Project Appalachian Coders

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Appalachian Coders Project Narrative

Large numbers of young people from underserved populations, including **rural** and **low-income**, are clearly capable of high levels of achievement but are failing to do so owing to lack of access and opportunities. To ensure success from these underrepresented students, a concerted effort must be made that nurtures talent and sparks aspirations. Unfortunately, most efforts over the last three decades have focused on closing the achievement gap as measured by differences in proficiency (i.e. minimal achievement) rates among different student subgroups, with little attention given to differences between subgroups of students performing at the highest levels of achievement (Plucker, Burroughs, & Song, 2010). High achieving students from disadvantaged backgrounds, when compared to their more advantaged peers, are twice as likely to drop out of school; more likely to lose ground as they move forward in their schooling; and less likely to attend or graduate from college (Wyner, Bridgeland, & Diulio, 2008). This is harmful for individual students, who are denied the opportunity to develop their talents, and harmful to society, which fails to reap the benefits of those talents. The overall purpose of *Project Appalachian Coders* is to increase identification of and services to students with advanced academic ability (Priority 1) who live in rural and low SES communities (Priority 3), particularly in computer science (CS; Priority 2), by providing effective instruction (Priority 3). Each of these priorities as they relate to *Project Appalachian Coders* is described below.

<u>Competitive Preference Priorities</u>

Priority 1—*Identification of, and Provision of Services to, GT Students*

Although Federal law acknowledges that children with gifts and talents have unique needs that are not traditionally met in regular school settings, there are currently no specific provisions, mandates, or requirements for serving these children. Gifted education is purely a local responsibility and is dependent on local leadership, which can be a problem in high poverty schools with limited resources and competing priorities. Whereas nationwide high poverty schools are as likely as low poverty schools to have a gifted program (e.g., 68% vs 67.6%; Yaluma & Tyner, 2018), students in high poverty schools participate in gifted programs at half the rate of their low poverty school peers (e.g., 6.1% vs 12.4%; Yaluma & Tyner, 2018).

West Virginia. This disparity in services is personified in West Virginia (WV), one of the lowest ranked states in the U.S. with regards to key socioeconomic indicators, including median household income (U.S. Census Bureau's 2017 American Community Survey). Although 90.8% of WV schools have a gifted program (Yaluma & Tyner, 2018), only 1.8% of WV students are identified and served in those programs (WVDE, 2019).

Fayette County. In Fayette County WV, the overall picture is even more bleak. Only 97 or 1.34% of 3,195 K-5 students are identified and served in a gifted program (district reported data, 2019). This is a problem as participation in a gifted program is likely a driver of student success that can mediate gaps in achievement (Yaluma & Tyner, 2018).

One barrier to identification for low-income students is overly exclusive admission criteria (Peters & Mann, 2009) that rely heavily on a single test score, even when district criteria include multiple assessments (Matthews & Shaunessy, 2010). In alignment with these findings, WV uses statewide norms that require students to score in the 97th percentile rank or higher on a comprehensive test of intellectual ability (WVDE, 2018), which exacerbates existing inequities. Identification pathways for low SES students in WV allow for alternate assessments, such as teacher rating scales, however, these alternate assessments are rarely considered. Universal screening using local school-based norms would increase the number of low income students with access to GT services (Peters, Rambo-Hernandez, Makel, Matthews, & Plucker, 2019).

Lack of family advocacy is also a barrier to student identification in rural and low SES communities, particularly in Appalachia were loyalty, hard work, religion, and resistance to change are often valued over education (Wallace & Diekroger, 2000). Preliminary findings from in progress research in Fayette County (Brigandi, 2019) indicate native Appalachian parents were less likely to perceive gifted education services as valuable and less likely to pursue formal identification in comparison to non-native parents, regardless of parent education level.

Therefore, *Project Appalachian Coders* seeks to increase identification of students with gifts and talents by (a) promoting the use of alternate identification measures to support ongoing and universal screening and establishing local norms, and (c) increasing parent advocacy by providing opportunities for family engagement. Specific details are provided in Section A.

Priority 2—*Promoting STEM Education, With a Particular Focus on Computer Science*

Job opportunities in the STEM fields have grown and are expanding at a greater rate than non-STEM positions (Langdon, McKittrick, Beede, Beethika, & Doms, 2011). STEM positions as an added benefit offer workers greater earning potential and job security than non-STEM positions (NSB, 2018). Unfortunately, due to the rapidly increasing need for STEM workers and the unpreparedness of our current population to meet this need, many STEM positions go unfilled. Estimates indicate the U.S. will need to fill about 3.5 million jobs by 2025; yet as many as 2.4 million of those jobs may go unfilled due to difficulty finding people with the skills in demand (Deloitte and The National Association of Manufacturing Institute, 2018). Whereas about half of high school graduates are *interested* in pursuing a STEM career, only about 30% meet STEM college and career readiness benchmarks. These numbers are even lower for underrepresented students, including students from low-income families. Fewer than 10% of students who are low-income meet STEM college and career readiness benchmarks (ACT, 2018). Students from rural districts that struggle to teach students from lower SES backgrounds and have educators who lack support for professional learning (PL) are similarly unprepared to attend post-secondary institutions. As a result, post-secondary institutions then struggle to provide programming to bridge educational deficits for the rural and low SES students they attract (Marksbury, 2017). This is a problem, as higher education institutions are charged with creating one million more STEM professionals over the next decade, a 34% increase in undergraduate STEM degrees annually (PCAST 2012).

West Virginia. The STEM skills gap is evident in West Virginia, (particularly low SES) students' performance on math and science assessments are in the bottom third of states. On national assessments, WV 4th grade students scoring at or above proficient are below the national averages in both mathematics (35% vs. 40%) and science (33% vs. 39%). More significantly, when disaggregated by family socio-economic status, students from low SES families are significantly less likely than their higher SES peers to demonstrate proficiency in mathematics (31% vs. 52%) or science (26% vs. 50%). On a newer assessment of Technology and Engineering Learning (TEL) administered for the first time to 8th graders in 2017, marked differences in proficiency were noted based on SES (25.2% - low SES vs. 59.3% - high SES) (NCES, 2017). Students from rural and low SES communities who lack STEM skill proficiency may not think of themselves as mathematicians or computer scientists; in other words, they fail to form a STEM identity because they lack confidence in their own STEM ability.

