VASS Rural Math Innovation Network

Project Narrative

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Virginia Advanced Study Strategies, Inc. (VASS), a 501c(3) nonprofit organization, and 20 eligible rural LEAs (districts) in Virginia propose to form the Rural Math Innovation Network (RMIN) to address the i3 *Absolute Priority 5—Serving Rural Communities* and *Absolute Priority 4—Influencing the Development of Non-Cognitive Factors*. VASS seeks to continue its evidence of success in helping high need rural schools. In operating the National Math and Science Initiative (NMSI) in Virginia, VASS achieved impressive student gains in qualifying scores of 3, 4 or 5 on AP exams. After two years (2009 to 2011) in the project, Cohort 1 schools achieved more than a 143% increase in math, science and English (MSE) qualifying scores, compared to a 97% increase achieved by NMSI schools overall and a national and state average of less than 10%. The increase in MSE qualifying scores for African American and Hispanic students in Cohort 1 schools was more than 340%, compared to 154% for NMSI schools and a state and national average of less than 10%. Gains among female students increased more than 150%, compared to 116% for NMSI schools. State and national averages were less than 10%. After only one year, Cohort 2 schools achieved 98% gains for all students compared to 84% in NMSI schools; for African American and Hispanic students, 133% compared to 97% in NMSI schools; and for females, 160% compared to 92% in NMSI schools. State and national averages for AP qualifying score gains were below 10%.

A. Significance

(1) Magnitude or Severity of the Problem to be Addressed by the Proposed Project

A major taskforce on measuring SEL reports that "Mainstream education has traditionally put an emphasis on mastery of core academic content, particularly since the inception of "No Child Left Behind." However, emerging research is demonstrating that other, non-content competencies are important to success in school and career" (Philliber Research Associates, 2013, p. 2; CASEL, 2015). And two of the five most essential competencies the taskforce notes are academic self-efficacy and growth mindset or mastery orientation, the focus of this proposed project.

In three large scale reviews of research Payton and colleagues (2008) report SEL programs are effective in both school and after-school settings, across the K-8 grade range and for racially and ethnically diverse students from urban, rural, and suburban settings. Unfortunately, a dearth of SEL studies and strategies specific to the rural context in the U. S. are found in the Educational Resources Information (ERIC) database. Yet, a Turkey study (Totan, Ozyesil, Deniz, & Kiyar, 2014) found social behaviors exert partial mediation effects over students living in rural and urban areas. A study on adolescent females in India (Gul & Bilal, 2015) found significant difference exists between rural and urban adolescent girls in their socio-emotional adjustment.

Scott (2012) argues culture matters and current practices overlook low income and/or underachieving African American students who historically perform poorly on intelligence tests due to psychological factors such as test anxiety, perfectionism, and low academic self-concept in a subject area or areas. Further, Bruton (2012) notes that in rural settings teacher perceptions of African American boys may be linked to their low academic school performance, with teachers needing to be more sensitive to their culture.

But why are SEL and non-cognitive factors for student success in school so critical for students and communities across rural America? Most rural economies are repositioning to compete in a global context (Gibbs, Kusmin, & Cromartie, 2005). Public education must contribute (Brown & Swanson, 2003; Carr & Kefalas, 2009) by achieving mutually beneficial goals of high student achievement and economic/community development (Harmon & Schafft, 2009; Schafft & Harmon, 2010) that address growing the new economy (Drabenstott 2010).

President Obama's Council of Economic Advisers (2010) notes: "While rural counties have made great strides in ensuring that larger proportions of their populations pursue schooling beyond high school, they have been unable to close this gap" (p. 10) between urban and rural college attainment. Also, technician occupations, a majority of which require some education beyond high school, are among the fastest growing in America (Carnevale, Smith, & Strohl, 2010), especially rural areas. Rural communities need students able to pursue technician-level and higher career choices (Alliance for Excellent Education, 2010; Beaulieu & Gibbs, 2005; Gibbs, Kusmin, & Cromartie, 2005; Thompson, 2007). And evidence exists from a current rural i3 project operated by VASS that a math gap exists in what students learn and what STEM technician occupations in a rural region require (Harmon & Wilborn, in press), particularly pre-Algebra and Algebra I skills and concepts which are used most by STEM-H technicians.

This math gap matters for the future of rural students and communities in rural America. More than 900,000 teachers work in rural America, comprising 27% of the nation's public school teachers. Of these teachers, about 52% teach at the secondary level, of which approximately 15% teach mathematics (NCES, 2015). Just as significant, motivation to learn matters (Azzam, 2014). Teaching math in applied ways is necessary to motivate and engage students in a rural school context (Hardré, 2009, 2011, 2013; and Harmon & Smith, 2012). And it is this motivation and engagement, fostered by a teacher's instructional practices to increase non-cognitive factors of student academic self-efficacy and growth mindset, that hold promise for students to learn and apply math competencies used by STEM technicians in the workplace. RMIN targets these non-cognitive factors.

(2) Builds on Existing Strategies

Missing from rural education research and practice is how SEL messaging and strategies incorporated into quality lessons plans developed by math teachers in a networked improvement community can increase a student's self-efficacy and growth mindset required to learn math competencies required for STEM technician occupations. Consequently, RMIN builds on a recent Northwestern University study of three Virginia school districts (Jackson & Makarin, 2016). Researchers found providing teachers with online access to anchor lesson plans and supports to promote their use significantly increased students' math achievement by about 0.08 of a standard deviation. The effect on learning was about the same as moving from an average-performing teacher to one at the 80th percentile—and weaker teachers benefited the most from using the plans developed by strong teachers. According to the researchers, the intervention is highly scalable and is more cost effective than most policies aimed at improving teacher quality, a finding particularly valuable to rural school systems. Jackson and Makarin (2016) explain:

> Because the lessons and supports were all provided online, the marginal cost of this intervention is low. Moreover, the intervention can be deployed to teachers in remote areas where coaching and training personnel may be scarce, and there is no limit to how many teachers can benefit from it. The peer-teacher average cost of the intervention was about $431, and each teacher has about 90 students on average. …Calculations suggest that the test score effect of about 0.08 (standard deviation) would generate about $360,000 in present value of student future earnings. This implies a benefit to-cost ratio of 835, and an internal rate of return far greater than that of well-known educational interventions (p. 4).

