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Project Narrative

A. Quality of Project Design

(A1) Goal, Strategy, Objectives. The Virginian Advanced Study Strategies, Inc. (VASS), a 501c(3) nonprofit organization, and six eligible rural LEAs in Virginia propose to form the Rural Math Excel Partnership (RMEP) to address the U.S. Department of Education's Investing in Innovation Fund (i3) *Absolute Priority 5—Improving Achievement and High School Graduation Rates (Rural Local Educational Agencies)*. The project will also address two competitive priorities: *Competitive Preference Priority 7—Innovations That Support College Access and Success* and *Competitive Preference Priority 10—Technology*.)

VASS operates the Virginia-based model of the National Math and Science Initiative (NMSI) and its implementation of the Advanced Placement Training and Incentive Program (APTIP). APTIP is an innovative program that increases teacher effectiveness and student achievement in rigorous math and science courses by offering pre-AP and AP teacher training, student support, and student and teacher financial incentives (National Science and Math Initiative, 2011; See *Appendix J, Attachment I*).

VASS, in implementing the model over four years in 73 schools, has found that a strong sense of *shared responsibility* is necessary to raise the academic bar for middle and high school students in high-poverty rural areas. Families, teachers, and community-based organizations can work collectively to support student pursuit of excellence in foundational math courses. The goal of the Rural Math Excel Partnership (RMEP) project is to develop a sense of *shared responsibility* among families, teachers, and communities in rural areas for student success in and preparation for advanced high school and postsecondary study. Our research hypothesizes that (a) math teachers, families of rural students, and community organizations can each perform unique support functions for students; (b) these supports collectively enable students in Algebra I, Algebra II, and Geometry courses to acquire foundational math knowledge and skills; (c) such foundational math knowledge and skills are necessary for success in advanced high school courses; and (d) advanced high school courses serve as preparation for postsecondary education

and training for STEM-related careers.

Technical occupations are among the fastest growing job fields in America (Carnevale, Smith, & Strohl, 2010). Traditional, blue-collar, rural communities need students capable of pursuing technical-level and higher career choices (Alliance for Excellent Education, 2010; Beaulieu & Gibbs, 2005; Gibbs, Kusmin, & Cromartie, 2005; Thompson, 2007). As a result of this need for a more highly-qualified workforce, the proposed RMEP project is well-aligned with U.S. Department of Education's *Absolute Priority 5—Improving Achievement and High School Graduation Rates (Rural Local Educational Agencies)*.

Specific project objectives are to (1) prepare all teachers of Algebra I, Algebra II, and Geometry courses in seven middle schools and seven high schools to integrate Khan Academy or TED-ED videos into their lesson plans and subsequent student homework assignments; (2) engage the parents/family members of at least 90% of students in Algebra I, Algebra II, and Geometry courses in supporting student completion of Khan Academy and TED-ED Internet-based videos as math home work assignments; (3) organize representatives of community-based organizations in each LEA service area (i.e., county) to conduct at least one major STEM career event for students and their families to reinforce the importance of academic achievement in mathematics; and (4) conduct a high-quality external evaluation that provides evidence of the innovation's (i.e., *shared responsibility for math excellence*) implementation fidelity and feasibility as a promising practice in high need rural schools. *Appendix A (Evidence of Partnership)* describes key characteristics of the middle and high schools in the six LEAs, all of which are eligible for the federal Rural Low-Income Schools Program.

(A1a) Aligned with Priorities. VASS has learned through its tutoring assistance that the content students are currently mastering in foundational math courses, such as Algebra I, Algebra II, and Geometry fails to prepare them for AP or college credit dual enrollment courses. Consequently, students have little chance of being ready for postsecondary education, for careers as skilled technicians or higher level professional positions, which have different math requirements (Lee, 2012).

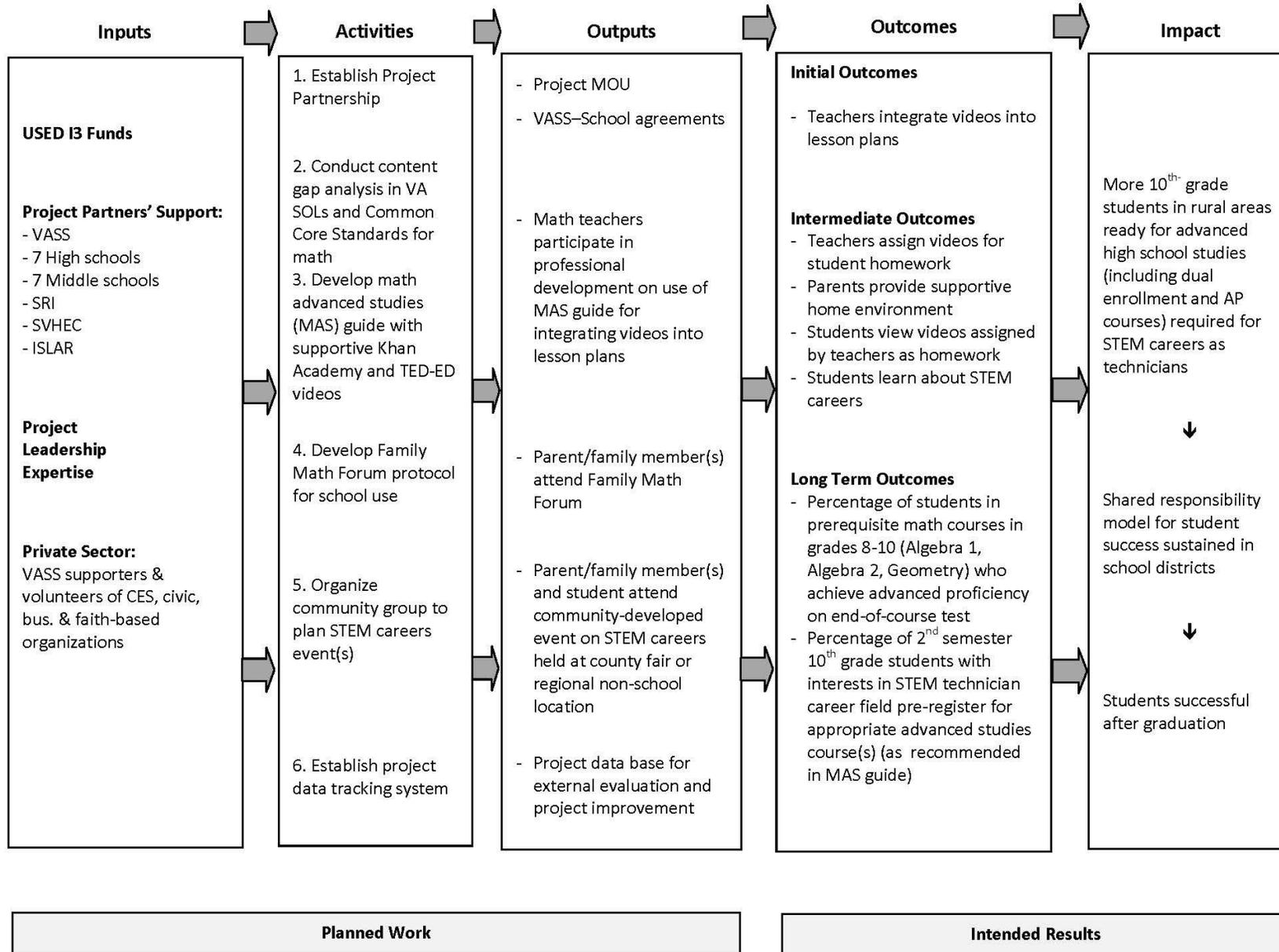
Public education must produce more capable graduates (Brown & Swanson, 2003; Carr & Kefalas, 2009) by achieving mutually beneficial goals of increasing student achievement and promoting economic and community development (Harmon & Schafft, 2009; Schafft & Harmon, 2010). Although it has been suggested that “rural areas have highly unique contributions to make in critical new areas of the economy such as green growth and renewable energy” (Drabenstott, 2010, p. 45), an educated workforce is essential to attract these type jobs into rural communities rather than urban areas. But rural areas historically have been unable to close the gap between urban and rural college attainment (President’s Council of Economic Advisers, 2010).