Research supports inclusion of CS and computational thinking in the elementary school curriculum for its collateral advantages of increasing students' autonomy and collaborative problem-solving skills (Google & Gallup, 2016), higher-order thinking and reasoning skills, STEM identity and career choices (Perez, Cromley, & Kaplan, 2014). Studies of student STEM identity development identify the importance of having opportunities to develop an interest, to become competent, and to perform and be recognized for that competence (Carlone & Johnson, 2007; Hazari, Sonnert, Sadler, & Shanahan, 2010). However, despite substantial evidence supporting the value of teaching CS to elementary school students, school administrators are (

challenged to find teachers with the necessary skills, and again, schools serving low-income students disproportionately suffer (Google & Gallup, 2016; NASEM, 2015). Teachers entering the profession articulate positive intentions relative to STEM teaching, and yet express a lack of confidence about having the needed skills and experience (Kurup, Li, Powell, & Brown, 2019). High quality PL that is active and collaborative supports teacher learning and is likely to support lasting change in classroom practices and student outcomes (Desimone, 2009).

Therefore, *Project Appalachian Coders* seeks to promote evidence-based STEM education with a focus on CS by (a) providing teachers with high-quality PL that is content focused on CS to support knowledge acquisition and efficacy, and (b) increasing opportunities for students to engage in CS and computational thinking to promote CS interest and identity. Student engagement in CS includes CS curriculum in the general and GT classrooms, CS clubs, and CS enrichment clusters.

Priority 3—*Promoting Effective Instruction in Classrooms and Schools in Rural and/or High-Poverty Schools*.

Nicknamed the Mountain State, West Virginia is home to 1.8 million people. Although known for its rural beauty and tree-covered Appalachian Mountains, it is also home to some of the most economically and educationally challenged communities in the United States. West Virginians have long suffered from disparities in education and income. These disparities are often rooted in generational and rural poverty. In 2013, more than 332,000 West Virginians lived in poverty (U.S. Census Bureau, 2013), including nearly 100,000 children (West Virginia Center on Budget and Policy [WVCBP], 2013). In 2014, the Mountain State was ranked the 13th highest in terms of child poverty (WVCBP, 2014).

High-poverty. In Fayette County WV, the numbers are even more daunting. According to the WVDE, in 2018, 90% of the 6,434 students enrolled in Fayette county schools were eligible (

for Free and Reduced Price Meals (FARM), with individual school-percentages ranging between 71% and 100% (see Table 1). Consequently, all 10 Fayette County WV elementary schools exceed the established criteria for **high-poverty** as determined by section 1113(a)(5) of the ESEA, which requires only 50% of students come from low-income families.

Rurality. The majority of WV counties are designated as rural, and in fact, WV is one of few US states that does not have a city with more than 100,000 residents (West Virginia Population, 2019). Fayette County, in addition to meeting the criteria for high-poverty as determined by the ESEA, also meets the criteria for the **Rural and Low-Income School Program (RLIS)** as authorized under Title V, Part B of the ESEA. Over 27% of students enrolled in Fayette County schools live below the 20% poverty line as established by REAP.

Table 1. *Fayette County, WV schools, enrollment, and need based on FARM*

County	Elementary School	Enrollment	Free	Reduced	Needy	% Needy
Fayette	Anstead	225	219	0	219	97.4%
Fayette	Divide	229	165	0	165	72%
Fayette	Fayetteville	499	411	0	411	82.4%
Fayette	Gatewood	87	87	0	87	100%
Fayette	Gauley Bridge	152	141	0	141	92.6%
Fayette	Meadow Bridge	235	202	0	202	85.8%
Fayette	Mount Hope	343	343	0	343	100%
Fayette	New River	796	796	0	796	100%
Fayette	Rosedale	265	265	0	265	100%
Fayette	Valley	364	364	0	364	100%

Source:https://wvde.us/wp-content/uploads/2018/12/Percent_Needy_2019_CEO_Ungrouped.pdf (

Effective Instruction-evidence-based practices. *Project Appalachian Coders* takes a novel approach to intervention to increase the capacity of Fayette county schools to identify and serve students with high academic ability using a combination of interventions and practices supported by strong evidence in the current research literature as described in Priority 2. For example, PL will actively engage teachers in collaborative, intensive experiences designed to strengthen their skills and confidence in teaching CS and computational thinking, with ongoing support throughout the implementation period to facilitate the development of a community of teachers who will support student learning (Desimone, 2009). Training, training materials, and classroom resources will be provided by Code.org, a non-profit dedicated to expanding CS access in schools. Code.org training materials and classroom resources are designed to provide students with opportunities to explore new concepts and develop understandings through active engagement in collaborative, creative, personally-relevant problems solving (Curriculum Values, 2019; Michaels, Shouse, & Schweingruber, 2008; NASEM, 2017; NRC, 2013; NRC, 2007). Teachers will also participate in PL on using the Scales for Rating the Behavioral Characteristics of Superior Students [SCRBCSS] (Renzulli et al., 2010). The SCRBCSS is a standardized teacher judgement instrument that can be used to identify students with general and STEM giftedness (Priority 1), support ongoing and universal screening (Priority 1), and establish local norms (Renzulli et al., 2010). The SCRBCSS has four scales to measure general giftedness, including: (a) learning (r=.91), (b) creativity (r=.84), (c) motivation (r=.9), and (d) leadership (r=.87). Content specific STEM SCRBCSS scales include: (a) mathematics characteristics [$x^2(44) = 260.545$, RMSEA = .084, CFI = .978, TLI = .972. r=.731], (b) technology characteristics [$x^2(14) = 67.195$, RMSEA = .074, CFI = .987, TLI = .981.], and (c) science characteristics [$x^2(14) = 45.940$, RMSEA = .060, CFI = .993, TLI = .990] (Renzulli, Siegle, Reis, Gavin, & Sytsma Reed, 2009). By comparing students' percentile ranking using data from the (

SCRBCSS collected in grades 1 and 2 to their percentile ranking using data from state mastery tests in years 3-5, this project will provide new information on using the SCRBCSS to establish local norms, particularly for students in rural and low income communities. We additionally use components of Renzulli and Reis's (2014) Schoolwide Enrichment Model (SEM) and tenets of Response to Intervention (RtI), both **evidence-based** practices described in detail below.