Unlike traditional math instruction of "learning terms and practicing procedures," the researchers hypothesize the lessons plans enable the teacher to guide students in thinking more creatively and critically about the real world, an exploratory and inquiry-based approach that better develops a student's deep understanding. Consequently, VASS and its partner LEAs seek to embrace this new research and also employ improvement science research on network improvement communities (NIC) advocated by the Carnegie Foundation for the Advancement of Teaching (Byrk, 2015). VASS and partner LEAs (see **MOUs** in **Appendix G**) will form a NIC of innovation-minded math teachers to create SEL lesson plans for instruction of students in pre-Algebra and Algebra 1.

A NIC is a colleagueship of expertise that builds on the focused work and creativity of many. It is an intentionally designed social organization with a distinct problem-solving focus. Jackson and Temperley (2006, p. 2) point out two ways such a network differs from a professional learning community (PLC): "The first is the school as a unit has become too small-scale and too isolated to provide rich professional learning for its adult members in a knowledge-rich and networked world. A new unit of meaning, belonging and engagement – the network – is required. The second is that the collaborative learning and enquiry norms of school PLCs actually require openness to external learning from networks….The permeability to external learning referred to, from other schools and from the public knowledge base, is crucial to informed internal learning." Networks foster teacher learning (Katz, Dack, & Earl, 2009).

Use of a NIC to develop and implement the SEL lesson plans is a modern-day strategy that considers what has been learned in important mathematics education reform efforts to address persistent problems for teachers and schools in rural America. A common lesson learned in most of the 30 Rural Systemic Initiatives (RSIs) (Harmon & Smith, 2012) is improvement-minded mathematics and science educators in high poverty rural areas need supportive experiences with like-minded peers. It is difficult to implement, much less innovate, solutions to problems of practice in high poverty rural school districts.

Rural barriers include a culture resistant to change (Brown & Schafft, 2011; and Brown & Swanson, 2003), difficulty in recruiting and retaining quality teachers (Monk, 2007), limited fiscal and human resources (Dessoff, 2010), teacher professional and geographic isolation (Beesley et al., 2008), inherent small-scale weaknesses (Stephens, 2008), and school and community cultures that reinforce low expectations for student achievement (Azano & Stewart, 2015, 2016; and McCoy, 2006). Moreover, teachers in rural schools also may have little or no involvement in planning their professional development (Wallace, 2014), an important factor in determining teacher buy-in, reflection, and implementation of new practices (Rasberry & Mahajan, 2008).

Teachers can improve their own professional development (Hickey & Harris, 2005) where they believe content and pedagogy development is led by teachers themselves (Scoggins, 2010). As adult learners, however, they need opportunities to interact with other learners, reflect and make sense of their learning relative to their prior experiences, and connect the learning to their own contexts, purposes, and needs (Kelly & Cherkowskil, 2015). The learners need a safe environment to try out new ideas and share personal experiences (Brookfield, 1986; Gravani, 2012; and Terehoff, 2002), such as an environment facilitated by the NIC using online technology.

Teachers learning from quality peers can positively impact student performance (Jackson & Bruegmann, 2009), particularly if SEL needs of students are addressed (Dusenbury, Calin, Domitrovich, & Weissberg, 2015). Innovative teachers see their own positive attitudes and beliefs as drivers for improved classroom practice, not external factors such as money, state standards, or time (Ertmer et al., 2012). Blanchard, LePrevost, Tolin and Gutierrez (2016) concluded reform-based teaching beliefs and comfort using new technologies increased significantly in teachers receiving technology-enhanced professional development (TPD). Moreover, Blanchard et al. (2016) reported African American students who had more TPD teachers over more years experienced significant gains on end-of-grade mathematics and science tests.

Further, RMIN builds on the work of numerous authors who have highlighted the importance and/or positive achievement results of making mathematics relevant for students. These authors include Bafumo (2006), Barta and Kyriopoulos (2014), Gaspard and colleagues (2015), Hardré (2011), Sealey and Noyes (2010), and McCrone and Dossey (2007). Relevance is a key mediator in building student self-efficacy and a growth mindset.

RMIN also builds on staff involvement in and lessons learned of the RSIs and the ACCLAIM project. Both funded by the National Science Foundation (NSF), each strived to reform the teaching of mathematics content in rural places. The RSIs (Harmon & Smith, 2012) targeted high poverty rural areas in 30 projects across America. ACCLAIM (2012) produced almost 150 publications, including 23 peer-reviewed journal articles, specifically on rural mathematics education. Selected USED-funded mathematics and science partnership projects also inform RMIN. Lastly, yet highly important, the RMIN project builds on staff knowledge of the learning gaps in math competencies required for STEM technician occupations in a high poverty rural region (Harmon & Wilborn, in press).

(3) Project Addresses Absolute Priority

RMIN addresses the i3 *Absolute Priority 5—Serving Rural Communities* and *Absolute Priority 4—Influencing the Development of Non-Cognitive Factors*. Only Virginia LEAs eligible for the federal low income schools program comprise the RMIN partnership. Thus, poverty makes them high need (see **Appendix C** for profile of LEAs and selection criteria.) The purpose of the project is to create a process to develop, implement, and test SEL lesson plans that include messaging that will increase student self-efficacy and growth mindset in learning math competencies required in math assessments considered essential for earning a STEM-H technician credential. The next section explains how RMIN will achieve development and implementation of the SEL lesson plans. A final section reveals how external evaluators will examine their impact on student non-cognitive factors of self-efficacy and growth mindset, and their contribution to student passage of career readiness math assessments.

