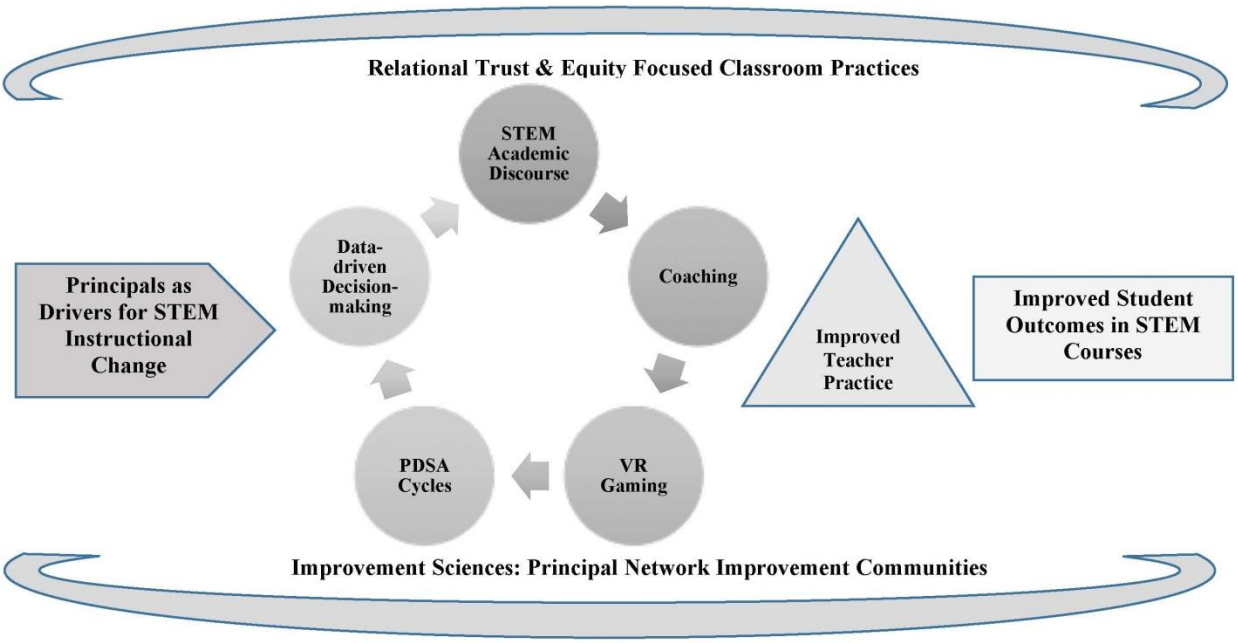
improve instruction" (p. 8). Project I[4] professional development, with its emphasis on relational trust, diagnostic observation of STEM instruction, and use of data, incorporates these key areas.

A second program implemented by the Johns Hopkins Center for Data-Driven Reform in Education (CDDRE), had five elements, the first three of which had been implemented for the analysis year. These elements were: 1) quarterly benchmark tests; 2) detailed reviews of student test data, educator questionnaires, and other indicators; 3) training for school leaders in interpreting and using data to improve student outcomes; 4) reviewing of research on appropriate interventions; and 5) assistance in selecting and implementing research-based interventions. A study of this program, (Carlson et al., 2011), which met Works Clearinghouse (WWC) standards without reservations (USDOE, 2016), included a large set of schools (n=524) in a randomized control trial and found that data-driven reform significantly increased student achievement in mathematics with an effect size of .21. Project I[4] will incorporate all five key elements of this data-driven reform process and support those few principals serving in schools that are not already implementing benchmark testing to identify and implement appropriate assessments. Additional formative data principals will use to inform decision making and instructional coaching include the Comprehensive Assessment for Leadership Learning (CALL) survey and the MUSIC Inventory, an instrument to assess components of student motivation to improve instruction. The CALL is a nationally validated 360° diagnostic assessment focused on leadership for learning (Kelley & Halverson, 2012). The MUSIC Inventory, also with evidence of reliability and validity (Jones & Skaggs, 2016), may be used to help teachers identify areas for improvement related to factors that affect students' motivation and engagement (Jones, 2009; Jones, 2017). These various sources of data will then be used as evidence in iterative 90-day PDSA cycles of analysis and improvement. Leaders will further learn to assess current research

evidence in order to select and test appropriate professional development for teachers and interventions for their students.

Project I[4] Framework. Project I[4]'s strategies are framed by and depend on relational trust and the development of Network Improvement Communities (See Figure 1). In the framework from multiple studies that inform the Chicago school reform work, Bryk, et al. (2010) identify relational trust across a school community and teachers' knowledge of students' home cultures and communities as essential supports for school improvement that must be accomplished along with instructional guidance and building professional capacity of teachers and principals. This trust is increased by collaboratively engaging in problem-solving with common standards (Tschannen-Moran, 2004). Building relational trust requires "professional structures—such as opportunities for collective inquiry, scrutiny, reflection, and decision making… to promote teacher professionalism and school success" (Tschannen-Moran, 2009, p. 218). As a key intermediate outcome, changes in relational trust will be measured using CALL.

Figure 1: Project I[4] Framework



Project I[4] principals will develop relational trust in their schools as active participant-researchers; they will work together in principal NICs and then with teacher NICs to *innovate* by better understanding and supporting academic discourse in STEM classrooms, practice cycles of *inquiry* (PDSA) building capacity to use evidence to make decisions, and *iteratively* use evidence to *impact* student learning. The principals will deepen their ability to lead reform initiatives by engaging in improvement communities "focused on a common aim, guided by a shared working theory of the education system, [we will] use improvement sciences practices and measures to spur improvement in testable iterations, and organize [principals in NICs] to integrate practices and processes that they develop in other contexts" (Proger, Bhatt, Cirks, & Gurke, 2017, p. 2).

In addition to the design elements described above, Project I[4]'s framework relies on what we know about how leaders learn to enhance the professional learning of teachers in the service of improved student outcomes (Grissom, Loeb, & Master, 2013): stronger post-observation coaching practices and using aggregate data from teacher observations to inform professional learning for teachers. The project relies on research evidence that principals who foster these practices can boost student outcomes: **academic discourse** in teacher practice in science and math, effective **observation and coaching** of teacher practice, **equitable access** to instruction, and **use of technology** for principal learning as a key step in transferring this to more effective classroom use. To foster academic discourse, Stein, Engle, Smith, & Hughes (2015) identify core practices for mathematical discussions that better incorporate student thinking: anticipating and monitoring student responses, purposefully selecting and sequencing student responses for public display, and connecting student responses. The evidence from Lampert, Ghouseeini, & Beasley (2015) identifies how novice math teachers can learn to foster **academic discourse** by engaging in a cycle of inquiry similar to the improvement sciences' PDSA. In a large descriptive study of

principal time use in Miami-Dade schools, Grissom, et al. (2013) found that principals spent very little time coaching teachers – but that **coaching** after observations was associated with student achievement growth in mathematics. "For example, for an additional percentage of principal time spent coaching (i.e., coaching increased by .01), math achievement increases by about 1% of a standard deviation" (p. 437). Thus, we will model effective observational and coaching practices to improve principals' coaching of teachers.