In addition to addressing the i3 “rural” absolute priority, the project is also designed to address *Competitive Preference Priority 7—Innovations That Support College Access and Success* by focusing the shared support roles of the teachers, families, and community-based organizations in increasing student success in the math courses (i.e., Algebra I, II and Geometry) essential to preparation for advanced high school and postsecondary study, which are required for success in STEM-related careers, including as technicians. VASS will also provide parents/families and students with numerous online resource materials offered by The College Board, a VASS partner in the NMSI project, including guidance for planning a career, selecting a two- or four-year college, completing a college application, reviewing financial aid information, and on college success for underrepresented populations (e.g., females, African Americans).

Although the College Board materials support *Competitive Preference Priority 10—Technology*, the major technology applications in this project focus on teacher roles in using the Khan Academy and TED-ED digital videos for student homework assignments and on students viewing the online videos and completing online assessments (see *Appendix J – Attachment 2*).

(A1b) Expected to Achieve Intended Results. Figure 1 reveals a logic model of how the project proposes to achieve its intended result of increasing readiness among 10th- grade students in rural areas for advanced high school and postsecondary studies.

Figure 1. Rural Math Excel Partnership Project Logic Model



To accomplish *Objective 1*, project staff will first lead a team of community college faculty and technicians in STEM-related careers in the rural Southside, VA region to conduct a gap analysis of mathematics knowledge and skills required in the technician fields and those required in the Virginia Standards of Learning (SOLs) and the national Common Core State Standards (CCSS). This is an essential first step – according to a recent National Research Council of the National Academies report (Pellegrino & Hilton, 2012), students must learn transferable knowledge and skills relevant to life and work in the 21st century. The research studies outlined in the report present a remarkably consistent characterization of mathematics teaching in upper elementary school and middle–grade classrooms in the United States:

Students generally work alone and in silence, with little opportunity for discussion and collaboration and little or no access to suitable computational or visualization tools. They focus on low-level tasks that require memorizing and recalling facts and procedures rather than tasks requiring high-level cognitive processes, such as reasoning about and connecting ideas or solving complex problems. The curriculum includes a narrow band of mathematics content (e.g., arithmetic in the elementary and middle grades) that is disconnected from real-world situations, and a primary goal for students is to produce answers quickly and efficiently without much attention to explanation, justification, or the development of meaning. (p. 5-12)

Robert Rothman (2012) points out in the July/August 2012 issue of the *Harvard Education Letter* that approximately 80 percent of mathematics teachers believe the Common Core State Standards are “pretty much the same” as their current state standards. But the Common Core State Standards are substantially different. In describing differences, Rothman notes: “The Standards end one of the fiercest debates in mathematics education—the question of which aspect of mathematics knowledge is most important—by concluding that they all are equally central. Students will need to know procedures fluently, develop a deep conceptual understanding, and be able to apply their knowledge to solve problems” (p. 1).

Using state and U.S. Department of Labor projections data, staff will identify the 10 most

prevalent and 10 fastest growing STEM-related technician careers. Staff will then match these careers, and others targeted by economic development authorities in the rural Southside, VA region, with technician-level certificate and/or Associate of Applied Science degree programs offered in the Virginia Community College System to select 20 community college faculty (10 mathematics; 10 career/technical courses) to participate in the gap analysis. Staff will also select 20 technicians who are both employed in the Southside, VA region in one of the STEM career fields and hold a postsecondary credential in the technician career field (i.e., certificate or Associate degree. If a technician position does not exist within occupations/career fields among industries in the Southside, VA, region, the technician will be selected from another rural area of the state to represent the position. Project staff will facilitate the DACUM (2012) process to identify the core math competencies a technician must possess in STEM-related careers. The project math specialist will compare the math competencies with those in the Virginia SOLs and the National Common Core Standards (CCSS) to create a Matrix of Essential Mathematics Competencies for Technician-Level STEM Careers in Rural Areas (*Appendix J, Attachment 3*).

Second, the math specialist and a development team of Algebra I, Algebra II, and Geometry teachers will select Khan Academy's online videos to supplement competencies not taught in the Virginia Standards of Learning (SOLs). If a video is not available in the Khan Academy repository, the team will use resources in TED-ED to create the video. Information on Khan Academy and TED-ED videos is found in *Appendix J, Attachment 4*. The team will incorporate the online videos into a guide for teachers that includes strategies on incorporating use of the digital videos as student homework assignments.

Third, the math specialist and other staff will train Algebra I, Algebra II, and Geometry teachers in project schools on content outlined in the guide, including how to help parents reinforce student viewing of the videos in the home environment. Teachers will receive online and face-to-face follow-up assistance in schools.

Fourth, to accomplish *Objective 2*, in addition to developing materials to promote parental involvement, teachers will receive assistance in planning and conducting a family math night at

the start of each semester. The family math night will help parents and students understand their responsibilities in viewing the videos and completing online assessments as homework assignments. Teachers also will access online videos of the National Math Panel (e.g., *Critical Foundations for Algebra, Encouraging Girls in Math and Science*) and best practice guides in the IES What Works Clearinghouse (e.g., *Helping Students Navigate the Path to College*).