B. Quality of Project Design

(1) Goal, Objectives, and Outcomes

The goal of the RMIN project is to develop a process using a NIC of pre-Algebra and Algebra 1 teachers in high need rural school environments to incorporate non-cognitive, social-emotional learning (SEL) factors of academic self-efficacy and growth mindset into lesson plans for teaching math competencies used by technicians in STEM-H occupations. Bandura (1977) defines self-efficacy as one's belief in one's ability to succeed in specific situations or accomplish a task. Self-efficacy plays a major role in how one approaches goals, tasks, and challenges. Growth mindset is a self-perception or self-theory or belief by persons that their most basic abilities can be developed through dedication, effort and hard work (e.g., effort and resilience). (Dweck, C. 2007). In essence, effective teachers must encourage students to believe that they can learn more and master content if they work hard and practice.

Anchor lessons (Jackson & Makarin, 2016) will be designed to complement traditional classroom instruction using real-life applications used by STEM-H technicians to facilitate deep understanding of math concepts. Hardre's research (2013, 2011, and 2009) will inform design of lessons for teaching math in the rural context with specific intent to impact math self-efficacy and growth mindset. Lessons learned in the NSF RSIs (Harmon and Smith, 2012) and research in the rural mathematics NSF ACCLAIM (2012) project also greatly inform project and lesson design.

Specific project objectives are (1) to prepare all teachers in the NIC to innovate lesson plans with SEL strategies that address self-efficacy and growth mindset needs of students for learning mathematics required in STEM-H technician careers; (2) to provide supports for each teacher in the NIC to innovate 5 SEL math lessons and implement 10 SEL math lessons into instruction; (3) to establish technology capacity for all teachers to use the NIC in development and implementation of SEL math lessons; (4) to achieve a student passage rate increase of 25% on the career readiness math assessments as follows: VA pre-Algebra test, VA Algebra 1 test, Work Keys math test, and community college math assessment; and (5) to broadly disseminate information on the project that results in four schools as teacher innovation sites and a 125% increase in the NIC math teacher membership by the end of the project. Increase in student self-efficacy and growth mindset is to result in student passage of the four math assessments considered critical for pursuing appropriate high school and postsecondary education as preparation for technician occupations in STEM-H career fields. Attainment of this education has important impact for the students, schools and communities in the rural areas (see logic model, Figure 1). Students served are in grades 6-12 who take pre-Algebra and Algebra 1 (see **Appendix A**).

(2) Management Plan

Figure 1 reveals a logic model of how the project follows a <u>strong theory</u> to achieve its intended outcomes. Inputs (resources) are used to conduct specific activities that produce outputs necessary to achieve essential short-term outcomes. Achievement of short-term outcomes result in achievement of intermediate outcomes that produce long-term outcomes. Attainment of outcomes produce impact on four results important to students, schools and the rural communities. For example, resources (inputs) will be used to offer training (activity) for teachers to develop the SEL math lesson plans (output).

Figure 1. Rural Math Innovation Network (RMIN) Project Logic Model

Inputs → Activities → Outputs → Outcomes (A-Initial, B-Intermediate, C-Long-Term) → Impact

Inputs

USED I3 Funds

Private Match Funds

Project Partners' Support:
- VASS
- 20 School Districts (40) Schools
- ICF
- JMU

Project Leadership Expertise

Private Sector:
- Business/ Industry (technicians)
- Matching funds

Activities

1. Establish Project Consortium
2. Establish NIC
3. Conduct facilitator training
4. Conduct SEL training
5. Conduct DACUM math analysis with STEM-H technicians
6. Establish website, NIC communications platform & resource repository
7. Provide math applications support
8. Establish project data tracking system
9. Conduct external evaluation

Outputs

1. Project MOU VASS–School agreements
2. Technology platforms & tools operationalized
3. Project staff and regional facilitators complete SEL training (i.e., self-efficacy, growth mindset)
4. Facilitators training completed
5. Math competencies matrix completed
6. Teachers & principals complete SEL training sessions
7. Teachers complete webinars on teaching high need students
8. Teachers access SEL & math specialists & resources
9. Teachers develop math lessons with integrated SEL practices
10. Teachers complete practice with own students; lessons video-taped
12. Teachers complete critical friend reflection
13. Evaluation used

Outcomes

A. Short Term
1. SEL math lesson plans implemented
2. Principals support teacher(s) use of SEL lesson plans in instruction
3. Teachers use videos in data base for instructional improvement
4. High need students complete Saturday SEL math sessions

B. **Intermediate**

Math readiness assessments:
1. Student self-efficacy and growth mindset increases

C. Long Term
1. Increase teachers use of math SEL lesson plans readiness math assessments
2. Students pass 8th grade state test
3. Students pass state Algebra 1 test
4. Student pass Work Keys math test
5. Students pass community college math assessment

Impact

1. Increase no. math teachers that join NIC
2. Increase no. math teachers in school districts with access to SEL math lesson plans
3. Decrease passage rate gaps between white and minority students on career readiness assessments
4. Increase no. students in schools who earn National Career Readiness Certificate
5. Increase pool of students with readiness for pursuing education aligned with STEM-H technician occupations in rural region

Planned Work | Intended Results

Disseminate plan (e.g., web site, project articles, webinars, videos, conferences, i3 CoP, evaluation reports)

The teachers then develop and use the lesson plans (short-term outcome) in instruction to increase student success on specific career readiness tests (intermediate outcome), which is ultimately to result in an increase in the use of the lesson plans in schools (long-term outcome). This use of lesson plans and student success is to long-term influence the closing of achievement gaps on the career readiness assessments. Ultimately, achievement of outcomes impact NIC sustainability, math teachers in school districts with access to SEL math lesson plans, students attaining National Career Readiness Certificate, and the pool of students ready to pursue education aligned with STEM-H technician occupations in their rural areas.