Project I[4]'s emphasis on equity-focused classroom discourse practices relies on evidence from a national report and multiple research studies about improving **equitable access.** (National Commission on Equity and Excellence, 2013). Boykin and Noguera's meta-analysis (2011) indicates that principals can influence student outcomes because principals pay attention to the quality of the teacher-student relationship and provide observational evidence and coaching to teachers. By forming stronger relationships with students, teachers can concurrently reduce student anxiety and increase student motivation, which are predictors of student academic success. This is particularly important for Black and Hispanic students because it reduces the stereotype threat that tends to cause student anxiety, particularly in classroom settings where they may already have internalized beliefs about their own abilities in math and science (Steele, 2010). Principals can ensure access to curriculum and instruction as the first step of equitable practices by modeling with teachers what they should do with students and by providing strategies and coaching support for equitable access and cultural responsiveness.

Educational gaming improves student motivation for and engagement in learning while changing attitudes and efficacy (Annetta et. al, 2009). By using new VR technologies to enable principals to practice observation and coaching skills, we can bolster their capacities as instructional leaders and dramatically change the way we prepare and coach principals to

improve instruction in science and math. Now used for training persons in complex scenarios in diverse fields such as medicine and aviation, **gaming technology** is critical for the preparation and ongoing professional learning of principals. Our VR platforms will use gaming logic to scaffold learning experiences and simultaneously gather assessment data for analyses.

The immersive VR experiences for principals will be built on the Unity Game Engine™ and created and implemented in three stages. In the first stage, a set of four (4) classroom simulations (elementary math, algebra, geometry, and a STEM design challenge) will track the principals' ability to identify academic discourse. In the second stage, game logic will be used to improve how principal participants interact with and coach with teachers. Unlike other current VR dialogue technologies with trained actors, this technology uses algorithms created and tested by the project team. There are many other advantages of the VR Gaming Experience, specifically the experience will be consistent for all persons participating in the training because it does not rely on a trained actor, will enable real-time feedback, and will be highly scalable and replicable across locations, a particular advantage for rural school districts. Furthermore, every interaction and word decision is collected on the data base for analysis. We will compile the scores and game interactions for all scenarios from stages one and two in a cloud-based data storage platform and use that data for analysis, especially with the coaches who work with principal NICs, thus, building principals' capacity to (1) observe academic discourse in math and science courses and (2) effectively coach teachers to increase academic discourse. Additionally, the evaluation team will harvest this data for assessment and continuous improvement purposes. In the third stage, the Project I^4 team will work with Sparkplug Games to move this gaming technology to a mobile app platform to make the simulations accessible to others while making our work more scalable and sustainable.

Additional strategies and activities for the MC. The 14-month MC (Summer One, Fall, Spring, and Summer Two) includes the following components that solidify the co-learning of the principal NICs and provide coherency and consistency to their efforts: 1)Three graduate level **courses** (See Table 2); 2) Two Summer Leadership Learning Exchanges (LLEs) with **capstone project**; 3) **Coaching** for instructional improvement using what we know about coaching principals and instructional coaching (Bloom, et al., 2005; Knight, 2007; Aguilar, 2016; Costa & Garmston, 2017); and 4) **Multiple technology** platforms for online discussion that focus on structuring academic tasks carefully and maintaining equitable discourse (Vella, 2008).

Finally, during the MC, while each principal is participating in a principal NIC with a coach, he or she will institute a 90-day improvement cycle using the improvement sciences processes to address academic discourse in science or math instruction by focusing on one teacher NIC (4-6 persons). The MC is awarded upon completing the competencies for the full set of courses and experiences. The MC includes the use of virtual learning tools that principals use with teachers, and, in turn, teachers will be expected to use with students for science and math instruction.

Principals who choose to continue in the **AMC** will earn an additional 21 graduate level credits (See Table 2), gain deeper knowledge and skill as instructional leaders, while

will set up teacher NICs to engage all science and math teachers in PDSA cycles of inquiry on examining their practices in science and math classes and work more intensively with one NIC as a *co-practitioner research group* of teachers (n=4-6) on the participatory action research project required in the AMC.

The Ed.D. program adds depth and rigor to the project design and builds on the unique

nature of the newly redesigned ECU Ed.D. to develop a group of research scholars to sustain and scale our work with a specific focus on academic discourse in STEM education. The Ed.D. utilizes the Carnegie Project on the Educational Doctorate (CPED) framework including a condensed three-year, practitioner focused experience with a dissertation-in-practice (Perry, 2013). The Ed.D. will be both online and face-to-face. In translating the dialogical learning to an online platform so that students could engage in academic discourse and learn from peers, a key component for adult learning is to clearly focus the academic tasks so that students can engage in co-construction and sense-making in the virtual classroom and to use a technology platform that fully supports virtual dialogue (Vella, 2008; Militello, Tredway, & Jones, 2018). Regular contact with the instructors is essential for keeping the individuals and the group on track. We have created two annual opportunities for face-to-face meetings with faculty members, the summer coursework and an annual visit from a faculty member at their work and dissertation site. Participants will select a focus of practice that is aimed at improving local practice and outcomes and rooted in an issue of equity in STEM education. All students will use participatory action research (PAR) methodology to address instructional leadership in STEM academic discourse. Rather than a dissertation extracting data, these dissertations-in-practice ask Ed.D. students to engage in the PDSA cycles to reflect and refine their work. Finally, supported by the ECU Continuing Studies Office (matching funding) students will present emergent findings at national conferences each year. Each dissertation-in-practice will contribute to the empirical literature; a meta-analysis of cohort results will advance knowledge in the field.

2) Sufficient Quality, Intensity, and Duration

The quality of the experience is designed to be rigorous and accessible to education professionals. Project I[4]'s professional learning and support design was informed by careful

study of current research described above and the extensive and diverse experience of our leadership team. The ECU Department of Educational Leadership is an experienced and expert provider of online learning and has the technical capacity to support engaging online tools including interactive asynchronous applications. The duration and intensity of the MC experience is designed to replicate NISL, with additional follow-up to support the long term nature of the improvement science approach. The project design includes professional coaching from experienced school leaders to assist principals in implementing improved practices at their schools. The MC, AMC, and Ed.D. programs all provide graduate level credits as shown below in Table 2 with all courses meeting ECU's quality standards and requiring participants to demonstrate mastery of the competencies incorporated into that course.