Fifth, project staff will accomplish *objective 3* by organizing a team of business, civic and faith-based organizations in the rural county of each school district to conduct a STEM careers event at the county fair or other non-school location. A Cooperative Extension Service (CES) 4-H youth development agent will be requested to lead this team effort. 4-H, the youth development program of our nation's CES, has a successful tradition of serving the informal education needs of rural youth. Virginia is part of the National 4-H Council effort to increase the focus on STEM in youth development programs.

(A2) Project Estimated Cost. Project cost is \$3,123,881, which includes the private sector match of \$420,000 (or 15.5%) that ensures students have access to computers and Internet connectivity at home. The total number of students to be served is estimated at 6,591 (see *Appendix J, Attachment 4*). All students in Virginia must pass an end-of-course exam in Algebra I and Geometry to meet state high school graduation requirements. Therefore, the number of total students equals enrollment in the seven high schools (6,362 students) plus approximately 15% of the 229 estimated 8th grade students in the seven middle schools who take Algebra 1 annually. Cost per student is \$404, calculated as total project cost minus the cost of the external evaluation (\$460,000) divided by total number of students served (6,591) student. Future scale-up costs could be much less, given that a district would likely only have costs for training teachers, conducting the family math nights, and facilitating the community STEM events. The digital videos and most other materials are free and online. The math advanced studies guide would be available from VASS at minimal cost. A school district would not have the project's dissemination or i3 Community of Practice costs. Math specialist expertise not available in the district would likely be available free or at a minimal fee from the district's regional educational

service agency. Project might scale up to 20,000 more students after the special scale-up conference in year 4. Most rural schools may already have close working relationships with community-based organization needed to perform the STEM careers event. We estimate the cost for scale-up to be one-fifth (\$95 per student) of total project costs to reach 100,000 students, and less than \$50 per student to reach 250,000 and 500,000 students, respectively, where a regional educational service agency, statewide or multi-state not-for-profit organization, would likely lead the effort for rural school districts and achieve greater economies of scale.

(A3) Reasonable Costs. An investment of \$404 per student is very reasonable given that costs per student in rural school districts are inherently higher than in urban school districts due to lower enrollment in less populated areas (General Accounting Office, 2004; Levin et al, 2011). The project could have major impact on closing the rural-urban college attainment gap (President's Council of Economic Advisers, 2010), on demonstrating how public schools can serve mutually beneficial student academic and community economic development goals (Harmon & Schafft, 2009), and in increasing shared responsibility for student success in the public school districts that serve approximately 10 million students across rural America.

(A4) Incorporation of Project Innovation into Work of Partners. VASS plans to integrate the shared responsibility model into the teacher development, counseling, and outreach elements of the VA model of NMSI. Schools in the partner LEAs will integrate the shared responsibility model into their school improvement plans, particularly the math and parent and community involvement sections. The NMSI will disseminate project results to its national network and the VA state department of education, a VASS partner in the NMSI effort, will be encouraged to emphasize the strategy in its school improvement technical assistance for rural LEAs statewide. The Rural Center of Virginia and the Cooperative Extension Service will likely encourage replication of the community-led STEM events at county fairs and regional rural economic development events across the state.

B. Significance of Project

(B1) Exceptional Approach. Shared responsibility for student learning is strongly supported as a school improvement strategy (Conzemius & O’Neill, 2001; Epstein, & Associates, 2008; Linn, 2003). But implementation of such a strategy in a rural context is much less understood. The Rural Math Excel Partnership (RMEP) *approach* builds on the experiences of VASS over four years in operating the Virginia model of the NMSI in 73 schools, particularly in training AP math teachers and in tutoring students for success in AP math courses and on AP exams. Focusing on foundational math content gaps required for graduates to at least pursue postsecondary preparation for a technician-level career in STEM-related fields is critical for both students and communities in rural America. It is essential that parents and families reinforce this focus on learning essential math competencies by requiring their children to view teacher-assigned online digital videos and complete the assessments as homework.

Proposing a shared model responsibility of student support also builds on work of the ACCLAIM (2012) project funded by the National Science Foundation (NSF) that produced about 150 publications, including 23 peer-reviewed journal articles, on rural mathematics education. RMEP also uses what was learned from NSF’s investment of more than \$140 million over 15 years in 30 projects called the Rural Systemic Initiatives (Harmon & Smith, 2012). Dr. Harmon, who directed the parent and community engagement component of the six-state Appalachian Rural Systemic Initiative (ARSI), and subsequently co-authored a book based on the experience (Harmon & Dickens, 2007), will serve in a similar capacity as co-project director of the proposed RMEP project.

The RMEP approach gives parents and families a doable responsibility, rather than expecting parents from a blue-collar, rural culture with limited education and little understanding or historical need for math in the workplace, to help their children do algebra homework. As important, members of organizations in rural areas will unite to conduct educational events for students, recognizing the event will benefit students, the school, and the community (e.g., workforce). Incorporation of the free web-based Khan Academy and TED-ED instructional

videos is a unique feature of the RMEP approach that accommodates the increasing virtual learning world of students (*Technology Counts*, March 15, 2012), the limited improvement capacity of rural districts (Stephens, 1998), especially small districts (General Accounting Office, 2004), and declining financial resources where scarcity of STEM teachers already exists (Dessoiff, 2010).

(B2) Contribution to Field of Study. Rural schools serve almost 10 million students in the U.S. (Provasnik, KewalRamani, McLaughlin, Gilbertson, Herring, & Qingshu, 2007). All students must take foundational math courses. Almost all of the 30 fastest-growing occupations in the next decade will require at least some background in STEM (*Change the Equation*, 2011). Students without strong skills in foundational math courses will be unable to pursue postsecondary education, thus destined for a lifetime of low-skill, low-wage jobs, or unemployment. Students who excel in the foundational math courses are part of the solution to the undereducated American issue (Carnevale & Rose, 2011), the “hollowing out” of communities in rural America (Carr and Kefalas, 2009), the devaluing of rural public schools (Scafft & Harmon, 2010), and the successful transition of rural people and communities in the 21st Century (Brown & Schafft, 2011).

Project results will advance knowledge of how families, schools, and communities *in a rural context* can work collectively to increase student achievement in math. RMEP’s innovation could influence student aspirations (Meece, 2009); could help explain why rural high school graduates earn fewer mathematics credits than graduates of urban or suburban high schools, why rural students enter high school with a slightly lower level of mathematics and end their mathematics studies sooner than non-rural students (Anderson & Chang, 2011), and what motivates students to learn math (Hardre, Sullivan & Crowson, 2009); could underscore the importance of connecting teacher instruction to the relevance of STEM careers (Rose et al, 2012); could develop strategies for how rural counties might ensure larger proportions of their populations pursue schooling beyond high school to close the achievement gap with more urban areas (Council of Economic Advisors, 2010); and could gather insight into how parent and family

involvement influences student achievement in rural areas (Howley, Bickel & McDonough, 1997; Howley & Howley, 2010). Project results could help reveal gaps in math competencies between state standards and the Common Core State Standards noted in the National Academies report (Pellegrino & Hilton, 2012). Results might help explain why rural students who succeed in foundational math courses (i.e., Algebra I, II and Geometry) refuse to pursue advanced STEM courses, such as AP and dual-credit courses, which reinforce the diverse routes to postsecondary education and careers required in rural areas (McGrath, Swisher, Elder, & Conger, 2001).