In summary, the gaps in gifted identification and services identified by this project span all three key priority categories. We address these gaps through the following strategies:

1. (Increasing district capacity to identify, support, and serve high ability and high potential students through (a) continuing PL that supports ongoing universal screening, and (b) creating collaboration opportunities between school and home to increase family advocacy.
2. (Increasing district capacity to support (STEM) education, with a particular focus on CS by (a) providing educators with PL, materials, and resources supported by Code.org, to design and implement appropriately challenging CS lessons to general and GT students, and (b) increasing student access to CS through CS enrichment clusters and clubs.
3. (Increasing district capacity to provide effective instruction in rural and high poverty schools by using a modified RtI system designed to support high achieving students in conjunction with components of the SEM (Renzulli & Reis, 2014).

A. Project Design

Through *Project Appalachian Coders*, we seek to enhance instruction, collaboration, and assessment related to increased student participation in gifted education, achievement in math and science, interest in CS, and identity perceptions of students as computer scientists, particularly for students who live in **rural** and **low-income** households. The focus is on building teacher instructional capacity in core CS practices—including computational thinking, increasing collaboration between stakeholders, and increasing student exposure to CS through a multitiered system that supports advanced achievement.

Our approach to intervention builds on the tenets of RtI and Renzulli and Reis's (2014) SEM, an **evidence-based model** of gifted education (strong evidence of promise [WWC] provided in part 4). RtI is a multitiered system of support that uses **evidence-based decision making** to identify at-risk students before they fail and prescribe interventions to promote their success (strong evidence of promise [WWC] provided in part 4). Incorporated components of RtI include (a) high-quality and scientifically based classroom instruction, (b) collaboration, and (c) ongoing student assessment. Whereas RtI provides a framework to support students who are not achieving, we propose a similarly structured multitiered system to support advancement in students who are achieving (Coleman & Johnson, 2011; Fisher & Sloan, 2010).

We additionally overlay this multitiered system of supports with the SEM (Renzulli & Reis, 2014), a popular gifted education model widely implemented to meet the needs of GT students (VanTassel-Baska, 2005), and to provide advanced learning experiences for all students. The SEM is also one of few GT models specifically recommended for use with **rural populations** (Lewis, 2015). Components of the SEM included in this study are Enrichment Clusters and Type I, Type II, and Type III Enrichment (i.e., *The Enrichment Triad,* Renzulli, 1977). Enrichment Clusters extend components of gifted education to all students by providing them with opportunities to acquire advanced-level understanding of the knowledge and methodology used within particular disciplines, in this case, CS. Type I Enrichment activities are general exploratory activities designed to spark student interest. Type II Enrichment activities provide cognitive and affect training and let students practice skills and acquire knowledge. Type III Enrichment activities, which are often the result of an interest sparked through student participation in a general exploratory activity (i.e., Type I), involves students who become interested in pursuing a self-selected topic through individual or small group investigation. We (

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describe the proposed multitiered system of supports as follows (see Figure 1): (

Tier 1: Whole School

Tier 1 targets whole school improvement with regard to teacher and student awareness of and exposure to CS (i.e., Type I) and identification of STEM giftedness. First, all teachers will participate in evidence-based PL in CS practices (see *letter of support*). Teachers will then implement CS curriculum into their regular classrooms at various times throughout the school year to spark student interest. Subsequently, all students will receive high-quality scientifically based CS instruction provided by trained personnel (Priorities 2 & 3). Additionally, students, teachers, and students' families will have the opportunity to participate in Hour of Code, a one-hour introduction to CS designed to demystify coding and broaden participation in CS. Students whose interest is sparked by these Type I activities (i.e., exposure to CS in the regular classroom and Hour of Code) and who subsequently want to learn more, may elect to participate in Tier 2 interventions that focus specifically on CS skill development (i.e., Type II Enrichment). Additionally, teachers will be taught to use the SCRBCSS (Renzulli et al., 2010) to identify students with general and STEM giftedness (Priority 1), support ongoing and universal screening (Priority 1), and establish local norms (Renzulli et al., 2010).

Tier 2: Small Group Instruction

In Tier 2, the frequency and duration of student exposure to CS is increased, as is the level of training of the professionals providing instruction. In addition to receiving CS instruction in the general curriculum, students who express an interest in CS or score high on the SCRBCSS relative to their peers will also optionally participate in small group extracurricular enrichment clubs and clusters (Renzulli & Reis, 2014) with more intensive instruction (i.e., Type II's). In this way, Tier 2 is designed not to mediate poor achievement, but to encourage high achievement. Students who show exceptional progress at this level of intervention or are (

measured highly by teacher ratings on the SCRBCSS will then be considered for more intensive interventions in Tier 3, which includes formal **identification** as GT (Priority 1) using local norms. Teachers facilitating enrichment clusters and clubs will participate in a professional learning community (PLC) to foster collaborative learning and organize teacher's CS instruction.

Tier 3: The Gifted Education Classroom

Few GT students excel in all academic areas at all times (Renzulli & Reis, 2014). Rather, some students display different talents at different times and in different areas. Additionally, GT identification should align with school programming. Tier 3 is novel in that it approaches identification of students as GT with a specific focus on CS aptitude. This talent is then nurtured through a variety of CS interventions in Tiers 1 and 2, and students who display exceptional CS talent in Tiers 1 and 2 using local norms as established by the SCRBCSS and school level WV General Summative Assessment data will then be recommended for participation in Tier 3.