Table 2: Credentials, Courses, and Products Demonstrating Competencies

Term	Course	Outcome	Product
MICRO-CREDENTIAL (3 courses = 9 credits + noncredit capstone)			
SU 2019	LLE: Teaching and Learning I	1a, c, d	Simulation Analysis
FA 2019	Design I: Improvement Sciences for STEM	1c, d	Diagnostic Portfolio
SP 2020	Methods I: Data-Driven Decision Making	1 b, c, e, f	Facilitation Analysis
SU 2020	LLE: Capstone Experience for MC	1e,	Digital Learning Map
ADVANCED MICRO CREDENTIAL (7 courses = 21 credits) **Continuation of outcomes 1a, 1b, 1f, and 1h**			
SU 2020	LLE: Equity and Access	2b	Classroom Analyses
FA 2020 **(2 courses)**	Design II: Improvement Sciences Education Policy: Standards and STEM	2a	Mapping Standards

SP 2021 **(2 courses)**	Design III: Leading Teams for Improvement Teaching and Learning II: Technology	2 a, b, c	Poster Sessions: Technology Use
SU 2021 **(2 courses)**	LLE: Methods II: Making Use of Evidence Organizational and Change Theory	2c	PAR Cycle Presentations
EDUCATIONAL DOCTORATE (Ed.D. of 10 courses = 30 additional credits) includes:			
The specialized Ed.D. program dissertations will have a common focus: improving student outcomes in STEM classes by focusing on academic discourse, equitable access, and technology use. Using PAR methodology and the improvement sciences, we will conduct a meta-analysis and publish results to the field. Depth and breadth in coursework is ensured by including 10 additional courses in History and Sociology of Education, quantitative and qualitative methods, design thinking, dissertation proposal, literature review, and dissertations (Objective 3a, b, c, d)			

3) Appropriate Partners to Maximize Effectiveness

The mission of **ECU's College of Education (COE)** includes the preparation and development of professional educators, research, and service in all areas of education. We are committed to support for the K-12 schools in our area of mostly rural and low income communities. Because of this commitment we have developed the relationships, experience, and expertise needed for the success of Project I[4].

The partnership with **IEL** partnership brings capacity in several key areas necessary to project success including recruitment, expertise in facilitating LLEs, and convening of national forums. IEL has extensive networks facilitating scalability to a national cohort of principals serving high need schools; all IEL projects (Coalition of Community Schools, Family and Community Engagement School and District Networks, Appalachian Higher Education Network, Career Development Network, and Education Policy Fellows) work in high need urban

and rural areas. These networks include over 9,000 principals from over 450 districts. IEL has also developed expertise in facilitating Leadership Learning Exchanges in multiple communities for 15 years, ensuring high quality LLE experiences for participants. Finally, IELs work in convening of national forums that include principal network participation will assist with recruitment and dissemination.

The **Latham Clinical Schools Network (LCSN)** is a formal collaborative of 43 mostly rural eastern NC school districts committed to partnering for research, pre-service educator development, and school improvement support. The COE has a formal partnership with the LCSN which ensures quality clinical experiences for teacher education candidates, and facilitates implementation of research, innovative practices, and new initiatives with the public schools. Within the network, there are approximately 564 schools with over 22,500 teachers who participate in partnership efforts. This network provides us with the relationships needed to recruit sufficient principals to participate in the experimental NC NIC and the district relationships needed to obtain research approval and access district data for the research and evaluation component of our project. Four of the LCSN districts work closely with the PI on a Panasonic Foundation grant to meet principal professional development needs in these high poverty, geographically isolated districts and will work closely with Project I[4]. Additionally, Wake County Public School System's Area Superintendent for eastern Wake County has indicated the need for this project in the 23 high need schools he supervises. Additional school districts that have already agreed to recruit principals to participate in the National NIC cohorts as well as participate in evaluation include Oakland Unified School District (USD), El Rancho USD, and San Lorenzo USD in California. (See support letters for school district commitments.)

The Carnegie Center for the Advancement of Teaching brings capacity in improvement

science and the development of NICs. Carnegie has worked with various health, business, and educational entities to create sustainable change in vulnerable settings (See letter of commitment and advisory board role).

SparkPlug Games is a leading independent games developer creating products for Sony PlayStation®3, Nintendo Wii™, Nintendo DS™, Microsoft Xbox 360®, Android, and Apple iPhone™ platforms. They develop educational products as well as augmented and virtual reality. They will bring their expertise and technology to develop the proposed VR simulations.

4) Focus on Those with Greatest Needs

In North Carolina, Project I[4] will focus recruitment efforts on the Latham Network Districts and the eastern part of Wake County. The Latham districts serve predominately rural, low-income communities where student achievement is significantly lower than in other North Carolina districts (See Table 3); Eastern Wake serves a high proportion of low-income students.

Table 3: Achievement in Latham Districts: % of students scoring at the Grade Level Proficient (GLP) and at the College and Career Ready (CCR) Levels (NCDPI, 2018).

Subject and Grade	Latham Districts		Non-Latham Districts		Entire State	
	GLP	CCR	GLP	CCR	GLP	CCR
All EOC Subjects	54.4%	43.7%	62.2%	52.6%	60.8%	50.9%
EOG Math Grades 3-8	49.6%	41.0%	56.9%	49.5%	55.4%	47.6%
Math ACT benchmark	20.8%		30.4%		28.5%	

*Note: rounding errors possible

Recruiting for our national cohort will focus on partner districts in California. These districts serve diverse, low-income communities with high numbers of English Language Learners. Many of their schools are under resourced and struggle with teacher retention and student performance

(See letters). Beyond that recruitment will include districts participating in IEL networks, which focus on high need communities.

5) Addresses Needs of Target Audience

The direct target audience of Project I[4]'s interventions is school principals who subsequently make interventions affecting teachers and thus students in their schools. Discussions with principals and superintendents as well as the evidence from multiple researchers strongly indicates that, despite all the efforts in instructional leadership emphasis for school leaders, principals do not provide sufficient or rigorous professional learning and coaching to teachers. Principals' need for effective professional development in this area was evident in a recent Rigby et al. (2017) study, which included 271 principals from four large school districts. The participating districts invested in inquiry-oriented mathematics curricula. The researchers were interested in the quality of administrator support for teacher adoption of more inquiry-oriented mathematics instruction and found that "administrators spent a large percentage of their time observing teachers and providing feedback with no measurable impact on the quality of their instruction as measured by Instructional Band" (p. 508). Analysis of feedback to teachers revealed that most principals did not address content and content pedagogy in their observations of mathematics lessons. Instead principal feedback focused on classroom management and generalized suggestions which did not advance teacher's use of academic discourse or inquiry-oriented teaching. Knapp, Copeland, Plecki, & Portin (2006) indicate school leaders require a "leadership support system that directs, supports, improves and assesses leadership", and they need "feedback on their learning, improvement efforts and performance" so that they can "influence student, professional and system learning" (p. 2).

Project I[4] will help principals build the capacity of teachers to foster deeper and more

rigorous conversations in science and math classrooms. Principals receive substantial feedback from the NIC coach; they use virtual reality to enhance their abilities to observe and give feedback; they get feedback on their ability to design interventions using the improvement sciences so that they can influence teacher and student learning and change the ways they "do business" in addressing the instructional core in their schools. The project assesses the iterative changes in principal capacity to provide support to teachers through the regular use of CALL. Finding time to be effective instructional leaders is challenging (Grissom, et al, 2013); however, this intensive level of support will aid principals in adjusting schedules and deepening observation and coaching practices so that they can better support improvement in instruction in STEM subjects. The CALL instrument will provide iterative evidence of this.

The program will also address the needs of the subset of principals who choose to continue in the AMC and Ed.D. by supporting them as they form and work more deeply with NIC groups of teachers in their schools, some of whom become co-practitioner researchers. Thus these principals and their school communities will deepen their abilities to use evidence to make iterative changes in their school improvement efforts.