(B3) Positive Impact of Project. VASS has achieved impressive student gains in qualifying scores (score of 3, 4 or 5) on AP exams. After two years 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 about 116% for NMSI schools. State and national averages were less than 10%. After only one year, VASS 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, about 160% compared to 92% in NMSI schools. State and national averages for AP qualifying score gains were below 10%.

In a doctoral dissertation study that examining data from the National Education Longitudinal Study (NELS) conducted from 1988 to 2000, Zelkowski (2008) found continuous enrollment in secondary mathematics education emerged as important, if not more important, than the completion of a specific secondary mathematics course for students seeking a bachelor's degree during their post-secondary education. The secondary mathematics intensity level (MIL) significantly increased the odds of bachelor degree completion. Further, Lee and McIntire (2000, as cited in Howley and Gunn, 2003) compared rural versus nonrural mathematics achievement in examining 8th grade NAEP data for 1992 and 1996 to investigate state-level variability in six

conditions of schools (including offering Algebra I in the eighth grade). Lee and McIntire reported: “*Rural students* in states where they have access to instructional support, safe/orderly climate, and collective support tend to perform better than their counterparts in states where they don't” (emphasis added. p. 171). The magnitude of correlation (of achievement) with the conditions of schooling across the 2 years changed substantially. Progressive instruction was moderately related ($r = .52$) to 1992 achievement for nonrural, but not for rural students. Among rural students in 1992, the correlation was $r = .70$, accounting for *nearly 50%* of the variance in state-level achievement, but in 1996, the correlation was a more moderate $r = .50$, accounting for 25% of the variance in state-level rural achievement (the same as for nonrural students in 1992).

Lastly, Singh and Dika (2003) used confirmatory factor analysis regression models in a study of five rural high schools in southwest Virginia and found adult social network processes explain between 13% and 15% of variance in educational and psychosocial outcomes of students, particularly for academic effort, academic orientation, and trust. Academic support is statistically significant for educational aspirations, academic effort, academic orientation, and self-concept. Emotional support is statistically significant for academic effort, academic orientation, and trust. These findings are relevant to the parent (family) and community engagement elements of the project. See *Appendix D* for table of additional research supporting impact.

C. Management Plan and Personnel

(C1) Tasks, Time Lines, and Responsibilities. Table 1 reveals the project’s management plan and shows when meetings of project staff, and the advisory leadership team (ALT) will occur and how (i.e., x=face-to-face; c=conference call or SKYPE) will be held. Thirteen persons will serve on the ALT. The team will include two math teachers (1 middle school, 1 high school); two parents of students enrolled in the middle school (1) and high schools (1); one high school student; two members of business/community-based organizations (1 from the Cooperative Extension Service), one high school counselor, two college faculty members, (1 math, 1 career/technical); one high school principal; one district superintendent from participating LEAs; and one member of the VASS Board of Directors.

VASS personnel will select the two math teachers and the principal. Each school principal will nominate a parent and student based on selection criteria provided by project leadership, who will select the two parents and student from among those nominated. The project director will select the business representative with suggestions from directors of local Chambers of Commerce and regional economic development council in the region. Superintendents of the six rural LEAs will select their representative on the leadership team. The project co-director will select the Extension Service representative or other community representative in collaboration with 4H extension personnel in the six counties.

Table 1 reveals key tasks of the external evaluation, as well as sustainability and scale-up tasks. While previous information shared *elements of sustainability* for the innovation among key partners (see **(A4) Incorporation of Project Innovation into Work of Partners**), VASS will hold a special conference in year 3 at the Southern Virginia Higher Education Center to present results of the project and stimulate support among leaders in public education, higher education, the private business sector, and community-based organizations. Leaders of all LEAs and schools statewide that have participated in the VASS NMSI project since its inception in 2008 will be invited, as will key leaders of businesses and community-based organizations, community college math and career/technical faculty, community and workforce development associations, and Cooperative Extension 4H personnel. Prior to the conference, VASS will hold a webinar to share project results and build interest in the special conference. Leaders of LEAs and schools used as comparison schools will be invited and recognized at the conference. Also, project staff will provide copies and conduct a special professional development webinar for math teachers in LEAs of the comparison schools on use of the advanced studies guide and project results. Scale-up of the shared responsibility model also will occur as VASS adds new schools to the NMSI schools.

VASS also plans to broadly disseminate project information and results at state, regional, and national conferences where topics of rural education, mathematics education or STEM education are particularly valued. The project will also submit at least two articles to peer-reviewed

education journals, submit documents to the ERIC data base, and share project activities and results at meetings of the National Math and Science Initiative.

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

Objective & Major Tasks	Responsible Party	Year 1 Jan.-Dec. 2013				Year 2 Jan.-Dec. 2014				Year 3 Jan.-Dec. 2015				Year 4 Jan.-Oct. 2016			
		q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3	q4
Announce award	Project Dir. (PD)	x															
Perform fiscal duties	Proj. Mngr. (PM)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Hold project adv. leadership team mtg.	PD, PM	x	x	x	x	c	c	x	c	c	c	x	c	c	x		
Hold project staff meeting	PD, PM	x	biweekly	c		c	c	x	c	c	c	x	c	c	x	c	
Submit USED project reports	PD	As required by USED															
Attend USED I3 meetings	PD, PM, 2 others	As required by USED															
Objective 1: To prepare all teachers of Algebra I, Algebra II, and Geometry courses in the schools to integrate Khan Academy and TED-ED videos into their lesson plans and subsequent student homework assignments.																	
Hire project math specialist	PD, PM	x															
Conduct math skills gap analysis	Math specialist	x	x														
Develop advanced studies guide	Math specialist	x	x														
Train teachers on use of guide	Math specialist			x				x				x					
Provide teachers follow-up assistance	Math specialist			x	x	x	x	x	x	x	x	x	x	x			
Objective 2: To engage the parents/family members of at least 90% of students in Algebra I, Algebra II, and Geometry courses in supporting student completion of Khan Academy and TED-ED Internet-based videos as math home work assignments.																	
Provide teachers with resources from IES What Works Clearinghouse	Math specialist			x				x				x					
Plan family math night events	Co-PD), Math specialist & school personnel			x													
Conduct family math night events	School personnel			x		x		x		x		x		x			
Provide Internet access in homes & computers if necessary	Technology specialist			x		x		x		x		x		x			
Provide parents with supportive fact sheets	School personnel			x		x		x		x		x		x			
Objective 3: To organize representatives of community-based organizations in each LEA service area (i.e., county) to conduct at least one major STEM careers event for students and their families that reinforces academic achievement in mathematics.																	
Organize community team to plan STEM careers event in county	Co-PD	x	x														
Conduct STEM careers event in county	Community Teams			x				x				x					
Objective 4. To conduct a high quality external evaluation that provides evidence of the innovation’s (i.e., shared responsibility for math excellence) implementation fidelity and feasibility as a promising practice in high need rural schools.																	
Operate project data base	PM, data specialist	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Implement evaluation plan (see Table in narrative)	SRI evaluators	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Identify comparison sites	SRI evaluators; PD,	x	x														