Table 1 shows the management plan tasks, responsibilities, time lines and milestones by objective (Obj.). Administrative project tasks are noted first. Most tasks in year one focus on developing the technology capacity to support the NIC and supporting teachers in developing the SEL lesson plans. In year one, teachers learn how to develop the lesson plans and use the NIC technology in a four-day face-to-face summer institute, where at least one high quality SEL lesson plan is developed by each teacher. Experts at the JMU Research Motivation Institute and a mathematics teacher educator in the JMU College of Education will assist teachers. The nation's leading researcher on rural student motivation, self-efficacy and growth mindset, Dr. Patricia Hardre, will offer sessions on motivating students in a high poverty rural context. With support of trained facilitators (RMIN staff and four teachers in NIC), teachers continue developing and refining lesson plans with classes in fall semester 2017 and spring semester 2018. Key reflection activities with a critical friend, another teacher in the NIC, will enable teachers to critique videos of their lessons in instruction with students and make revisions in the lesson plan. Teachers will receive a key book (Knight, 2014) and training on using video technology to critique and reflect on lesson plan implementation in their classes. JMU faculty consultants and Dr. Hardre will conduct follow-up webinars for teachers on key topics addressed at the summer institute, such as teaching students in rural poverty environments, using strategies that build student math self-efficacy and growth mindset among different ethnicities and genders. Follow-up webinars will facilitate teachers in sharing lessons learned and promising practices.

Table 1. RMIN Management Plan Tasks, Responsibilities, Time Lines and Milestones by Objective

Objective & Major Tasks	Responsible Party	**Year 1** Jan.-Dec. 2017				**Year 2** Jan.-Dec. 2018				**Year 3** Jan.-Dec. 2019				**Year 4** Jan.-Dec. 2020			
		q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4
Announce award	Project Dir. (PD)	x															
Finalize USED i3 cooperative agreement	PD, VASS CEO	x															
Add LEAs, schools, teachers & finalize MOUs	PD, VASS CEO	x	x														
Perform fiscal duties	Fiscal manager	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Hold project adv. leadership team mtg. (ALT)	PD, PM	f	c	c	c	f	c	c	c	f	c	c	c	c	c	f	
Hold project staff meeting	PD	f	Biweekly, alternating f/c														
Submit USED annual project reports	PD, PM	As required by USED															
Attend USED i3 PD meetings	PD, PM, 2 others	As required by USED															
Collaborate with USED designated TA provider	PD, project staff	As required by USED															
Collaborate with RMIN & USED external evaluators	PD, project staff	As required by USED															
Objective 1: To prepare all teachers in the Networked Improvement Community (NIC) to innovate lesson plans with SEL strategies that address self-efficacy and growth mindset needs of students for learning mathematics required in STEM-H technician careers.																	
Train NIC facilitator	PD, PM	x	x														
Select NIC teachers	PM, Math spec.	x	x														
Train teacher lead facilitators	PM, NIC facilitators	x	x														
Establish SEL math lesson design protocol	PD, Math spec., JMU teacher ed.			x													
Plan and conduct DACUM sessions	RMIN cert. staff	x	x														
Develop math competencies matrix	Math specialist		x	x													
Develop/post STEM-H technician videos	NIC facilitators				x												
Conduct SEL math summer institute	PM, RMIN facilitators		x				x				x						
Conduct principal training at summer institute	PM, consultant		x				x				x						
Conduct summer institute session: self-efficacy and growth mindset strategies for different ethnicities	JMU MRI consultant		x				x				x						
Develop SEL math lesson plans & assessments	Math spec., NIC teachers, JMU math teacher ed.		x	x	x	x	x										
Use SEL math lesson plans in classes	NIC teachers			x	x	x	x										
Facilitate SEL math lesson reflection & revision	Math spec., NIC facilitators, teacher facilitators			x	x	x	x	x	x	x	x	x	x	x	x		
Implement SEL math lesson plans in classes	NIC teachers							x	x	x	x	x	x	x	x		
Conduct ½-day business sponsored recognition & STEM careers event	PM, Adv. Lead. Team, & staff		x												x	x	

Conduct webinar: teaching students in rural poverty	PD, U OK consultant				x				x				x				
Conduct webinar: math self-efficacy and growth mindset strategies	JMU & U OK SEL consultants				x				x				x				
Objective 2: To provide supports for each teacher in the NIC to innovate 5 SEL math lessons and to implement 10 SEL math lessons into instruction.																	
Conduct teacher reflection webinars	JMU teacher educator, Math specialist				x				x								
Provide facilitation of NIC	Lead teacher facilitators			x	x	x	x	x	x	x	x	x	x	x	x	x	x
Provide assistance to teacher lead facilitators	Math specialist, RMIN facilitators				x	x	x	x	x	x	x	x	x	x	x		
Place "idea generators" for teaching self-efficacy and growth mindset on NIC web site	Math specialist, PD, media specialist				x	x	x	x	x	x	x	x	x	x	x		
Post teacher videos using SEL math lessons on NIC web site	Media specialist, math specialist, NIC lead facilitators							x	x	x	x	x	x	x	x	x	x
Hold teacher lessons learned webinars on using SEL math lessons	Math specialist, Lead facilitators							x			1 held by NIC of teachers						
Produce & place STEM-H technician videos on NIC web site	Math specialist, Media specialist		x	x	x	x	x										
Objective 3: To establish technology capacity for all teachers to use the Networked Improvement Community (NIC) in development and implementation of SEL math lessons.																	
Hire technology specialist/NIC facilitator	PD, PM	x															
Create project website	Media specialist	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Purchase/establish/maintain NIC technology communication platform(s)	PM		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Purchase, configure and test teacher tablets	PM, NIC facilitators, & teachers		x	x	x												
Establish/maintain video development capacity	Tech. provider		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Establish/maintain electronic resource repository	Tech. provider, media specialist		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Establish/maintain platform for online assessment access	PM, Tech. provider		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Operationalize webinar delivery platform	Tech. provider		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Objective 4: To achieve a student passage rate increase of 25% on each of the career readiness math assessments: pre-Algebra, Algebra 1, Work Keys math test, and community college math assessment.																	
Offer online career readiness math self-assessment	Math specialist, PM, tech. provider							x	x	x	x	x	x	x	x	x	x
Conduct f2f career readiness math prep sessions	Math specialist, NIC							x	x	x	x	x	x	x	x	x	x