B. SIGNIFICANCE OF THE PROJECT

1) Magnitude of Results for Participants, Teaching and Student Achievement

Project I^4 is designed to build on the positive results of two studies (Carlson. Borman, & Robinson, 2011; Nunnery et al., 2011) of programs working to improve student outcomes through work with school leaders. Both studies have been reviewed by the WWC and found to have statistically significant positive effects on math achievement. The Carlson et al. study met WWC standards without reservations; the Nunnery et al. study met WWC standards with reservations (USDOE, 2014, 2016). The improvement index for math achievement was similar for the two programs +7 for CDDRE and +6 for NISL and effect sizes ranged from .14 to .22.

The participants will be similar to the participants in NISL in that the recruitment focus will be principals serving in high need schools although our group will be broader in that it will also include high school principals. We believe that the level of impact on principal knowledge, skill and efficacy will be as strong as these studies while the emphasis on academic discourse, diagnostic observation, and providing coaching to STEM subject teachers (particularly mathematics) will result in similar if not greater effects on student outcomes in mathematics. The evaluation team from Policy Studies Associates (PSA), which has conducted large studies on principal practice and impact for the Wallace Foundation, and has access to comparison groups will specifically look at NIC I (n=52), a subset of principals in North Carolina, and use propensity matching to identify comparison schools (See Section D).

In addition to matching the effect size of the sample studies, Project I[4] is relying on evidence from the Grissom et al. (2013) study that identifies how principals can improve teacher practice in the service of impacting student outcomes. In particular, they note that "more time spent coaching teachers predicts greater student math achievement growth and increases in math achievement growth" (p. 437). The study identifies two critical factors of principal instructional leader capacity that most impact student outcomes: conducting post-observation coaching conversations and using aggregate results from observations to structure teacher professional development. While districts emphasize that teachers ought to be in classrooms, little guidance is available on how to do observations and what to do with the information gained during an observation. Further, the study indicates the typical administrator walkthrough that concentrates observation on a checklist of factors that have very little to do with instructional quality or student learning actually has negative effects on teachers and student outcomes. Unless principals learn to use observation processes that collect evidence of instructional practice and

use the aggregate analysis of those observations to inform coaching and professional learning for teachers, their observations have no effect on learning outcomes. In addition, an eight-year longitudinal study of 271 principals in four urban districts and principal practice in providing feedback to math teachers in middle schools indicates that principals give generic feedback in math classes and do not exhibit "math press" in their responses to teachers (Rigby, et al., 2017). As with the Grissom, et al. study, more time is not necessarily the variable for instructional leadership; the important variable is content and pedagogical knowledge (Shulman, 1986). By incorporating specific strategies to support principal knowledge, skill, and efficacy to use the precise kinds of academic discourse needed to improve student learning in math and science (National Research Council, 2012); by addressing principal coaching practices based on observational practices that collect useful evidence; and by supporting them to use evidence to re-think professional development for math and science teachers, we believe that we can match and exceed the results of the Nunnery et al. (2011) and Carlson et al. (2011) studies. As a result, Project I[4] shows promise for informing the field of educational leadership and offering a strategic approach to building principal and teacher capacity in STEM classrooms.

The optional component of building on the micro-credentials to an Ed.D. offers an intervention that can build the long-term capacity of current principals who often choose to engage in an Ed.D. because they want to gain additional knowledge and skill to become district supervisors, assistant superintendents and superintendents. Our initial leaning from a current Ed.D. program at ECU that uses the CPED principles to conduct participatory action research projects and uses technology creatively in virtual learning (n=15), includes two preliminary findings. First, the regular use of Leadership Learning Exchanges in schools and districts builds the necessary relational trust to engage collaboratively in networked improvement communities

(also called in some district professional learning communities or communities of practice). Second, because principals do not fully understand learning theory nor academic discourse as it applies to science and math instruction, they make decisions about school improvement that are not consonant with research-based knowledge or practice. The most vulnerable rural and urban communities need educational leaders who understand how to improve STEM content knowledge and instructional practices so that, in turn, we can have more robust student learning outcomes. Project I^4 aims to understand and promulgate those practices.

2) Reasonable Costs

A simple computing of per- participant costs for this project, $30,368 for first 3 years, does not convey the extensive collateral benefits for school leaders, schools, and students. Specifically, in the first three years, the Project I^4 will serve a total, unduplicated-count of 220 K-12 principals (estimated 88 high schools, 88 middle schools and 44 elementary schools). Using an average estimated size of 1500 students/high school and an average of 20 high school science and math teachers/school, 600 students/middle school students and 8 math and science teachers, and 250 students/elementary school and 10 teachers, we potentially impact 195,800 K-12 students and 2,904 teachers. In addition, 24 participants will be further supported to achieve advanced credentials in the first 3 years (AMC), providing leadership and expertise for sustaining principal development. These individuals will develop advanced capacity to serve as leaders and mentors for the future across their districts and beyond. The development of new VR technology for principal leadership training will further increase the impact on teacher development and student outcomes. Moreover, application of the project's technology with principals in isolated rural areas paired with advanced leaders to facilitate ongoing learning and application, including the CALL assessment, will further sustain data-informed continuous

improvement to set up the conditions necessary for student success. When looking at the cost per participant over five years (292) the increased cost per person ($33,605) includes not only an additional 72 principals receiving high quality professional development and coaching, but a cohort of leaders from the first three years who will go on to complete doctoral degrees. This will further increase the impact of the project as they become district superintendents, implementing system-wide use of data to drive continuous improvements and models to develop principals and teachers that will positively impact student performance; or as they assume higher education positions to further the research and support principals in higher education and the field.

The majority of grant expenditures are directly for participants, including training grant stipends, direct service to the participants (i.e. coaching, participation in IEL conferences), and development and deployment of the instruments and technology tools for participants' use in their schools. More challenging in assessing value per participant is the significant difference in training stipends for those participants within and outside of NC. ECU realizes a significant amount of support from the state legislature to ensure that it remains a "comprehensive low cost public university" (Moody's Investors Service, 2018), Between 2012 and 2017, NC legislative appropriations increased by 11.2% and are second only to California in overall dollar amount for 2017 (Seltzer, 2017). Consequently, tuition for those from outside of the state (204 individuals) is approximately 28% higher than for in-state graduate students. While the cost of the evaluation is approximately 11% of the budget, the quality of the research and the data it will yield on the effectiveness and impact of the initiatives is a further benefit that contributes to the reasonableness of the costs for this project. When considered in relation to numbers, a preparation model that includes a pathway to develop competence for advanced leadership, the impact directly on schools, teachers, and students, and on school leaders within and across

education systems, the costs are both reasonable and represent a good investment in reaching the goals of the SEED funding initiative.

3) Potential for incorporation of results after funding period

IEL will incorporate results of Project I[4] into work across their networks (Coalition of Community Schools, Family and Community Engagement, Appalachian Education Network, etc.). In particular, as described below in the dissemination section, the IEL team is interested in incorporating results into their work with the Coalition of Community Schools in order to promote more rigorous STEM education in schools that serve high need communities.