	Co-PD																
Develop evaluation briefs	SRI evaluators				x	x	x	x	x	x	x	x	x	x			
Develop and submit formal annual report	SRI evaluators					x				x					x		
Use ongoing evaluation results in project implementation	Proj. Leadership team				x	x	x	x	x	x	x	x	x	x			
Cooperate with technical assistance provided by USED & its contractor	SRI evaluators, Proj. staff	As requested															
Other Tasks: Sustainability & Scalability																	
Integrate model into improvement plans of schools	Math specialist, Co-PD												x	x	x		
Integrate innovation model into VA NMSI sites	PD												x	x	x		
Hold webinar on project activities and results	Co-PD															x	
Hold special RMEP conference	Co-PD																x
Solicit new partners from private and public sectors	VASS CEO/ Proj. PD									x	x	x	x	x	x	x	
Continue support for project schools	VASS staff															x	x
Conduct webinar for comparison schools on advanced studies guide	Co-PD, Math specialist															x	
Conduct special conference	Co-PD, PD																x
Other Tasks: Disseminate project results broadly																	
Present at state, regional, & national conferences	Co-PD, PD, Math specialist	At least 2 per year based on dates of appropriate conferences accepted or invited to present															
Submit articles to peer-reviewed ed journals	Co-PD									x							x
Submit documents to ERIC data base	Co-PD	As appropriate evaluation documents are available															
Share results with NMSI network	PD	Ongoing at NMSI national project meetings															
Participate in USED I3 “communities of practice”	PD, Co-PD, others as necessary	As required by USED															

(C2) Qualifications, Training and Experience of Project Personnel. Bios of key project personnel, including the evaluators, are found in Appendix F. Paul Nichols, president/CEO of VASS, will serve as the project director, committing .20 FTE time to the project. A former high school teacher, Nichols also held positions as an executive administrator in 3 VA school districts, education specialist in a VA Governor's Best Practice Center, and director of guidance and counseling in a VA high school. Nichols also has served as a director of secondary education and technology education, and director of Gifted Education & Career and Technical Education. Nichols has led the VASS, the National Math and Science Initiative (NMSI) in Virginia, since its inception in 2007. He holds a Master's degree from Longwood University.

Jennifer Stevens will serve as the project's program manager, committing .50 FTE time to the project. Stevens will perform the fiscal responsibilities, duties she has performed as CFO/program director for the \$18mil. budget of VASS, In. since its inception. Previously Stevens was a research and development specialist for the Southern Virginia Higher Education Center, director of Tech Prep and Career Placement at Danville Community College, an education specialist at the Institute for Advanced Learning and Research, and Program Administrator at Virginia Polytechnic Institute and State University, where she administered contracts with NASA and the National Institute of Aerospace to create STEM educational multimedia content and nationally broadcast television programs. She holds a Master's degree from Longwood University.

Kimley Blanks, a VASS technology & data specialist, will devote .20 FTE to fulfill technology and data tracking needs of the project. Blanks has worked for VASS the last two years, responsible for data base development and technology support to teachers. She holds an MBA in management accounting from Old Dominion University and has nine plus years of experience in accounting, and data collection and analysis.

Dr. Hobart Harmon, a national expert on public education in rural America, will devote 0.80 FTE as co-director of the project, with major responsibilities to lead the parent and community engagement features of the innovation and project dissemination efforts. Dr. Harmon previously

served as director of parent/community engagement in the six-state Appalachian Rural Systemic Initiative funded by NSF, as a state DOE official and state rural development council vice-chair, and as R&D senior manager in a regional education laboratory, where he directed the National Rural Education Specialty and ERIC Clearinghouse on Rural Education and Small Schools. Dr. Harmon serves on the editorial boards of *The Rural Educator* and the *Journal of Research in Rural Education*. He is lead author of the monograph *Legacy of the Rural Systemic Initiatives: Innovation, Leadership, Teacher Development, and Lessons Learned*. Dr. Harmon received the National Rural Education Association's *Rural Education Research Award* in 2009. He is a certified DACUM facilitator and holds a Ph.D. from Penn State University, where he is an adjunct associate professor in the Center on Rural Education and Communities.

A math specialist (1.0 FTE) with a minimum of a Master's degree, knowledge of the Virginia SOLs, and demonstrated expertise in delivering VASS NMSI teacher professional development will be employed by VASS to lead development of the advanced studies guide, train math teachers on using the guide, and provide follow-up technical assistance to the math teachers in the 14 schools.

SRI International will provide external evaluator services for the project. Raymond McGhee, Ph.D., Senior Researcher, will serve as SRI's Project Director and Co-Principal Investigator for the Rural Math Excel Partnership's project evaluation (see McGhee bio). He will participate in all aspects of the evaluation, supporting and supervising staff conducting data collection, data analysis, and reporting subtasks in both the implementation and impact studies. With key staff based in Menlo Park, California and Arlington, Virginia, SRI has extensive expertise in the design of complex evaluations, including innovative approaches to survey administration, case studies, and rigorous analysis of instructional strategies for STEM education and studies examining different types of learning outcomes. SRI has years of experience studying efforts to improve teacher quality in a number of nation-wide efforts as well as state initiatives.

D. Quality of Project Evaluation

(D1) Evaluation Methods & Goal. Objective 4 of the project is to conduct a high quality external evaluation that provides evidence of the innovation's (i.e., *shared responsibility for math excellence*) implementation fidelity and feasibility as a promising practice in high need rural schools. Therefore, the goal of the external evaluation conducted by SRI is to document project implementation and impact by collecting and analyzing quantitative data and qualitative information that addresses the project's research hypothesis, which is *math teachers, families of rural students, and community organizations can perform unique support functions that collectively enable students in Algebra I, Algebra II, and Geometry courses to acquire the foundational math knowledge and skills necessary for taking advanced high school courses as preparation for postsecondary education leading to at least technician-level STEM-related careers.*

Table 2 shows seven questions guide the external evaluation. Questions 1-3 address implementation and questions 4-7 address outcomes associated with the project's innovation. The project evaluation team will develop a variety of instrumentation and employ numerous techniques for collecting quantitative data and qualitative information to answer the questions over the time period of the project.