	teachers																
Provide online math videos	Math specialist, PM									x	x	x	x	x	x	x	x
Objective 5: To broadly disseminate information on the project for sustainability and scalability that results in 4 schools as teacher innovation sites and a 125% increase in the NIC math teacher membership by the end of the project.																	
Post information on project web site and social media	Media specialist, PM	Ongoing															
Present at state, regional, & national conferences	RMIN staff, NIC teachers, principals	At least 2 per year based on dates of appropriate conferences accepted or invited to present															
Produce & disseminate RMIN electronic newsletter	PM, staff & media specialist				x				x				x				x
Submit articles to peer-reviewed ed journals	PD, others					x	Ongoing as lessons learned and evaluation results become known										
Submit articles to non-peer reviewed publications (e.g., NCTM, Learning Forward, ASCD)	PD, others					x	Ongoing as lessons learned and evaluation results become known										
Submit documents to ERIC data base	PD					As appropriate evaluation documents are available											
Partner with National Rural Education Association to conduct RMIN webinars & conference sessions	PD								x				x				
Participate in webinars for i3 rural communities of practice	PD, others	As appropriate and requested by rural i3 community of practice leader															
Participate in USED i3 PD meetings and "communities of practice"	PD, others as necessary	As required by USED															
Seek dissemination opportunities	PD, RMIN staff	As identified in quarterly calls with USED i3 designated TA provider															
Evolve formal sustainability plan with/for NIC members	PD, Adv. Lead. Team		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Designate 4 schools as teacher innovation sites	PD, PM, Adv. Lead. Team, Math spec.													x	x	x	x
Partner with VDOE to conduct NIC sessions at annual REAP meeting	PD, PM			x				x				x				x	
Make repository of SEL math lesson plans and videos free to new NIC members	PM, Tech. spec.													x	x	x	x
Pursue additional funding to provide external supports for NIC	VASS CEO, PD				x	x	x	x	x	x	x	x	x	x	x	x	x

Note: x means task activity occurs; f means face-to-face meeting; c means video or telephone conference call meeting.

The second summer institute, a two-day blended face-to-face and online event, will be held in June 2018 to review teacher progress in developing their five SEL lesson plans, to discuss videos, to share lessons learned and for teachers to discuss experiences with strategies that showed success in addressing self-efficacy and growth mindset of students. External evaluators will also report implementation findings. Teachers implement their five lesson plans in their classroom instruction during fall 2018 and spring 2019. They and their "critical friend" colleagues continue to reflect on lesson implementation. NIC facilitators will stimulate discussion, implementation of lesson plans and promote a culture of learning from each other.

In fall 2019 and spring 2020, each teacher is to implement 10 SEL math lessons plans, their original five, and five selected from those developed by colleagues in the NIC. Numerous supports are provided to teachers during the implementation period. The third summer institute, a one-day online institute, will be held in June 2019 for teachers to share their implementation experiences. Thus, the series of summer institutes in the project gradually move from an entirely four-day face-to-face format, to a two-day blended format (f2f and online), to a one-day totally online format. This is to build comfort and competence by teachers, facilitators and others in using online technologies that are essential for the NIC process to give teachers in rural isolated areas high quality professional development through such a process. An important objective in the project, discussed later, is to broadly disseminate information that can build interest in the NIC process for educators in rural America and increase sustainability of the RMIN.

To accomplish Objective 1, 40 teachers will be selected for the NIC from 20 REAP eligible LEAs. REAP eligible LEAs in the target regions are selected and profiled in **Appendix C**. Each LEA will have two teachers, one that teaches pre-Algebra (grades 6-8) and one that teaches Algebra 1 at the high school level. Thus the project consortium is comprised of 40 schools. **Appendix G contains a signed MOU** for eight LEAs, representing 16 schools. Selection of all 40 teachers, including in the remaining 12 LEAs and their respective schools, will occur within 3 months after the i3 award is announced. The process for selecting all teachers and the additional 12 LEAs (and respective schools) is found in **Appendix C**.

The JMU SEL experts will provide training for teachers and their principal at the RMIN Summer Institute on the SEL non-cognitive factors of self-efficacy and growth mindset. Hardre will provide training and follow-up webinars on motivation factors, self-efficacy and applied learning for students in rural areas. The JMU teacher educator will instruct teachers on development of quality SEL integrated math lesson plans for use in instruction. Principals will attend one day of the four-day RMIN Summer Institute to receive training on how to support innovative teachers in developing and using SEL math lesson plans.

A key output of the first RMIN Summer Institute will be a high quality SEL math lesson by each teacher. Examples of math lesson plans with self-efficacy and growth mindset strategies and messages will also be collected and available at the Summer Institute. During the Summer Institute, the JMU mathematics teacher educator will instruct NIC teachers on how best to conduct a "critical friend" reflection activity after teaching a SEL math lesson plan.

The SEL math lessons will include content that focuses on real-life applications of math used in the rural region. The Summer Institute will include a one-day modified DACUM sessions with technicians in STEM-H occupations. These sessions, conducted by DACUM certified facilitators among RMIN staff, will identify the math competencies and their applications used by the technicians in performing their STEM-H job. Teachers and principals will observe the DACUM process. Teachers also will interact with the technicians to gain important understanding for making the content relevant to students. These competencies will be used in a matrix analysis to compare how the technician math competencies align with competencies in the project's three career readiness math assessments and the national Common Core State Standards. Results of the matrix will be used to determine math content for SEL math lessons. The accepted peer-reviewed manuscript in **Appendix J** gives more information about DACUM and rural student math gaps.

Training at the Summer Institute will include how to produce assessment items for the SEL math lessons, with teachers to develop items for each SEL math lesson plan. RMIN staff will lead training and support development of assessment items for use as an online assessment. This effort will ensure that items also align with expectations of the project's three career readiness math assessments and can be used in the online assessment platform. NIC teachers will use the online self-assessment to identify students who might benefit from participation in the RMIN career readiness math prep sessions, including needs among different ethnicities and genders. Out-of-school career readiness math prep sessions will be offered using the SEL math lessons that align best with student deficiencies revealed in the online self-assessments. The summer institute in year two will focus on teacher lessons learned in developing and using the SEL lesson plans.

In an effort to maximize impact of the lesson plans on closing achieving gaps among subpopulations of students, in years one and two, the Summer Institute will include sessions on how to teach students in rural poverty and what strategies are most promising for increasing self-efficacy and growth mindset needs of students from different races/ethnicities and genders. In year three, a special webinar will be held on increasing math self-efficacy and growth mindset needs of African American and female students in high poverty rural areas.