The following strategies will increase the sustainability of Project I[4] innovations for the

1) The cohort experience and Summer LLEs (in which PI Militello and IEL Project Coordinator Tredway have been engaged for over 20 years) build ongoing networks of relationships and support – these supports help sustain principals as they implement new practices at their schools; 2) By attending other IEL national conferences, participants engage in building and strengthening their network communities beyond their cohort and schools; and 3) The project emphasizes and provides tools that schools can use for an affordable price to continue collecting formative data for iterative improvement. The cost of the

CALL formative assessment has been reduced by the University of Wisconsin for this project; however, the yearly cost of $1500 is not prohibitive for most schools. Schools may reproduce and administer the MUSIC Inventory free of charge. Many additional tools introduced for online learning, including a tool called FlipGrid that project coordinators have used to support academic discourse in online classes, are low or no cost applications that principals will be able to introduce to their schools.

Evaluation will provide ongoing evidence to the project PIs and coordinators so that we can adjust the micro-credential content, pedagogy and coaching to support principals in ways that are useful to changing their practices as well as teacher practices leading to a program that will promote sustainable improvements. The evaluators will also work with the Project I[4] team to identify other ways in which project findings can be incorporated at ECU, IEL, and the partnering school districts.

4) Dissemination and Replication

With SEED funding, we can touch multiple networks, districts, schools, and research and nonprofit organizations engaged in educational reform. Uvin & Miller (1996) indicate that the more clarity with which we can name the key design factors that are essential to the process, the better the chance for replication. The Carnegie Project on the Advancement of Teaching has named the factors that are critical to our design: 1) make a problem specific; 2) focus on variation in performance by creating NICs that name and specify the focus of practice that needs improving; 3) analyze the system that produces current outcomes; 4) measure and analyze evidence often as we cannot improve at scale what we cannot measure; 5) use disciplined inquiry based on driver diagram and a facilitated cycle of inquiry; and 6) accelerate learning through networked communities.

Several additional factors will support and strengthen wide dissemination and contextual replication of Project I[4] innovations. First, the project partnerships with IEL and Carnegie bring valuable dissemination networks. IEL has multiple networks; for this project we are particularly interested in dissemination through the Coalition for Community Schools (CCS). Community schools provide wrap-around social services in high need schools to address the social, emotional, and health conditions that often impede academic outcomes. Study of CCS schools confirms that these schools promote positive student learning outcomes (Maier, et al., 2017). Connecting with CCS, we will reach principals receptive to the project focus and work with their schools for long-term relationships and sustainability. In addition, the Carnegie Project for the Advancement of Teaching at Stanford has annual summits at which we plan to present posters and sessions. They have limited evidence on what principals do in the arena of improvement sciences and are interested in the using the results of this project in their network. The Carnegie Project for the Educational Doctorate and the University Council on Education Administrators also have large networks to further dissemination. Second, we plan to work with Sparkplug to develop a mobile app version of the VR simulation teaching diagnostic observation and coaching skills. We anticipate widespread interest in this innovative training method. Finally, the emphasis on virtual learning will allow the program to reach principals in distant rural communities and support them in their efforts to advance teacher and student outcomes.

C. QUALITY OF THE MANAGEMENT PLAN

1) Measurable Goals, Objectives and Outcomes

Project I[4]'s **goal** is to increase student achievement in mathematics by supporting principals to engage with teachers to improve practices. Table 4 below details our objectives and measurable outcomes leading to this goal. In addition, the evaluation team will monitor progress towards recruitment, enrollment, participation, and completion of each project component.

Table 4: Objectives, and Measurable Outcomes

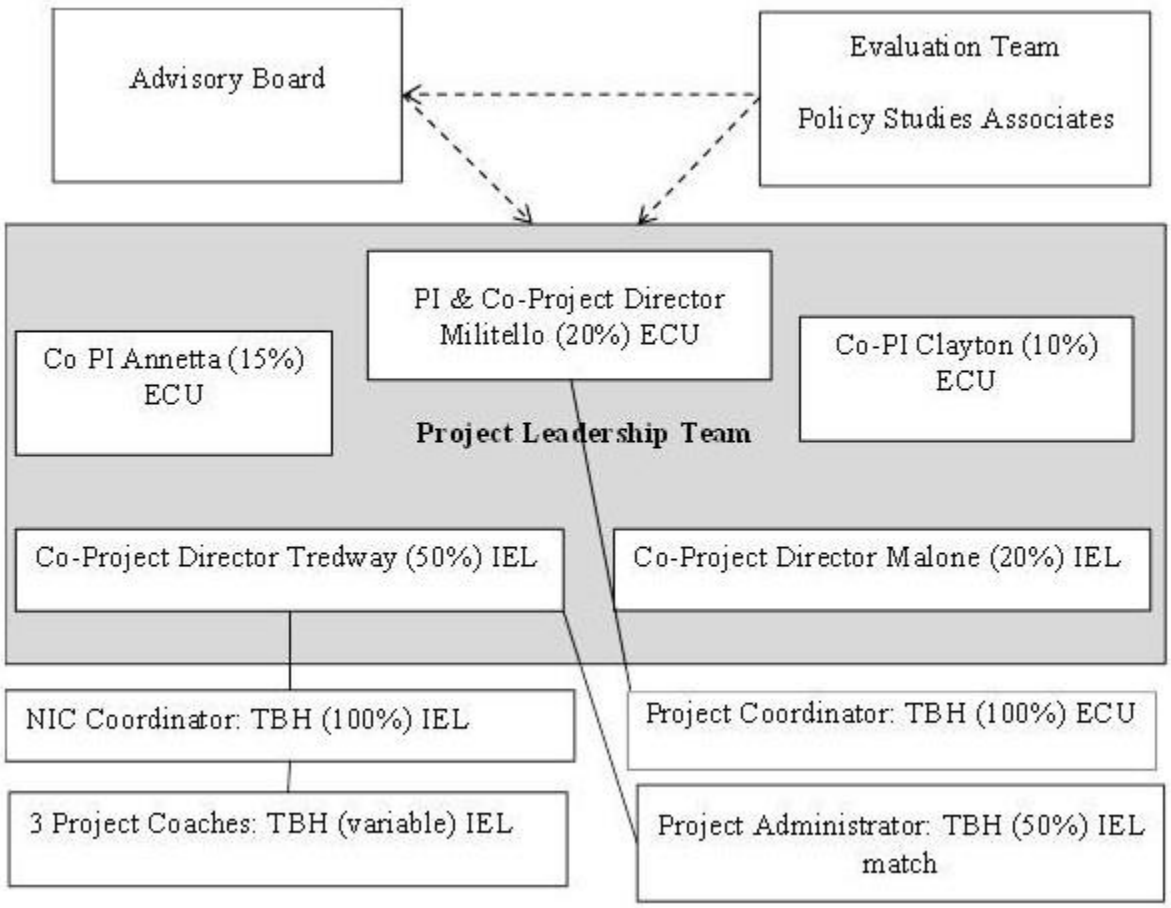
OBJECTIVE 1: Provide Micro-credential (MC) to 292 principals to develop leadership knowledge and skills leading to increased student achievement in mathematics.
Outcome 1a: By completion of MC, participants score 3.75 or above on relational trust in their schools (5 pt. scale) as measured by the CALL assessment.
Outcome 1b: By end of first summer session, MC participants show advanced proficiency in classroom observation as measured by the VR classroom academic discourse assessment by scoring 80% or above on identifying academic discourse targets in VR classroom scenarios.
Outcome 1c: MC participants increase proficiency in providing feedback on mathematics lessons by 10 percentage points as measured by video simulation assessment.
Outcome 1d: From Fall to Spring of each MC cycle, the school staff of each MC principal increase 0.25 pts. (5 pt. scale) in ability to analyze and use data in planning instruction and professional development as measured by the CALL assessment.
Outcome 1e: By spring of each MC cycle, 75% of principals show increase of at least 0.25 pts on the 5 pt. CALL scale in efficacy in providing feedback on STEM content and instruction.
Outcome 1f: By spring of each MC cycle, STEM teachers at MC participants' schools report an increase of 0.25 pts (5 pt. scale) in receiving useful feedback for increasing academic discourse as measured by CALL assessment.
Outcome 1g: By spring of each MC cycle, teachers in participants' schools will score 4 or above (6 pt. scale) on MUSIC inventory components, which measures student motivation for learning, including caring relationships with teachers.