Evaluation and Project Logic Model. The evaluation follows the project logic model (see **section (A1b)**), which provides a conceptual framework for understanding the project's implementation, its inputs and activities, its outputs, and possible outcomes. Inputs, in the left most column, depict the global and local context of this initiative. Inputs represent resources and assets that support and lead to specific project activities that produce a variety of outputs. These outputs eventually lead to teacher, student, community, and family outcomes. These interventions (activities and outputs) will lead to the projected outcomes for the project, which are focused on students, teachers, and parents. The ultimate impact of the project is to increase the number of 10 graders prepared for advanced studies (the right most column).

Table 2. Evaluation Research Questions and Associated Data Sources

Evaluation Questions	Teacher Surveys	Student surveys	Parent Surveys	Digital Use Data	Grades & SOL exams	Focus Group Interviews	Document Analysis
1. What are the broader contextual factors of the LEAs, schools, and communities where the Rural Math Excel project is being implemented?	√		√			√	√
2. What are the different components of the Rural Math Excel project, and how are they implemented?	√	√	√	√		√	
3. What are the barriers and challenges faced in implementing the Rural Math Excel project?	√	√	√	√		√	
4. What is the impact of the teachers shared responsibility role (i.e., integrating digital video into homework assignments) on student success in course?	√	√	√	√	√	√	
5. What is the impact of the parent/family members' shared responsibility role (i.e. supporting student engagement in out-of-school mathematics learning) on student success in course and interests in advanced studies for STEM careers?	√	√	√	√	√	√	√
6. What is the impact of the community-based organizations shared responsibility role (i.e., hold community event) on student attitudes and interests in advanced studies for STEM careers?	√	√	√	√		√	√
7. What is the impact of the collective shared responsibility roles of teachers, parent/family members, and community on students' achievement on end-of-course SOL examinations and pre-registration in advanced studies courses?		√				√	√

Evaluation Design and Sampling. The evaluation design addresses the need to collect and analyze (1) formative data on the implementation of digital videos by teachers as homework assignments, parent reinforcement of such videos by the student in the home environment, and parent and student participation in a community event on STEM-related careers emphasizing mastery of mathematics, and, (2) summative data on how the shared responsibility roles of teachers, family members, and community-based organizations impact students. Surveys, focus group interviews, and document reviews are used in a mixed methods evaluation design to project implementation components (i.e., the gap analysis, development of the advanced studies guide, the delivery of professional development, and the family and community engagement activities) and to assess effects of the innovation on students.

A quasi-experimental cohort control group design will be used to compare student achievement in mathematics courses (i.e., Algebra I, Geometry, and Algebra II) between the treatment group of students and a matched sample of students in a control group. Evaluators will match each of the initiative districts with one or more (where available) Virginia rural districts that are similar in important characteristics such as eligible for the federal Rural-Low-Income Schools Program, district size, demographic composition, and prior student outcome indicators. We will match on multiple years of prior student outcome indicators to ensure that the matched districts are on the same trajectory of student outcomes before the initiative takes effect, thus increasing confidence in attributing the difference in student outcomes between treatment and comparison districts to the initiative itself, instead of pre-existing, historical factors.

The implementation study will focus on three dimensions of implementation fidelity: *adherence* (presence or absence of core program elements), *quality of program delivery* (the manner in which the program innovation is delivered), and *participant responsiveness* (the extent to which participants are engaged by and involved in the activities and content of the program innovation) (Dane and Schneider, 1998). Given that the math courses will be implemented in natural school settings, the focus on fidelity of implementation will examine the ability of the intervention to produce positive results in actual use, as opposed to in ideal

circumstances (Dorland, 1994; O'Donnell, 2008).

To evaluate *adherence*, we will combine information on the teacher's attendance at professional development and their level of training prior to the intervention, teachers reports about the degree to which they were able to integrate digital video and student support in the course over the year, and student survey data on the prevalence of digital video homework assignments. To evaluate the *quality of program delivery*, we will combine information from the teacher survey (including teacher motivation, teacher engagement, and teacher pedagogical practices) and the student survey (regarding the content and engaging quality of the digital videos for the course). In addition to examining these elements separately, we will create indexes to measure the degree of quality on these multiple dimensions. Analyses will focus on the distribution in the degree of program adherence across the participating classrooms. Finally, to evaluate *participant responsiveness*, we will examine student perceptions of relevance and rigor in completing the digital videos assigned by the teacher and related online assessments.

Evaluators will interview a sample of implementing teachers and conduct observations of the mathematics class, guided by a standard observation protocol informed by lesson planning strategies in the project's math advanced studies guide. Evaluators will analyze individual student profiles maintained in the Khan Academy digital system data base (e.g., activities completed, amount of time engaged in activity, focus of activity, exercise progress over time). Focus group interviews with a sample of parents will be held to understand their support role functions in the home, during family math nights, and in the community event. Classroom observation and teacher and parent focus group interview data collected at school sites will be analyzed to inform quality of implementation. The research team will hold a debriefing meeting after the qualitative data has been collected to discuss common themes observed on-site and to identify patterns in the data by comparing and contrasting what was learned from each site. After examining alternate explanations for the data patterns, the team will generate assertions from the qualitative data and provide illustrative examples of school conditions and classroom implementation to support the assertions.

Descriptive statistics analyzing teacher surveys will be used to quantitatively describe the challenges associated with integrating digital video into the course homework assignments, the pedagogical practices and school conditions that support implementation. Qualitative data from the observations and interviews with teachers, school leaders, and parents will help document teacher-student interactions, parent-student interactions, impasses and breakthroughs teachers and parents encounter, and mechanisms in the school and family that facilitate using digital videos.

The impact study will examine the extent to which the collective roles of teachers, parents/families, and community members (i.e., shared responsibility model) produced positive outcomes on students' success in math courses, and subsequent enrollment in STEM-related advanced studies courses, including AP and dual-credit courses.

Student Outcomes

To measure student achievement in mathematics, the team will obtain student course grades and Standards of Learning test scores results from the Virginia Department of Education linked to teachers from each participating school division. We will study all students in the initiative and comparison schools in the first two school years of the implementation. Students take the SOL mathematics assessments upon completion of the course each spring, with results available in early fall. We will conduct analyses at the individual student level to investigate how the initiative affects outcomes of students in the six participating districts. We will posit a regression model with each of the student outcomes as the outcome and initiative district identification as the predictor, adjusting for student prior outcome and demographic information. The estimated coefficient for the initiative district identification will inform on the impact of the initiative on student outcomes. Assuming 1,600 students each in the initiative and comparison schools for each math course, and assuming that baseline student achievement and student characteristics explain 50% of the variation in the student outcomes, the MDES for each student outcome analysis is 0.07.