Objective 2 tasks focus specifically on development of the SEL math lessons, using the NIC electronic platform to overcome the distance barrier and isolation of teachers in rural areas. To increase NIC sustainability, four teachers from among the 40 teachers in the NIC with time, desire and experience in using distance learning as a professional development approach will be selected to serve as lead teacher facilitators. Each will receive a stipend and be responsible for 10 teachers. Each will facilitate teacher networking, sharing of plans and instructional resources.

The math specialist will place on the NIC web site example math lesson plans, fact sheets or infographics, and teaching practices as "idea generators" that address student math self-efficacy and growth mindset. Videos of teacher success stories in using SEL math lessons will be posted. Planned with the lead teacher facilitators, the RMIN math specialist also will conduct a series of webinars that feature teachers' use of the SEL math lessons plans in student instruction. In addition, videos produced from the DACUM sessions with technicians will be available on the NIC web site for teacher instructional use. As follow-up to year one Summer Institute training, the JMU teacher educator will conduct a webinar in fall of years two and three that aids NIC teachers in conducting “critical friend” reflection of video tapped SEL math lessons.

Objective 3 tasks (see Table 1) begin as soon as the i3 award is announced. VASS will acquire technology services to meet needs of the NIC facilitator and teachers, such as web site operations and technology platforms for teachers to accomplish tasks in objectives 1 and 2. Each teacher will receive an electronic tablet fully loaded and operational with software and apps to actively participate in the NIC and perform video-taping of lessons taught.

RMIN will also purchase the equipment and/or contract the expertise to develop videos from the DACUM sessions, summer institute sessions, teacher classroom instructional videos, and webinars. These become valuable resource materials for implementing the SEL math lessons plans, and in supporting project dissemination, sustainability and scale-up. A special resource repository on the RMIN website will give teachers easy access to the resources. Assessment items for the SEL math lessons will be available via an online platform.

Objective 4 tasks focus on supporting student success on the four career readiness math assessments (see Table 1). NIC teachers will have access to an online career readiness math self-assessment for use with the SEL lesson plans. A select set of online math videos will be made available on the RMIN web site for students to view that teach math content for which the self-assessments reveal students are deficient. These videos are expected help students who need additional support, particularly students for which the in-class SEL self-efficacy and growth mindset lessons are showing promise to impact student beliefs or desire to make more effort for success. RMIN Objective 5 is addressed under the last section heading below entitled (4) Broad information dissemination for project further development or replication.

(3) Ensuring Feedback and Continuous Improvement

The management plan (Table 1) reveals meetings of project staff and the advisory leadership team (ALT), held as either face-to-face or video or conference call. The role of the ALT is to review evaluation results on project implementation and suggest strategies or actions to increase implementation fidelity and achievement of intended outcomes. The project director and manager will organize, with staff input, an agenda for ALT meetings that includes external evaluators explaining their results during the meeting. In-depth discussion will occur on those findings needing the most attention for increasing project implementation fidelity and success.

Quick turnaround written reports (briefs) and the annual performance report by evaluator(s) will be shared with ALT members and in each RMIN staff meeting, with evaluators participating if necessary to discuss findings. An annual evaluation retreat will be held that includes ALT members and staff to discuss evaluation findings and changes needed prior to preparation of the project's submission of the i3 annual performance report. Status of project progress, success, challenges and future actions will be presented in the RMIN e-newsletter, posted on the RMIN web site, and in the required RMIN annual performance report. Evaluation results and project changes will be reported in monthly update calls with the project's USED i3 project officer.

Nine persons will serve on the RMIN ALT. The team will include two math teachers who also serve as teacher lead facilitators of the NIC (one middle school, one high school); a community college faculty member who teaches mathematics courses for technician level STEM-H programs; a superintendent of a participating LEA; two principals of participating schools (one middle, one high school); a high school counselor; one business leader who hires STEM-H technicians; and a member of the VASS Board of Directors. Final membership will be determined after all teachers, schools and LEAs are selected for project participation.

(4) Broad Information Dissemination for Project Further Development or Replication

As Objective 5 in Table 1 shows, a comprehensive set of tasks occur to disseminate project information. These tasks are intended to support sustainability and scalability that result in four schools as teacher innovation sites and a 125% increase in the NIC math teacher membership by the end of the project. Of the 125% increase, 25% will represent math teachers outside the state of Virginia, reinforcing the national significance of the project. Thus, at the end of the project period, a total of 90 math teachers will be members of the NIC.

VASS will continuously post information on the project web site and social media. Staff and available NIC teachers and/or principals will make presentations on project results at state, regional, and national conferences where topics of rural education, mathematics education and SEL teaching practices are particularly valued. The project will also submit at least two articles each to peer-reviewed education journals and nationally read non-peer reviewed publications. Key documents will be submitted to the ERIC data base. The project also will disseminate results through an electronic newsletter and a series of webinars. VASS will partner with the National Rural Education Association (NREA) to host a webinar in years two and three, as a strategy to solicit teachers from non-Virginia states to join the NIC (see NREA support letter, **Appendix G**). RMIN leadership and staff will provide extensive support to the i3 rural Community of Practice. VASS also will seek dissemination opportunities from the USED i3 designated TA provider.

To further position the NIC for expansion and sustainability, the project plans to create a sustainability plan with/for NIC members, designate four schools as teacher innovation sites, hold webinars on project activities and results for rural schools, and partner with VDOE to conduct NIC planned promising practices sessions at annual meetings of REAP-eligible school districts. The RMIN ALT members will have a key role in developing the sustainability plan. VASS also will make the repository of SEL math lesson plans and videos free to NIC members and their districts, and start early in the project to pursue additional funding.

Qualifications, Training and Experience of Project Personnel. Bios/resumes of key project personnel, including the evaluators, are found in **Appendix F**. FTE allocations are in the budget narrative. Dr. Hobart Harmon, a nationally recognized expert in rural education with experiences as director of an i3 rural development project and in research and development, will perform project director responsibilities. Veronica Tate, VASS CEO/President, a former NCLB federal programs director in the Virginia Department of Education (VDOE) with extensive curriculum and teacher development experiences, will perform project manager responsibilities.