Outcome 1h: By Spring 2022, students in Cohort 1(NC) participants' schools (n=52) **demonstrate greater student achievement in mathematics** than those in comparison schools as measured by North Carolina assessments and the ACT.
OBJECTIVE 2: Provide Advanced Micro-credential to 24 principals leading to advanced knowledge and skills needed for sustainability and dissemination. Outcomes 1a, 1b, 1f, 1g, and 1h will continue to be measured for the AMC participants as well as Outcomes 2a-2c below.
Outcome 2a: STEM teachers in AMC participants' NICs increase at least 0.25 pts. (5 pt. scale) in knowledge, skill and efficacy in use of improvement sciences, building relational trust with students, and use of academic discourse in classrooms as measured by CALL.
Outcome 2b: By Spring 2021, 100% of AMC participants will use the equitable access observation tool to observe and coach STEM teachers (record review).
Outcome 2c: By conclusion of AMC, 100% of AMC participants complete and present a two-year PAR project using improvement sciences processes.
OBJECTIVE 3: Provide Ed.D. program for 20 of those completing AMC, which prepares leaders who will become district level administrators, faculty in principal preparation programs, and contributors to policy making. Objective 3 continues outcomes 1a,1b, 1f, 1g, 1h, and 2a-2c above and adds 3a-3d below.
Outcome 3a: By end of AMC, 20 AMC participants will be accepted into the Ed.D. program.
Outcome 3b: By end of Year 4, 80% Ed.D. participants (n=16) will move to candidacy in the Ed.D. with a proposal and IRB approval for dissertations.
Outcome 3c: By the end of Year 5, 80% of 16 Ed.D. candidates will complete dissertations
Outcome 3d: By Year 5, all Ed.D. participants will present findings at national conferences.

2) Management Plan Ensures Project is on Time and within Budget

The Project I[4] leadership team and ECU have the demonstrated **capacity needed to manage** this project ensuring adherence to the timeline and budget. Project I[4]'s management plan includes a management team and organizational structure (see Figure 2 below), a detailed timeline of tasks, responsibilities and milestones (Table 6 below), and a detailed budget narrative. The project will also benefit from the institutional support provided by ECU's Division of Research, Economic Development, and Engagement (REDE).

Figure 2: Project I[4] Organization Chart



Each member of the Project I[4] Team has distinct expertise and responsibilities. They will meet face-to-face two times during the project start-up period and each summer during the LLE period. They will have formal virtual meetings weekly during Years 1 and 2 and bi-monthly

thereafter, supporting those calls with regular lines of communication using virtual platforms.

Leadership Team. Project I[4] will be led by PI Dr. Matthew Militello, Professor of Educational Leadership, ECU who will serve as lead PI and Co-Project Director, Co-Project Director Lynda Tredway, IEL Senior Associate, and Co-Project Director Dr. Helen Malone, IEL Director of Education Policy and Institutional Advancement. Dr. Len Annetta and Dr. Charity Clayton will serve as additional Co-PIs to bring expertise in gaming and mathematics. Dr. Militello will be responsible for overall coordination of the project, its courses and curriculum, recruitment of the NC cohort and relationships with NC school districts. Ms. Tredway will provide oversight for program direction in collaboration with Co-Project Directors Drs. Malone and Militello. She will be responsible for training and supervising the NIC Coordinator and project coaches as well as recruitment and school district relationships for the national cohort. She brings experience in teaching graduate level courses, coaching principals, facilitating the professional development of coaches, academic discourse, and coordinating large projects. Dr. Malone will coordinate evaluation with third party evaluators, Policy Studies Associates including coordinating data sharing, archiving, and ECU and school district IRB requirements. Co-PI Annetta will develop the VR simulations. He brings expertise in serious educational gaming. Co-PI Clayton brings expertise in academic discourse in mathematics and will lead curriculum and simulation development.

Additional Personnel. **Kwesi Rollins,** Director of Leadership Programs at IEL will mentor the NIC Coordinator on leadership coaching (10% IEL matching contribution)**. Reuben Jacobson**, Deputy Director of IEL's Coalition for Community Schools, will provide oversight of how to bring this instructional focus on math and science to community schools (10% IEL matching contribution); he and Ms. Tredway are working at IEL to develop and institutionalize a

stronger focus on STEM instruction in community schools. A full-time **NIC Coordinator** (to be hired) will have capacity in STEM instruction, coaching, academic discourse, and facilitation of professional learning. He or she will supervise the coaches. **Coaches** (to be hired) will coach principal participants on data driven decision making and observation and feedback to support academic discourse. They will support LLE and NIC processes. The **Project Coordinator** will coordinate data collection, archiving, partner communication, and reporting. IEL will provide a fulltime administrator (100% matching).

A five-person **Advisory Board** will provide expertise and complementary perspectives. They will meet virtually on a quarterly basis and provide individual expertise as needed. Committed members (See Letters) are Dr. Kyla Johnson-Trammel, Superintendent of Oakland Schools; Dr. Peter LeMahieu, Carnegie Center for the Advancement of Teaching; Dr. Jere Confrey, Math Education, North Carolina State University (NCSU); Dr. James Minogue, Elementary Science Education, NCSU; and Dr. Ron Smith, Senior Director of Education Initiatives, Salesforce; former Oakland principal and district assistant superintendent.

Institutional Support for Management of Federal Funds. ECU's REDE oversees a 3-Hub research and grant management structure across the University, one of which is based in the College of Education (COE). The COE Hub provides pre-grant support and manages post-grant administration including: a) fiscal management, expediting grant transactions; b) budget forecasting aligned with project goals and implementation; c) budget monitoring, monthly reconciliation, and reporting; d) compliance monitoring; e) liaison with ECU's university-level Offices of Sponsored Programs and Grants and Contracts; and f) liaison with researchers and other resources. Since 2013, ECU has received over 1,348 awards totaling over $137 million. Over $3 million of these funds were awarded to the COE. Through these awards, the COE has

demonstrated its ability to manage large grants, manage large budgets with subcontracts, coordinate the work of multiple partners, and complete required reporting.

Key tasks for each year are listed Table 5, along with the lead person taking responsibility for that task, the timeframe, and benchmarks.