The evaluation team will also examine how the collective roles of teachers, parents, and

community members contribute to achievement, and positive student attitudes toward mathematics and career aspirations using a pre-/post survey. At the beginning of the first mathematics class, our team will establish a baseline measure for students by having them complete a brief online survey asking them about their previous math learning experiences, their attitudes towards mathematics, and future courses they may want to take while in high school. The survey will also ask about STEM-related technician careers as well. At the end of the school year, students will be asked to complete a follow-up survey to measure how the learning delivered by digital math videos and how the shared responsibility of teachers, parents, and community members' efforts may have shaped their attitudinal and performance outcomes related to mathematics. The survey will also ask students what kind of math classes they intend to take in high school as well as what sorts of STEM-related careers they might like to pursue in the future. Quantitative outcome measures will be derived from students' response and descriptive and inferential statistical analyses will be conducted using student survey data as needed to describe the effect of the project on their attitudes, future course-taking (e.g., advanced placement or dual enrollment,) and STEM career options and aspirations.

Analysis of qualitative information collected from teachers, parents, and community members will help reveal how the individuals contributed to student success in mathematics learning, as well as how they collectively supported student learning and attitudes. Annual analyses of teacher focus group interviews will capture what teachers are doing specifically to focus students on the digital content, balance classroom and online digital video student learning activities (i.e., blended learning), and provide feedback that supports students viewing the videos as homework assignments and completion of related online assessments. Annual analyses of parent focus group will reveal extent of family engagement practices (e.g., monitoring student completion of video homework assignment, communicating with child's teacher, offering assistance to students, and discussing the various career options in the local area related to STEM). Members of the community event planning team will also be interviewed to identify how their actions and contents of the event could have shaped students' perceptions about

relevance of mathematics to STEM-related career options, and desire to pursue postsecondary education.

(D2) Sufficient Information & Reporting. SRI evaluators will produce a combination of evaluation briefs and annual reports from the synthesis of findings. Evaluation briefs (3-5 pages) such as infographics and other short reports will be designed as rapid feedback documents that highlight results of evaluation activities within 2-3 weeks after conducted. An annual report will describe in greater detail results of evaluation findings. Year one reporting will focus on identifying trends and patterns of implementation across the participating schools; implementation challenges; the levels of participation; and the extent to which teachers, parents/families, and members of community understand their role functions.

Reporting in later years will increasingly reveal fidelity of shared responsibility roles of teachers, parents/families, and the community event on student attitudes, achievement and enrollment in STEM related advanced studies courses, including AP and dual credit courses. SRI evaluators will work closely with the project leadership to ensure that reports are timely and responsive to the critical evaluation questions, to collaborate in preparation of annual reports for USED, and to support of the larger i3 program evaluation and performance reporting requirements. The evaluation team will report evidence on both short and long-term performance measures, including costs, that will reveal if the proposed shared responsibility model for supporting student excellence in mathematics (i.e., innovation) is feasible as a promising practice, therefore worthy of further efficacy testing and implementation in other rural school districts.

(D3) Resources for External Evaluation. The project is committing approximately \$460,000 to support SRI International in conducting the external evaluation (see budget narrative). This represents 17% of the total federal funds requested, or 14.7% of the \$3,123,881 total project budget.

References

ACCLAIM. (2012). Appalachian collaborative center for learning, assessment, and instruction in mathematics. See overview and publications of ACCLAIM at <https://sites.google.com/site/acclaimruralmath/Home>

Alliance for Excellent Education. (2010). *Current challenges and opportunities in preparing rural high school students for success in college and careers: What federal policymakers need to know*. Washington, DC: Author. Available at <http://www.all4ed.org/files/RuralHSReportChallengesOpps.pdf>

Anderson, R., & Chang, B. (2011). Mathematics course-taking in rural high schools. *Journal of Research in Rural Education*, 26(1). Retrieved on July 23, 2011, from <http://jrre.psu.edu/articles/26-1.pdf>.

Beaulieu, L. J., & Gibbs, R. (Eds.). (2005). *The role of education: Promoting the economic and social vitality of rural America* (pp. 6-9). A special report issued by the Southern Rural Development Center, in partnership with the USDA Economic Research Service and the Rural School and Community Trust. Available at <http://srdc.msstate.edu/publications/specialreports.htm>

Brown, D.L., & Schafft, K. A. (2011). *Rural people & communities in the 21st century: Resilience & transformation*. Cambridge CB2 1UR, UK: Polity Press.

Brown, D.L., & Swanson, L.E. (2003). *Challenges for rural American in the twenty-first century*. University Park, PA: The Pennsylvania State University Press.

- Carnevale, A. P., & Rose, S. J. (2011). *The undereducated American*. Washington, DC: Georgetown University's Center on Education and the Workforce. Retrieved on July 23, 2011 from <http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/undereducatedamerican.pdf>
- Carnevale, A. P., Smith, N., & Strohl, J. (June, 2010). *Help wanted: Projections of jobs and education requirements through 2018*. Washington, DC: Georgetown University's Center on Education and the Workforce. Available at <http://cew.georgetown.edu/JOBS2018>
- Carr, P. J., & Kefalas, M. J. (2009). *Hollowing out the middle: The rural brain drain and what it means for America*. Boston: Beacon Press.
- Change the Equation. (2011). *Why STEM?* Washington, DC: Author. Retrieved on July 23, 2011 from <http://www.changetheequation.org/why/why-stem/>
- Conzemius, A., & O'Neill, J. (2001). *Building shared responsibility for student learning*. Alexandria, VA: Association for Supervision and Curriculum Development.
- DACUM. (2012). *Developing a curriculum*. Columbus, OH: The Ohio State University, Center on Education and Training for Employment. Available at <http://www.dacumohiostate.com/index.htm>
- Dane, A. and Schneider, B. (1998). Program integrity in primary and early secondary prevention: are implementation effects out of control? *Clinical Psychology Review*, 18, 23–45.