Jennifer Stevens, with exceptional training experiences and VASS COO, will provide NIC facilitation functions and fiscal agent responsibilities. Sandy Wilborn, math specialist in a rural i3 math project, will serve as the RMIN math specialist and also perform NIC facilitation duties and teacher support functions. Sue Adams, a media and fiscal specialist for VASS will provide selected project dissemination, data collection, and fiscal activities.

Social and emotional training of teachers is provided by consultants Dr. Kenn Barron, a psychologist and co-director of the James Madison University (JMU) Motivation Research Institute and Dr. Patricia Hardre, education psychology professor at the University of Oklahoma and the nation's leading researcher on rural student motivation behaviors. JMU teacher educator and head of the mathematics education department, Dr. Kyle Schultz, will provide key training expertise in lesson plan and teacher development. Dr. Dorothea Shannon, former superintendent in three VA school districts, VDOE Chief Academic Officer, and rural i3 project co-director, will provide essential training for school principals in the RMIN project to support teacher lesson plan development and implementation. Lastly, ICF International will provide external evaluation services for the project. Dr. Kimberly Cowley, with more than 20 years as an evaluator, will lead the external evaluation team in implementing the evaluation plan.

C. Quality of Project Evaluation

ICF will conduct the independent evaluation of the RMIN project. For more than 20 years, ICF's education experts have provided research and evaluation services to a variety of clients, and currently conduct three i3 evaluations. ICF staff have extensive experience in conducting objective, comprehensive program evaluations and have led numerous large-scale research and evaluation efforts, including randomized control trials and quasi-experimental studies.

The evaluation is based on a mixed-methods quasi-experimental design (untreated control group design with dependent pretest and posttest samples (Shadish, Cook, & Campbell, 2002) using a four-level model (Kirkpatrick & Kirkpatrick, 2006), which focuses on participants' reactions, learning, behaviors, and results. Results will include teacher outcomes (knowledge/ skill and instructional practices) and student outcomes (math self-efficacy and growth mindset, math academic achievement). The evaluation includes an implementation study to investigate fidelity and an impact study to determine the project impact on student achievement outcomes.

(1) Clarity/Importance of Key Questions and Appropriateness of Methods

Key Questions. The external evaluation will include a set of nine evaluation questions. As summarized in Table 2 below, six of the questions address implementation, two address impact, and one is exploratory, to be answered if data are available within the four-year project.

Formative Feedback. The evaluation team will work with the RMIN project team to ensure that ongoing communications occur about project activities and related evaluation activities. The evaluation lead will participate in the monthly project staff meetings and will attend the RMIN Advisory Leadership Team meeting twice per year to present evaluation updates. The evaluation lead will also attend the Year 1 Summer Institute to present an overview of the evaluation to participants, as well as to collect feedback on participants' reactions.

Table 2. Summary of Evaluation Questions, Data Sources, and Analysis Methods

ID	Evaluation Questions	Data Sources	Analysis Methods
Implementation			
1	What are the key components of the RMIN project, and are they implemented as planned?	Project staff interviews	Descriptive statistics for quantitative data (frequencies, measures of central tendency, and measures of dispersion); thematic analysis for qualitative data (transcripts are coded, content analysis is conducted using inductive and deductive techniques, and summaries are generated)
2	What factors served as facilitators or challenges to the RMIN project?	Project staff interviews, teacher interviews	
3	To what extent is the RMIN project sustainable?	Project staff interviews, extant data sources	
4	What are participants' reactions to the RMIN project?	Teacher interviews, teacher surveys, event feedback	
5	How did the RMIN project affect participants' learning?		
6	What effects did the RMIN project have on participants' behaviors?		
Impact			
7	What is the impact of the RMIN project on high need students' non-cognitive social-emotional learning? (mediator for ultimate student outcome)	Student SEL surveys	Propensity score matching and advanced analytic techniques such as logistic regression and/or hierarchical linear modeling (HLM)
8	What is the impact of the RMIN project on high need students' math achievement? (primary student outcome of interest)	Student achievement (math assessment data) and demographic database	
Exploratory			
9	Does the project impact on students' math achievement also result in decreasing the passage rate gap between student subgroups?	Student achievement (math assessment data) and demographic database	Propensity score matching and advanced analytic techniques (logistic regression; HLM)

To help ensure the RMIN project team is able to make any programmatic modifications necessary throughout the project, the evaluation team will hold an annual one-day Evaluation Retreat. These sessions will be used to discuss/interpret data and findings from the current year, reflect on subsequent program adjustments, and finalize evaluation activities for the next year. In order to get evaluation data to the RMIN project team in a timely manner for continuous improvement purposes, the evaluation team will generate and disseminate Evaluation Briefs following each data collection activity. These brief documents will summarize the data collection, present highlights of key results, and identify areas for consideration and reflection.

Deliverables and Performance Measures. Two major deliverables will be produced each year. An Annual Evaluation Report will be delivered 30 days after the end of each project year; the Year 4 Annual Evaluation Report will include a cross-year synthesis as well. An Annual Performance Report will be delivered 90 days after the end of Years 1-3; a Final Performance Report will be delivered 90 days after the end of Year 4 (subject to ED deadlines). The RMIN team will have opportunity to review and provide feedback on draft versions of each of these deliverables prior to finalization. ICF is cognizant of these mandatory measures for the i3 Development grants and the evaluation team will work with the RMIN project and i3 staff to ensure these short- and long-term measures can be addressed by the project evaluation.

Methods. The evaluation team will employ a mixed-methods approach to securing data for the RMIN project by using “qualitative and quantitative data collection and analysis techniques in either parallel or sequential phases” (Tashakkori & Teddlie, 2003, p. 11). Data collected from participating teachers will be secured from an annual interview (to be collected in person or by telephone) and an annual survey on their perceptions of project quality, knowledge and skills, instructional practices (behaviors), and other relevant information. These instruments will be developed with feedback from the RMIN project team to ensure alignment with and coverage of key project activities/strategies. In addition, feedback about participants’ reactions will be secured via brief surveys for all appropriate project events. Comparison teachers will also complete a parallel annual survey about their instructional practices.