Table 5: Key Tasks, Responsibilities, Timeframe, and Benchmarks

YEAR ONE (October 1, 2018-September 30, 2019)			
What	**Responsible**	**When**	**Benchmarks**
Contract Partners & Evaluation	ECU Business	FA 2018	Contracts in place
Hire NIC Coordinator & Coaches	Project I[4] team	FA 2018	Staff hired
PD/Coaching: NIC Coord/Coaches	Tredway, Rollins	FA 2018	PD completed/assessed
Develop VR and gaming tools	Annetta	SP 2019	Pilot with NIC I, II
Design MC Courses & LLE (SU)	Project I[4] team	SP 2019	ECU course approval
Present at Carnegie Summit	Project I[4] team	SP 2019	Poster Presentation
Recruit for NIC I & II	Project Coords	SP 2019	Enroll 72 principals
Implement /Assess LLE /NIC I, II	Annetta, I[4] team	SU 2019	VR Simulation Analysis
Implement /assess Fall MC course	Project I[4] team	FA 2019	Diagnostic Portfolio
Virtual online coaching of coaches	NIC Coordinator	ongoing	Coaching Simulation
Virtual online coaching of MC	Coaches	ongoing	Analysis/Feedback
Update IRB/Research approvals	PSA/Malone	SP 2019	ECU and LEA approvals
Collect data for ongoing evaluation	PSA/Malone	ongoing	Data collected and stored
Provide evaluation reports	PSA/Malone	ongoing	Quarterly reports
Use reports to plan for Year Two	Project I[4] team	FA 2019	Project Plan Year Two

YEAR TWO (October 1, 2019-September 30, 2020)			
Recruit for NICS III, IV, V	Project Coords	FA 2019	Enroll 72 principals
Present at Professional Conference (e.g., UCEA, NASSP, Carnegie)	Project I[4] team NIC I&II	FA 2019 SP 2020	Conference symposium
Recruit for AMC	Project I[4] team	SP 2020	Enroll 24 persons
Plan AMC courses	Project I[4] team	SP 2020	ECU course approvals
Implement/Assess MC final course	Project I[4] team	SP 2020	Facilitation Analysis
Revise courses/simulation	Militello, Annetta	SP 2020	Revised course syllabi
Plan Summer LLE	Project I[4] team	SP 2020	MC Capstone Experience
IEL Conferences (CCS/WPS/FCE)	Project I[4] team	SP 2020	Presentations
Implement AMC (SU)	Tredway	SU 2020	Classroom Analyses
Implement/Assess LLE NICs I-V	Project I[4] team Coaches	SU 2020	Digital Learning Map Simulation Analysis
Implement AMC courses (FA)	Malone	FA 2020	Mapping Standards
Coaching NIC Coord/Coaches PD	Tredway/Rollins	ongoing	Participant feedback
Online coaching	NICCo/Coaches	ongoing	Coaching logs
Continue Evaluation Activities	PSA*	ongoing	Data and Reports
Integrating learning: CCS team	Jacobsen	FA 2020	CCS Plan for Instruction
YEAR THREE (October 1, 2020-September 30, 2021)			
Identify Ed.D. candidates/Apply	Militello	FA 2020	16 applications to Ed.D.
Implement AMC courses (SP)	Militello	SP 2021	Tech Use Presentations
Plan Ed.D. courses—FA2021	Project I[4] team	SP 2021	ECU course approval
Disseminate learning: AMC	Project I[4] team	SP 2021	Carnegie Summit

Plan and implement LLE	Project I[4] team	SU 2021	Digital Learning Map
Implement AMC course (SU)	Project I[4] team	SU 2021	PAR Cycle Presentations
Plan and implement Ed.D.	ECU faculty	FA 2021	TBD
Continue Evaluation Activities	PSA/Malone	ongoing	Data and Reports
YEARS FOUR and FIVE (October 1, 2021-September 30, 2023) In addition to the Ed.D. program, evaluation and dissemination activities, Project I[4] Team will initiate new MC cohorts and continue a similar cycle to Years 1-3			
Complete course development and implement Ed.D. Program	Co-Project Dir	SU 2023	Course approvals Dissertations
Complete evaluation	PSA/Malone	ongoing	Final Evaluation
Publish findings	Co-Project Dir	ongoing	Publications
Conference presentations with AMC/Ed.D. participants	Co-Project Dir w/ AMC/Ed.D.	ongoing	Accepted for refereed presentations

3) Procedures for Providing Continuous Feedback and Improvement

In addition to the rigorous impact evaluation planned for the NC NIC cohort, Policy Associates plans an in-depth formative evaluation, looking at fidelity of implementation and opportunities for improvement of project processes. The Project I[4] leadership team will model the PDSA cycle in their work on the project and work collaboratively with Policy Associates and with the coaches and the advisory board to determine areas for improvement. Policy Associates will present formative evaluation findings on a quarterly basis or in some cases more frequently so that needed changes can be considered and implemented in a timely manner. With frequent review, corrective action can occur immediately if the project is not meeting benchmarks. The process evaluation is designed to ensure that project strategies are implemented with fidelity and

project data are reliable and valid. The evaluator will observe project activities and solicit feedback through surveys and possibly focus groups or interviews from diverse stakeholders, including participants, teachers, students, district superintendents, and project staff. The evaluator will work with the Project I[4] leadership team and coaches to document principals' levels of participation, and to identify where implementation issues may be impeding achievement outcomes. Coaches will work closely with participants (checking in with each principal at least twice a month and monitoring online NIC participation) to ensure understanding and implementation of project leadership strategies and feedback to the co-directors about barriers and challenges participants experience. Project findings and recommendations will be shared regularly with partner districts' superintendent and central office staff to ensure program innovations are understood and supported by district staff.

D. QUALITY OF PROJECT EVALUATION

1) Evidence Produced by the Evaluation will meet WWC Standards

ECU will contract with Policy Studies Associates, Inc. (PSA), with its extensive experience conducting rigorous, experimental and quasi-experimental impact research as well as formative and process evaluation to provide an independent evaluation of the impact and implementation of Project I[4]. PSA has more than 30 years of experience conducting research and evaluation of policies and programs intended to improve the learning and well-being of children and youth. Under grants and contracts with government agencies and national foundations, PSA provides high-quality research and evaluation design, data collection, statistical and qualitative analysis, and reporting. PSA's evaluation team will be led by Richard White, PSA Managing Director. He has forty years of experience conducting program evaluations, most involving a mixed methods approach to data collection and analysis. He has led multiple large-scale studies involving RCT and quasi-experimental designs, and complex hierarchical statistical procedures. He has

completed over 30 studies that used student performance on state end-of-year assessments as the primary means for estimating program impact.

The proposed evaluation plan will contribute high-quality evidence and insights to the field about the effects of principal participation in a high-quality development program. The impact evaluation component **comprises a quasi-experimental matched comparison group design that will meet the *What Works Clearinghouse Standards with reservations***. See Section D4 for details of sample and methodology. The proposed study includes a mixed methods process evaluation that will include review of administrative data generated during the operation of Project I[4], administrative data from the school districts of participating principals, and surveys and focus groups of participating principals and teachers in their schools. The information collected will be used to assess fidelity of implementation and explore the mechanisms by which Project I[4] impacts schools.