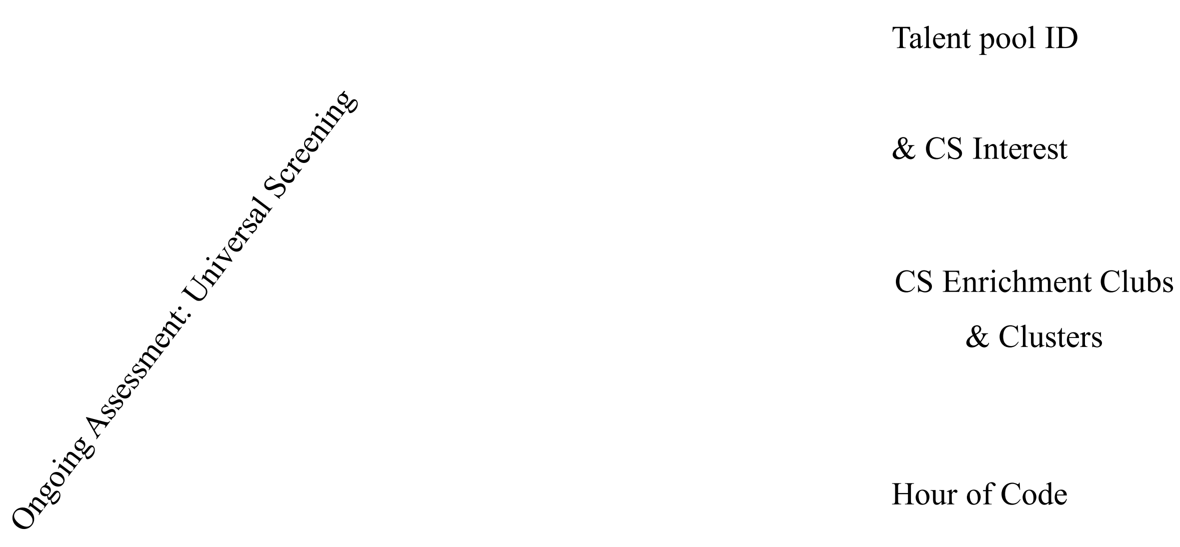

Figure 1: A model for developing whole school, talent pool, and gifted students' CS talent

Across the 5 years, *Project Appalachian Coders* will engage teachers, students, parents (

and families in Fayette County WV, a rural district that serves a large population of students from low SES families and has agreed to participate in this research (see *letter of support*), in interventions designed to support whole school improvement with specific foci on **CS instruction** and **gifted identification**. We use a scale up design engaging three elementary schools with grade level student cohorts serving as treatment and control groups. New River Elementary (NR), with a student population of almost 800 students, enters the project in Year 1 as the pilot and primary school. Table 2 illustrates all activities taking place at New River. Divide Elementary enters the project in Year 2 and doing the same activities as New River on a one year delay, and Ansted Elementary enters the project in Year 3 doing the same activities as New River on a two year delay. The activities in each school support objectives in two categories, (a) increasing CS competency for students schoolwide and serving students in Tier 2 and Tier 3 with more targeted interventions, and (b) increasing the number of identified students served in GT programming by increasing students being nominated (see Table 2). We will accomplish these objectives by increasing: (1) high quality instruction, (2) collaboration, (3) assessment of student outcomes, and (4) dissemination. More detail is provided below.

Project Goals, Objectives, and Outcomes

(1) The extent to which the goals, objectives, and outcomes to be achieved by the proposed project are clearly specified and measurable. In compliance with selection criteria for this competition from 34 CFR 75.210, the specific goals, objectives, and intended project outcomes for *Project Appalachian Coders* are clearly specified below, as are processes for measuring those outcomes. Our goals are adapted from overarching objectives of the RtI Framework and include: (1) high quality CS instruction across all Tiers, (2) increased collaboration, (3) assessment of student outcomes, including increased GT ID, self-efficacy, identity, and interest, and (4) dissemination of information.

Table 2. Project Activities

	Year 1	Year 2	Year 3	Year 4	Year 5
Goal 1: High Quality Instruction					
Training for General Education	CS Fundamentals				
Teachers	SCRBCSS				
		PLC			
		Differentiation & Flexible Grouping			
Training for GT Teachers	Foundations	Express	Discovery		
Nomination	Ongoing-previous year for following year				
Interventions	Tier 1				
		Tier 2			
			Tier 3		
Teacher Scales	Validation	All participating teachers			
Goal 2: Collaboration					
Hour of Code	Whole School				
Enrichment Fair			Whole School		
Goal 3: Student Outcomes					
SCRBCSS	1^{st} grade	1^{st} & 2^{nd} grade			
WVGSA Scores	3^{rd} grade	3^{rd} & 4^{th}	3^{rd}, 4^{th}, & 5^{th} grade		
CS Identity & CS Interest	Validation	All students			
Nomination	Ongoing-previous year for following year				
Goal 4: Dissemination	PLCs, family and stakeholder presentations, conference papers, manuscripts				

Note: The above figure illustrates the activities at New River Elementary School. Divide Elementary

Goal 1: High-Quality Instruction: To promote teacher and district capacity to engage general and advanced level students in rigorous evidenc-based coursework in CS through engagement in PL and the provision of materials, curriculum, and tutorials.

Objective 1a. Expand student access to rigorous evidence-based coursework in CS by supporting teacher learning in CS for use in general and GT classrooms. (Tier 1)

Objective 1b. Expand general and GT student participation in rigorous evidence-based coursework in CS by increasing districtwide CS enrichment activities. (Tier 2)

Objective 1c. Expand access to rigorous evidence-based coursework in CS by supporting general and GT teachers' learning in gifted education pedagogy. (Tier 2 & 3)

To accomplish these objectives, we have multiple activities (see Figure 2). Namely, teachers will participate in PL related to CS, gifted identification and differentiation, and professional learning communities (PLC). In addition, the gifted teachers will receive additional training in CS via Code.org. Both GT teachers already have extensive training in Type I, Type II, & Type III Enrichment (Renzulli, 1977), and one even attended Confratute last summer. Confratute is a weeklong conference in gifted education held annually.