Data collected from students of treatment and comparison groups will include a survey focusing on two social-emotional learning factors: math self-efficacy and growth mindset. This survey will be created using the mastery goal orientation and academic efficacy subscales from the *Patterns of Adaptive Learning Scales* (Midgley et al., 2000) and the math subscale from the *Academic Self-Concept* survey (Sabatelli, Anderson, & LaMotte, 2005). These instruments have been used in multiple settings, have sound psychometric properties (reliability coefficients in the .80s), are age-appropriate for the student sample, and align with the RMIN constructs of interest. Student achievement data will be provided annually by VDOE. ICF has had initial discussion with the VDOE and the RMIN project team to construct a Restricted Use Data Agreement in order to secure student achievement data (state assessment scores for 8^{th} grade math and Algebra 1) required for the impact analysis. It is anticipated that student-level data will be provided by VDOE annually for treatment and comparison teachers' classrooms. The evaluation team will work with treatment and comparison schools and the Virginia Community College System (VCCS) to secure work keys math data and community college placement data, respectively.

In addition to the teacher and student data described above, extant project data will be secured from the RMIN project team. This could include such artifacts as meeting agendas and minutes, internal communications, brochures/marketing/advertising materials, lesson plans or other products developed by participating teachers, or other relevant project materials.

Human Subjects Protection. The evaluation team will secure approval from the ICF Institutional Review Board for the independent evaluation of the RMIN project, as well as for all associated data collection activities. Signed consent will be secured from treatment and comparison teachers for their participation in evaluation activities. Further, signed parental consent will be obtained in order to secure students' SEL survey data and any work keys math test and community college placement data ICF may not be able to gather from VDOE or VCCS.

Implementation Fidelity. The implementation study will explore how well the structural and programmatic aspects of the RMIN project were implemented, i.e., the adherence, dosage, quality of delivery, as well as participant responsiveness (James Bell Associates, 2009). Building from the RMIN logic model and theory of change, a fidelity tool will be created in collaboration with the project team that identifies the critical components of the RMIN project. The tool will use quantitative data from teacher surveys and extant data sources (project records and artifacts) and qualitative data from interviews with project staff and participating teachers. An index will be created that measures implementation at the overall project level and by key components.

(2) Extent to Which Methods Will Produce Evidence about Project Effectiveness (WWC Evidence Standards with Reservations)

Comparison Group. One middle school and one high school each from 20 REAP eligible districts will participate in the four-year study starting in January 2017. Propensity score matching (PSM) will be used to identify 20 middle schools and 20 high schools comparable on several school-level characteristics. The matched comparison schools will be drawn from the pool of remaining REAP eligible districts. Middle schools will be matched on aggregated data at the 8th grade level, and high schools will be matched on aggregated data at the 9th grade level. Student data will include demographics, math achievement, and other characteristics. If a 1-to-1 match is not feasible for all 40 participating schools, PSM with replacement will be pursued to allow a comparison middle or high school to be selected for matching more than once. After the list of the matched comparison schools is determined, the team will recruit 20 middle school teachers teaching pre-Algebra and 20 high school teachers teaching Algebra I. Selected comparison teachers will satisfy the criterion of using technology in their math instruction.

Power Analysis. A power analysis concluded that the design produces the minimum detectable effect (MDE) of .20, which is considered a small effect by the What Works Clearinghouse. Parameter assumptions were based on the results of LSAY (Longitudinal Study of American Youth) at Variance Almanac of Academic Achievement and when no parameters were available, values and modeling options were used that returned conservative results.[1]

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[1] PowerUP software was used for the power analysis. Model: 3.1, Treatment at Level 2. Alpha level 0.05, Two-tailed test, Power .80, ICC 15%, Level 1 and level 2 variance explained, 40% and 40%, number of level 2 covariates 5, mean number of students per teacher/school 45, number of teachers/schools 80 (40 treatment, 40 comparison).

Impact Analysis Plan. To address evaluation questions 7 and 8, evaluators will conduct a multivariate statistical comparison of project and comparison group students' SEL scores, as well as math achievement scores collected at the end of each school year, and derive the program impact coefficient. The proposed hierarchical linear modeling framework (HLM) (Raudenbush & Bryk, 2002), wherein students are nested within schools, will explicitly model the structure of the data and adjust for between-school clustering effects. The impact coefficient will be adjusted for pretest scores on the same outcomes collected at the beginning of each school year, and models will include additional covariates to improve precision of estimates, including free/reduced price lunch status, gender, race/ethnicity, and English language learner (ELL) status.

The following summarizes the HLM model proposed to estimate the program impact effect (expressed as β_20): $Posttest_{ij} = \beta_{00} + \beta_{10} * pretest_{ij} + \beta_{20} * treatment_j + ... + r_{ij} + u_j$

where postscripts i, and j index, respectively, student and school, β's are parameters to be estimated, posttest represents a posttest score and pretest represents a pretest score, r's are independently and identically distributed residuals with a mean of 0, and u's are school effects estimated as random effects that are independently and identically distributed with a mean of 0. "…" indicates that the model will include multiple predictors and corresponding parameters. Covariates will be included as appropriate and available (such as race/ethnicity, gender, etc.).

(3) Extent to Which Proposed Project Plan Includes Sufficient Resources to Carry Out Evaluation

The ICF evaluation team has experience with QED studies in general, and i3 evaluations in particular. The evaluation is approximately 15% of the RMIN budget which, based upon ICF's experience in conducting independent evaluations of this size and scope, is deemed sufficient to support the proposed design. See the table in **Appendix J** for a summary of key tasks and timelines.

Dr. Kimberly Cowley, the evaluation lead, has managed multi-year studies ranging from case studies to experimental designs. She has developed i3 evaluation proposals and served as an i3 panel reviewer. Other team members include a specialist with i3 experience to analyze the student achievement data and an associate to help with data collection, analysis, and reporting.

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