- Dessoff, A. (June, 2010). Persuading teachers to go rural: District administrators craft incentives to attract and retain teachers. *District Administration*. Accessed on June 24, 2010 from <http://www.districtadministration.com/viewarticlepf.aspx?articleid=2431>
- Dorland, W. (1994). *Dorland's illustrated medical dictionary* (28th ed.). Philadelphia: W. B. Saunders.
- Drabenstott, M. (2010). *Past silos and smokestacks: Transforming the rural economy in the Midwest*. (Heartland Papers, Issue 2). Chicago: The Chicago Council on Global Affairs.
- Epstein, J. L., & Associates. (2008). *School, family, and community partnerships: Your handbook for action (third edition)*. Thousand Oaks, CA: Corwin Press.
- General Accounting Office. (2004). *No child left behind. Additional assistance and research on effective strategies would help small rural districts* (GAO-04-09). Washington, DC: Authors.
- Gibbs, R., Kusmin, L., & Cromartie, J. (2005). *Low-skill employment and the changing economy of rural America* (Economic Research Report No. 10, USDA). Washington, DC: U.S. Department of Agriculture.
- Hardré, P., Sullivan, D., & Crowson, H. (2009). Student characteristics and motivation in rural high schools. *Journal of Research in Rural Education*, 24(16). Retrieved May 5, 2010 from <http://jrre.psu.edu/articles/24-16.pdf>
- Harmon, H. L., & Dickens, B. H. (2007). *Creating parent and family involvement: 101 ideas for teachers who care*. Timberville, VA: PCRS.

- Harmon, H. L., & Schafft, K. A. (2009). Rural school leadership for collaborative community development. *The Rural Educator*, 30(3), 4-9.
- Harmon, H. L., & Smith, K. S. (2012). *Legacy of the Rural Systemic Initiatives: Innovation, Leadership, Teacher Development, and Lessons Learned*. Charleston, WV: Edvantia, Inc.
- Howley, A., Bickel, R., & McDonough, M. (1997). The call for parent involvement in rural communities: Mantra and mystification. *Journal of Research in Rural Education*, 13(2). Retrieved August 12, 2012 from <http://www.jrre.psu.edu/articles/v13,n2,p101-107,Howley.pdf>
- Howley, C. B., & Gunn, E. (2003). Research about mathematics achievement in the rural circumstance. *Journal of Research in Rural Education*, 18(2), 86-95. Retrieved on August 12, 2012 from <http://www.jrre.psu.edu/articles/v18,n2,p86-95,Howley,Gunn.pdf>
- Howley, C. B., & Howley, A. (2010). Poverty and school achievement in rural communities: A social-class interpretation. In K. A. Scaffit & A. Y. Jackson (Eds.). *Rural education for the twenty-first century* (pp. 150-172). University Park, PA: The Pennsylvania State University Press.
- Lee, J. (2012). College for all: Gaps between desirable and actual p-12 math achievement trajectories for college readiness. *Educational Researcher*, 41(2), 43-55.
- Lee, J., & McIntire, W. (2000). Interstate variation in the mathematics achievement of rural and nonrural students. *Journal of Research in Rural Education*. 16, 161-181. Available at

Levin, J., Manship, K., Chambers, J., Johnson, J., and Blankenship, C. (2011). *Do schools in rural and nonrural districts allocate resources differently? An analysis of spending and staffing patterns in the West Region states.* (Issues & Answers Report, REL 2011–No. 099). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory West. Retrieved from <http://ies.ed.gov/ncee/edlabs>.

Linn, R. L. (2003). Accountability: Responsibility and reasonable expectations. *Educational Researcher*, 32(7), 3-13.

McGrath, D. J., Swisher, R. R., Elder, G. H., Jr., & Conger, R. D. (2001). Breaking new ground: Diverse routes to college in rural America. *Rural Sociology*, 66(2), 244-267.

Meece, J. (2009, November). *Schooling influences on rural youths' educational aspirations.* Presentation at the Supporting Rural Schools and Communities Research Conference, Chapel Hill, NC. Retrieved July 24, 2011 from <http://www.nrcres.org/NRCRES%20Conference/Judith%20Meece/NRCRES%20Meece%20Schooling%20Influences%20on%20Aspirations.ppt>

National Science and Math Initiative. (2011). Advanced placement training and incentive programs. Retrieved on July 23, 2011 from <http://www.nationalmathandscience.org/programs/ap-training-incentive-programs>

O'Donnell, C. (2008). Defining, conceptualizing, and measuring fidelity of implementation and its relationship to outcomes in K12 curriculum intervention research. *Review of Educational Research*, 78(1), 33-84.

Pellegrino, J.W., & Hilton, M. L. (Eds). (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. Washington, DC: The National Academies Press, National Research Council of the National Academies, Committee on Defining Deeper Learning and 21st Century Skills. Available at http://books.nap.edu/catalog.php?record_id=13398#toc

President's Council of Economic Advisers. (April 2010). *Strengthening the rural economy*. Washington, DC: Executive Office of the President.

Provasnik, S., KewalRamani, A., McLaughlin, C., J., Gilbertson, L., Herring, W., & Qingshu, X. (2007). *Status of education in rural America*. NCES 2007-040. Washington, DC: National Center for Education Statistics.

Rose, R. A., Wooley, M. E., Orthner, D. K., Akos, P. T., & Jones-Sanpei, H. A. (2012). Increasing teacher use of career-related instruction: A randomized control trial of CareerStart. *Educational Evaluation and Policy Analysis* (34(3), 295-312.

Rothman, R. (July/August, 2012). Nine ways the common core will change classroom practice. *Harvard Education Letter*, 28(4), 1-2. Available at <http://www.hepg.org/hel/article/543#home>

Scafft, K. A., & Harmon, H. L. (2010). Schools and community development. In J. W. Robinson, Jr., & G. P. Green (editors). *Introduction to community development: Theory, practice, and service learning*, pp. 245-259. Thousand Oaks, CA: SAGE Publications, Inc.

Singh, K., & Dika, S. (2003). The educational effects of rural adolescents' social networks.

Journal of Research in Rural Education, 18(2), 114-128.

Stephens, E. R. (1998). *Expanding the vision: New roles for educational service agencies in*

rural school district improvement. Charleston, WV: Appalachia Educational Laboratory, The Rural Center at AEL.

Technology Counts. (2012, March 15). Virtual shift: E-learning turns toward district-level

approaches and a focus on accountability. *Education Week*, Vol. 31, No. 25.

Thompson, R. L. (2007). *Globalization and rural America*. (Chicago Fed Letter, No. 239).

Chicago: The Federal Reserve Bank of Chicago.

U.S. Department of Education. (2012). *Doing what works: Research-based education practices*

online. Washington, DC: What Works Clearinghouse. Available at <http://dww.ed.gov/> and the Institute of Education Sciences .

Zelkowski, J. S. (2008). *Important secondary mathematics enrollment factors that influence the*

completion of a bachelor's degree. Athens, OH: Unpublished doctoral dissertation of

ACCLAIM, pp. 207. Abstract retrieved on August 12, 2012 from

<https://sites.google.com/site/acclaimruralmath/Home/acclaim-doctoral-dissertations>