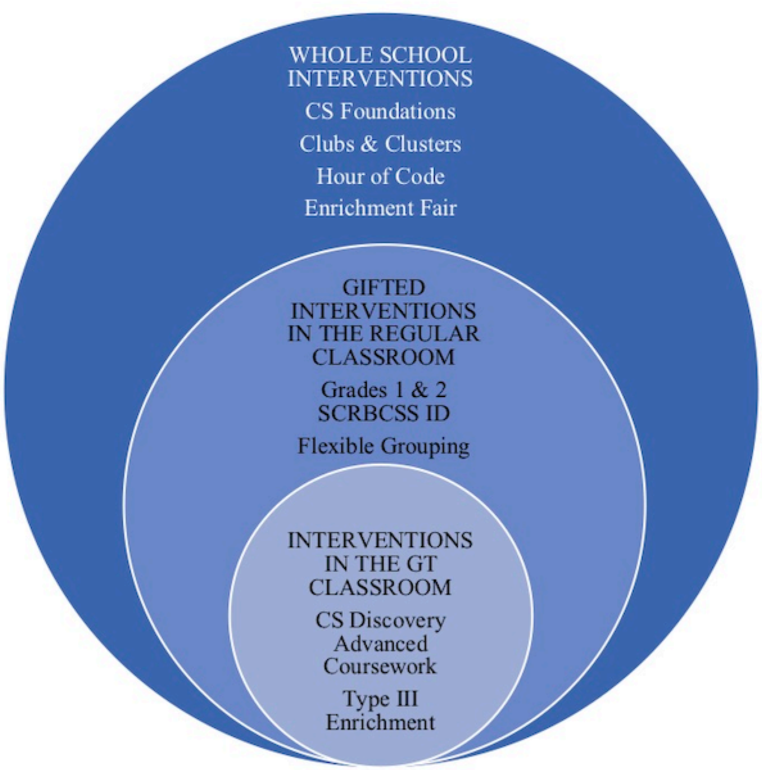

Figure 2: Spheres of supports

The interventions will be rolled out with Tier 1 (whole school) activities in year 1 for New River. Tier 2 interventions (

at the classroom level will occur in year 2, and the targeted interventions for identified gifted students will begin in year 3 (the other schools will follow suit in subsequent years with Divide starting a year behind New River and Ansted starting two years behind New River).

Intended Outcomes: General and gifted education teachers will provide rigorous, evidence-based, and well-developed CS experiences for students as demonstrated through (a) pre and post assessment of general and gifted education teachers self-efficacy for teaching CS content, including before and after PL, and then again after lesson inclusion using subscales adapted for teaching computer coding from the Mathematics Teaching Efficacy Beliefs Instrument (Enochs, Smith, & Huinker, 2010) and, (b) pre and post assessment of general and gifted education teachers efficacy to differentiate learning experiences for general and high ability students, including before and after PL, and then again after lesson inclusion using adapted self-efficacy subscales from the Teacher Attitudes toward Subject-Specific Acceleration instrument (Rambo & McCoach, 2012), (c) self-report, (d) submission of lesson plans, and (e) scores on classroom observation instruments. Indicators of rigorous and well-developed CS experiences will include evidence of teaching CS concepts, such as algorithms and loops, CS skills, such as coding, and use of evidence-based CS materials. For example, teachers might implement one or more of 15 CS lessons included in the schoolwide PL provided by Code.org. Gifted teachers will additionally be responsive to the advanced abilities of identified students as evidenced by accelerated CS experiences using above grade level curriculum and the use of advanced problem-solving, critical-thinking, and decision-making skills (i.e., Type II). To increase student exposure, Fayette County Schools and *Project Appalachian Coders* will also provide a variety of CS extracurricular enrichment activities for students, including in-school coding clubs and after school enrichment clusters at each of the district elementary schools. Extracurricular enrichment activities will be facilitated by teachers with CS training and who will receive a related stipend.

As the overall intent is to expand student access and exposure to CS, success will be measured by the number of students who elect to participate in CS enrichment activities.

Goal 2: Collaboration: To build collaborative systems that include teachers, students, and students' families, particularly to support CS awareness.

Objective 2a. To increase educator, student, and family awareness of computer science.

Objective 2b. To cultivate relationships among teachers, students, and students' families.

Intended Outcomes. Teachers will participate in PL described in high quality instruction above. The intended outcome is that teachers will include more content related to CS after participation in PL than prior to attending PL, indicating increased CS awareness and subsequently encouraging increased student CS awareness. Teachers, students, and students' families will attend communal CS events such *Hour of Code* and an annual year end *Project Appalachian Coders* enrichment fair also for the purpose of supporting both increased CS awareness and collaboration between school and home.

Success will be measured by (a) the number of teacher participants in yearly PL opportunities, (b) the frequency and duration of integration of CS activities into regular education classes, enrichment opportunities for talent pool students in regular classes, and tailored CS activities for identified gifted students, (c) greater student participation and increased parent attendance at the annual year end community event over the course of the grant. Collaboration will be measured by the number of participants—students, family members, and teachers— who engage in CS activities. The intended outcome is that more teachers, family members, and students will attend CS enrichment events over time, thus organically increasing both CS awareness and collaboration.

Goal 3: Assessment: Ongoing assessment for progress monitoring changes in student achievement, identification as GT, CS identity development, and CS interest.

Objective 3a. Increase student scores on state tests in math and science.

Objective 3b. Increase the number of students recommended for identification as gifted via SCRBCSS, local norms, and interest.