Exhibit 1: Research Questions

Research Question and Sub-Questions	**Data Source(s)**
RQ1: To what extent is Project I[4] implemented with fidelity? Do the expected numbers of principals enroll, continue active participation, and acquire sufficient knowledge and skills to apply them as part of their practice at their home schools? To what extent is the gaming technology useful for skill development?	• Data on enrollment, persistence, completion of MC, AMC • Participation in, performance on simulations, assessments • Survey, focus groups of principals
RQ2: To what extent do participating principals improve their performance as instructional leaders in their schools during and after program participation?	• CALL Assessment Survey • (Reports from Project I[4] coaches • Telephone interviews (sample of principals) • Survey, focus groups (sample of teachers) • School level NIC formation • Rates of principal retention
RQ3: To what extent did school culture, instructional leadership, and equitable access to STEM instruction change in schools led by participating principals?	• CALL Survey of teachers • NC Survey of Teacher Working Conditions • Rates of teacher retention • MUSIC inventory

RQ4: What were the effects of principal participation in Project I[4] on student mathematics achievement compared with similar students in similar schools? Did effects differ across students with different characteristics, across different school types and characteristics, or across level of principal's participation in the I[4] project?	• Identify comparison schools similar to the schools of the 52 North Carolina principals participating in NIC I. • NC EOG and EOC assessments in mathematics, ACT (required for NC juniors) • Student-level descriptors from administrative data NCRDC • School characteristics from state data files

2) Evaluation will Provide Performance Feedback

The evaluation is designed to provide frequent formative feedback and regular summative results to allow ongoing adaptation and improvement of Project I[4] and its implementation**.** The evaluation will report regularly on the analysis of formative data collected through surveys, interviews, focus groups, and administrative data reviews to provide developers with timely feedback about progress towards planned outcomes and challenges that emerge during principal's enrollment in Project I[4] components, their persistence, performance and completion of each component, and in the pace and depth of the application of the knowledge and skills acquired during Project I[4] into the academic practices of their school over three subsequent years. The evaluation will provide performance feedback and assessment of progress towards achieving the project's intended outcomes, as shown in Exhibit 2 below.

Exhibit 2: Performance Feedback and Schedule

Mechanism	**Purpose and Benefits**
Bi-monthly discussion w/Project I[4] staff	Informal updates on evaluation progress and findings to-date regarding implementation quality and impact
Interim Report 1: Fall 2019	Findings from review of Project I[4] and participating school district administrative data and surveys and focus groups of participating principals and teachers in their schools. Will include profile of participating schools and identification of comparison schools.
Interim Reports 2-4: Annual	Update on implementation findings plus comparison to baseline performance information for the students enrolled in participant and comparison schools.
Final Report: Summer 2023	Report and disseminate findings from the implementation and impact evaluations.

Data Collection Plan When finalizing the data collection plan for the implementation

evaluation, PSA will attempt to maximize our use of administrative data routinely collected as part of the operation of Project I[4]. For each principal enrolling in Project I[4], PSA will collect district-provided principal performance evaluation data, school demographic data, and human resource data to report on measures included as Government Performance Results Act (GPRA) indicators for the SEED competition, 1) % of the schools of participating principals that serve high-need students; 2) % of these schools that serve concentrations of high-need students and are highly effective; 3) % of these schools that serve concentrations of high- need students, are highly effective, and serve for two years. ECU will report on the cost per participant, based on Project I[4] budget expenditures. PSA will also leverage the CALL and MUSIC assessments planned as part of the intervention for the evaluation. The CALL assessment will be administered by WCEPS and participating principals will, as part of the Project I[4] assignments, administer the MUSIC Model of Motivation Inventory to students in their school. The surveys will be administered at the start and end of each school year for at least three years. The completed surveys will be submitted to Project I[4] staff and used for discussion with participating principals about data driven decision making and for tailoring coaching based on the results. PSA's measurement plan will ensure coordination with the CALL assessment system and the MUSIC Inventory to ensure that there is no duplication of the information requested, minimizing the burden the evaluation places on school staff and students.

3) Objective Performance Measures clearly related to Intended Outcomes

Exhibit 3 displays the objective performance measures proposed for each of the intended outcomes of Project I[4]. The performance measures reflect information from both the implementation and impact evaluations.

Exhibit 3: Research Questions and Performance Measures

RQ	Performance Measures
RQ1	Extent to which Project I[4] is implemented with fidelity? Documentation of development and use of VR simulation *(via review of Project I[4] administrative data; surveys of all principals participating in NIC 1; phone interviews with North Carolina subsample of principals annually 2019, 2020, 2021)*
RQ2	Extent to which principals improve their performance as instructional leaders – of participating principals, % improving their performance? *(via NIC VR simulations and assignments, CALL Survey, focus groups with sample of NC principals and with teachers; annually 2019, 2020, 2021)*
RQ3	Extent of change in school culture, instructional leadership, and equitable access to STEM instruction? *(via CALL Survey, MUSIC Inventory, focus groups with teachers, teacher retention rates; annually 2020, 2021)*
RQ4	Extent to which students in participating schools improve performance on state mathematics assessments compared to similar students in nonparticipating schools? *(NC assessments in mathematics (EOG and EOC, and ACT; annually 2019, 2020, 2021)*

4) Evaluation will Provide Valid and Reliable Performance Data on Relevant Outcomes.

For the impact evaluation, we propose a matched comparison group quasi-experimental design**.** The treatment group will comprise the students enrolled in the schools led by the principals who enroll in the NIC1**.** This cohort of 52 principals will be comprised of those leading schools in North Carolina**.** For each treatment school, comparison schools will be selected from the remaining public schools in North Carolina**.** The first round of propensity matching will be conducted at the school level, using school level administrative data from the North Carolina Department of Public Instruction (NCDPI), such as grades served, enrollment, student performance, and student characteristics**.** This process will identify three matched comparison schools for each treatment school.

A second round of propensity matching will occur at the student level, using student level administrative data from NCDPI, including student characteristics, disability status, performance on the state end-of-grade assessments in grades 3-8, end-of-course assessments in grades 9-12, and ACT scores in grade 11. We will analyze math proficiency data from three-years prior to

participation through two years post participation at the individual student level. The set of comparison schools will be selected so that differences in mean baseline achievement scores of the treatment and comparison groups are less than 0.20 standard deviations of the pooled sample. A quasi-experimental design with differences in mean baseline outcomes of 0.20 standard deviations or less can meet WWC evidence standards with reservations. To control for remaining differences in baseline achievement scores between the treatment and comparison groups, we will include the differences as covariates in our statistical models.

To determine the minimum detectible effect size (MDES), we used the *PowerUp!* tool (Dong & Maynard, 2013). For the analysis, a three-level hierarchical linear growth model, nesting students in schools, and including measures on the extent to which the principals adopt and apply the skills and knowledge of Project I[4], we will collect data for three years prior and two years post-intervention for students in the 54 schools in which the principal participated in the intervention and 216 matched comparison schools. Our power analysis assumes an average of 250 students with test scores nested within each school and that school-level covariates will explain 20 percent of the variance between schools. Under these conditions, the power analysis yielded an MDES of 0.20. Based on the Carlson et al. study presented earlier we predict an effect size of at least .21 for Project I[4], and possibly higher as data driven reform will be combined with the other leadership development strategies described in the Section A1. The MDES for our proposed research design of 0.20 indicates that the impact evaluation has sufficient statistical power to detect program effects of the magnitude projected for Project I[4].