Objective 3c: Support increased student interest in CS and identity development as computer scientists.

Intended Outcome: To enhance student achievement in math and science schoolwide through instructional practices that emphasize CS, including coding, for all students as well as students with gifts and talents, and to increase the number of students who go through the Student Assessment Team (SAT) process for formal identification as GT, particularly low SES students.

To assess Objective 3a, we plan to model student achievement scores using hierarchical linear modeling (see equation 1) with students nested at level 1 within classrooms at level 2. Specifically, y_{ij} is the student achievement score on the West Virginia General Summative Assessment (WVGSA), a vertically scaled achievement test given to all students in public schools in West Virginia. Because the assessment is vertically scaled, comparisons can be made across grades and across years and allow assessments of growth. We will collect data from a cohort of students at each school prior to the interventions being implemented (e.g., third through fifth grade students at NR in year 2). In this comparison cohort, we will collect data on whether the student was identified for gifted services and also use the same techniques (SCRBCSS and local norms) to identify comparison students who would have been identified for the talent pool but were not served.

The student's achievement score will be predicted from the student pretest score and whether the student was identified for gifted services and was (or would have been in the comparison) identified for the talent pool. To assess whether the intervention impacted student scores, we will estimate the impact of the intervention ($\gamma_{02}, \gamma_{22}, \gamma_{32}$) on the intercept ($\beta_{0j}$), the effect of being in the talent pool (β_{2j}), or the effect of being identified gifted (β_{3j}). Statistically significant positive effects ($\gamma_{02}, \gamma_{22}, \gamma_{32}$) will indicate students who received the intervention scored higher on the achievement test than students who were in the comparison (controlling for grade and pretest score).

$$y_{ij}= \beta_{0j}+ \beta_{1j}(pretest\ score)+ \beta_{2j}(talent\ pool)+ \beta_{3j}(gifted)+ e_{ij} \quad (1)$$

$$\beta_{0j}= \gamma_{00}+ \gamma_{01}(grade) + \gamma_{02}(intervention) + u_{0j}$$

$$\beta_{1j}= \gamma_{10}+ \gamma_{11}(intervention)+ u_{1j}$$

$$\beta_{2j}= \gamma_{20}+ \gamma_{22}(intervention) + u_{2j}$$

$$\beta_{3j}= \gamma_{30}+ \gamma_{32}(intervention) + u_{3j}$$

Assuming an ICC of 0.25 and the pretest covariate explains 50% of the variability in the dependent variable, a minimum of 32 classes are needed to detect a medium effect of the classroom level intervention. Given NR has approximately 10 classes per grade level, we are adequately powered.

For objective 3b, students will be nominated for gifted services in multiple new ways that incorporate the best practices of local norms and universal screenings. We employ a quasi-experimental design with lagged cohorts. Data will be collected on a comparison cohort before the implementation of interventions. These data will be compared to future cohorts matched by grade and school to determine the effect of the planned interventions. In grades 1 and 2, all students will be screened using the SRBCSS, which has been shown to help more students be identified for gifted services than traditional nomination systems (Perrone & Chen, 1982) and can be used with younger populations. Students with the highest scores will be clustered in classrooms and served by teachers receiving additional training in differentiation strategies and flexible grouping (Tier 2) and nominated for gifted services (Tier 3). When entering grades 3 through 5, top students (~15%) on each disciplinary WVGSA test (i.e., local norms) will be (

nominated for inclusion in a trained teacher's classroom (Tier 2) and for gifted services (Tier 3). To determine if more students are being nominated after the interventions, we will compare the number of students nominated at each grade level prior to the interventions to the number of students nominated after the intervention using chi-square difference tests. We will further examine if differences exist by grade if the sample size is sufficient for such comparisons.

Finally, to assess the impact of the intervention on student interest in CS and student CS identity, we will use hierarchical linear modeling with students nested within classrooms to assess the impact of the interventions. Prior to the analyses, we will test the validity of the modified instruments (Science Identity, Chemers et al., 2010, adapted to CS Identity; Attitudes toward Computer Science- Interest Subscale, Hoegh & Moskal, 2009, adapted for elementary students) using the current AERA, APA, and NCME recommendations (2014). After we will compare the effect of the intervention in the same way we conducted the analyses for Objective 3a. Of note, there are multiple interventions (whole school interventions, enrichment clusters), so the models for Objective 3a and 3c will be run multiple times to assess the impact of the specific interventions but are omitted here for brevity.

Goal 4: Dissemination: To disseminate project resources for PL and replication

Objective 4a. To disseminate project activities and findings through presentations and journal publications for various audiences, including researchers and practitioners.

Intended Outcome: To promote the use of research findings for the success and sustainability of practice-based research across networks in the long term. To accomplish these tasks, we will address multiple audiences in the dissemination plan. First, we will disseminate results to the community through short presentations at the Hour of Code events on each campus. Next, we will disseminate results to the teachers through the PLCs. Finally, we will disseminate results through multiple conferences (e.g., National Association of Gifted Children, American

Educational Research Association) and appropriate journals both in and outside of gifted education (e.g., *Gifted Child Quarterly, Computer Science Education*).

(2) The extent to which the design of the proposed project is appropriate to, and will successfully address, the needs of the target population or other identified needs. *Project Appalachian Coders* takes an innovative approach to systematically building school capacity in one rural and low SES school district to (a) increase identification of and services to GT students (i.e., Priority 1), (b) promote STEM education with a particular focus on CS (i.e., Priority 2), and (c) promote effective instruction in classrooms and schools (i.e., Priority 3). To do this, we seek to implement interventions grounded in evidence-based practices (e.g., RtI and the SEM [Renzulli & Reis, 2014]) to mitigate the effects of **poverty** and **rurality** for all children, including those with gifts and talents.

Poverty. Reducing the effects of poverty is an identified need. Over the past several decades, research on achievement gaps have indicated both periods of progress and stagnation (Barton & Coley, 2010). On the positive side, although persistent, findings from the National Assessment of Education Progress' Long-trend Assessment (NCES, 2013) indicate a narrowing in racial, ethnic and gender achievement gaps over the last four decades. On the other hand, the gap in achievement between children from high and low income families has been steadily increasing over the past 25 years (Reardon, 2011). Growing up poor has been linked to myriad negative outcomes that limit employment and earnings in adulthood. Children growing up in poor families have higher levels of social and emotional problems, higher levels of academic difficulties, and lower levels of proficiency (Wilson-Simmons, 2015). These difficulties may be more linked to **inequality of opportunity** than ability. Higher income families have more money to spend supplementing their children's education, such as providing private lessons, club memberships, and camps. Parents in higher income families are also more likely to have time to volunteer in schools, read to their children, provide regular homework help, provide transportation to and from events, and have college expectations (Putnam, 2015). Far too often, children from low income families are denied **advanced educational opportunities** regularly provided to their more economically advantaged peers (Peters & Mann, 2009). To address these inequities, *Project Appalachian Coders* will provide K-5 students in three Fayette County WV schools with access to rigorous instruction and enrichment activities commonly available to their higher SES peers. To support CS rigor, WVCode, the local partner for Code.org, a nonprofit dedicated to expanding CS access in schools at NO COST through the support of generous donors such as Amazon and Google, will provide Fayette County educators with PL, materials, and resources (see *letter of support*) as follows:

A). All Fayette county teachers will attend a 1-day PL in CS Fundamentals, a program that teaches educators to support computational thinking, problem solving, programming concepts, and digital citizenship optimized for students in grades K-5.

B). All GT teachers will also participate in CS Express, an online, self-paced PL course that covers core concepts from the CS Fundamentals from an accelerated pace for students age 9-11;

C). All GT teachers will attend CS Discoveries, a PL that provides 50-150 hours of curriculum for students in grades 6-10. CS Discoveries is a year-long program with a 1-week summer workshop, 24 hours of follow up workshops, and online support through a teacher forum.

To support increased access to enrichment opportunities, *Project Appalachian Coders* will support in-school CS clubs and after school enrichment clusters for all students in three Fayette County Elementary Schools. In summary, *Project Appalachian Coders* seeks to mitigate the effects of poverty by expanding student access to opportunities and increasing district capacity to provide rigorous coursework and enrichment opportunities not typically available.

Rurality. Supporting achievement in students who live in rural communities is an identified need. Rural children are more likely to live in poverty than their urban or suburban peers with almost 25% of rural children living in families with income levels below the federal poverty level (United States Department of Agriculture Economic Research Service [USDA ERS], 2015). Of the 46 counties in the U.S. identified as having child poverty rates of 50% or higher in 2011-2015, 41 (89%) were designated rural, as were 558 of the 708 (79%) persistent poverty counties (USDA ERS, 2015). Not only is the average family income lowest for rural students, but income in rural areas has been declining over the past 5 years. Furthermore, children in rural areas are more likely to experience the effects of generational poverty, which is where one generation lacking economic and social capital needed for development raises the next (Smith, Beaulieu, & Seraphine, 1995). Parents who themselves lack education often do not have the knowledge needed to help their children successfully navigate the higher education process and often discourage children from pursuing advanced education (Wallace & Diekroger, 2000). As a result, children growing up in generational poverty may not believe that they have the capacity to create change. In other words, they lack **self-efficacy**.

To address these inequities, *Project Appalachian Coders* will support increased family capacity through communal events such as Hour of Code and an Enrichment Fair. These events will support the development of collaborative relationships between Fayette County teachers, students, and students' families. In summary, this *Project* will create a school-home connection to build collaborative partnerships that support students' academic and emotional needs.

(3) The extent to which the proposed project represents an exceptional approach for meeting statutory purposes and requirements.

1. (*Project Appalachian Coders* proposes universal screening for all students using an evidence-based instrument, and the selected programming is designed for use by all students with accelerated programming and instructional practices for high ability students in general and

the GT classroom.

2. (The proposed programs will be continuously evaluated, including teachers' evolving skills, knowledge and use of CS lessons in the classroom; students' participation, engagement, and learning in CS; family involvement and changing perceptions of CS and GT programming; and changes in student identification for and participation in GT programs.
3. (All teachers in the selected rural, low income elementary schools will participate in PL described in Project Activities above to enhance their abilities to engage students in CS lessons using the Code.org curriculum across all grades in all participating schools.
4. (*Project Appalachian Coders* aims to (a, b) increase identification and participation of students in gifted programs through a diverse set of innovative approaches by: generating broad community interest in CS and increasing acceptance and understanding of the concepts of gifted education through activities such as *Hour of Code* and the *Project Appalachian Coders* enrichment fair; allowing all students to gain interest and competence in CS through regular classroom inclusion of CS lessons and in-school and after-school clubs and clusters; and increasing teacher capacity to identify GT students through use of the SCRBCSS.

   (c) Teachers of all students in the three rural, low income elementary schools will be supported in the continued implementation of the CS program through initial PL and ongoing PLCs designed to encourage dissemination of information, engagement, and opportunities to address challenges.

   (d) Participating teachers will be trained to use the SCRBCSS as an alternate process to expand identification of students as GT. All teachers will receive training to implement appropriate grade-level CS lessons to all students, and treatment teachers will additionally receive PL in differentiated instruction for high ability learners. GT teachers will also receive PL in accelerated and above grade level CS lessons to better challenge identified students in the GT classroom. All students as well as GT students will benefit from interventions.

(4) The extent to which the proposed project is supported by promising evidence. Each of the proposed models, frameworks, and instruments have been previously described above, including RtI and the SEM (Renzulli & Reis, 2014). Here we provide the evidence that supports using each to realize the goals, objectives, and outcomes of the project.

Response to Intervention (RtI): Introduced within the 2004 reauthorization of the Individuals with Disabilities Act (IDEA), when implemented with fidelity, RtI improves instructional quality and increases students' chance of school success (McInerney & Elledge, 2013). For many districts, the multitiered RtI framework not only provides support for struggling students, but is additionally reshaping general education (Fuchs, Fuchs, & Compton, 2012) and gifted education (Coleman & Johnson, 2011; Fisher & Sloan, 2010). *Project Appalachian Coders* will provide new information on using RtI systems to plan, conduct, and improve programs to identify and serve GT students, specifically those in rural and low income communities.

The Schoolwide Enrichment Model. Research supports the use of the SEM as a curricular framework (Reis, Gentry, & Maxfield, 1998; Reis & Fogarty, 2006) that positively affects student interests (Westberg, 2010), postsecondary school plans (Hébert, 1993), career choices (Delcourt, 1993), goal valuation (Brigandi, Siegle, Weiner, Gubbins, & Little, 2016), environmental perceptions (Brigandi, Weiner, Siegle, Gubbins, & Little, 2018), levels of self-efficacy (Schack, Starko, & Burns, 1991), self-regulation (Brigandi et al., 2018; Hébert, 1993), student attitudes toward learning (Olenchak,1988) and parent, teacher, and administrator attitude toward education for high ability students (Olenchak & Renzulli, 1989). Emerick (1988) and Baum, Renzulli, and Hébert (1999) also found that various components of the SEM, including Type I's and Type III's, successfully reversed academic underachievement in some students.

Anecdotally, Lewis (2015) recommended the SEM as one of few gifted education models with the potential to address the unique needs of gifted students who attend rural schools. This project will provide new information on using the SEM to improve programs for GT students in rural and low income communities.

(5) The extent to which performance feedback and continuous improvement are integral to the design of the proposed project. The progress of this study will be continuously monitored and evaluated allowing for continuous improvements and modifications. Pre- and post-surveys will be administered to teachers experiencing PL; classrooms will be observed and data collected on the implementation of CS classroom lessons and informal activities; pre- and post-surveys will be administered to family members participating in school-wide activities; and student participation and engagement will be evaluated annually. Results of ongoing evaluation will be used to refine program implementation to ensure program goals are met.

B. Project Personnel

The *Project Appalachian Coders* management team brings together experienced faculty members with years of experience and a breadth and depth of knowledge necessary for supporting students on their academic journeys. Their qualifications, including relevant training and experience, are outlined below. Responsibilities are included in section C.

Senior Personnel

Dr. Carla B. Brigandi will serve as the Principal Investigator and Project Director. She is a fifth -year tenure track Assistant Professor in the Department of Learning Sciences and Human Development at West Virginia University, a Tier 1 Research institution. She earned her Ph.D. in Educational Psychology with focus on Gifted Education and Talent Development from the University of Connecticut in 2015. As a graduate assistant for Dr. Joseph Renzulli, Dr. Brigandi worked on a Templeton Foundation grant ($175,000) to examine processes that support (

student imagination, creativity, and innovation in schools. She was PI on an American Educational Research Association (AERA; $5000) to mine existing data collected by a collaborative partnership between West Virginia's Land Grant Universities and 26 Local Education Agencies (LEA's), primarily from students living in rural and low SES homes, and two internal research grants (WVU; $5,500; $2,000). Dr. Brigandi has multiple publications on gifted education in high impact journals such as *Gifted Child Quarterly*, the *Journal of Educational Research*, and *Journal of Advanced Academics*. She additionally travels nationally and internationally providing invited keynotes and professional learning on a variety of topics related to gifted education and talent development.

Dr. Karen Rambo-Hernandez will serve as an Investigator on the project. Using advanced quantitative methods, her research focuses on the assessment of educational interventions to improve STEM education, and access for all students— particularly high achieving and underrepresented students— to high quality education. Dr. Rambo-Hernandez has a long track record in engineering and computer science education and in gifted education. She is currently PI at WVU on the NSF-DUE IUSE Award #: 1725880, *Collaborative Research: Cultivating Inclusive Identities of Engineers and Computer Scientists: Expanding Efforts to Infuse Inclusive Excellence in Undergraduate Curricula*. 07/1/2017 to 06/30/2022, $1,910,000 total/ $752,668 to WVU. Because of this funding and prior NSF funding (NSF-DUE IUSE: 1432601 *[EI]^2-Exploring Inclusive Engineering Identities*. Co-PI. 2014-2017, $200,000; NSF-RIGEE Award number: 1137023 *Research Initiation Grant: Problem/Project-Based Learning in Statics, a Stepping Stone to Engineering Education Research.* Co-PI. 2011-2014, $150,000), she and her team have two research awards related to this line of research (*Best Paper Award* in First-Year Programs Division and *First Place Paper in Best Diversity Paper Competition* at 2015 American Society for Engineering Education [ASEE] Annual Conference) and have (

thirteen engineering education research products resulting from the funded work, including publications in the flagship *Journal of Engineering Education* and the *European Journal of Engineering Education*. Dr. Rambo-Hernandez also has accumulated multiple publications in gifted education in high impact journals such as *Gifted Child Quarterly*, the *Journal of Educational Research*, and *AERA Open*. She has also received funding from the American Psychological Foundation ($25,000) and American Educational Research Association (AERA; $5,000) to support her work with high achieving students.

Dr. Nancy Spillane will serve as an Investigator on the project. Dr. Spillane currently serves as an Associate Clinical Professor in the Center for Excellence in STEM Education and a Master Teacher in the WVUteach Program at West Virginia University, preparing pre-service mathematics and science teachers for careers in inquiry-based and project-based STEM classrooms and facilitating partnerships with local schools. She received her Ed.D. in Curriculum and Instruction with particular focus on inclusive STEM schools and STEM teacher professional development from George Washington University. As a graduate student, she worked on a $3,131,900 NSF grant to study teachers and teacher professional development in successful inclusive STEM high schools. She currently is Co-PI on a $1,199,999 NOYCE research grant to understand how the inclusion of a micromessaging curriculum for pre-service STEM teachers influences their evolving understandings of and classroom practices relative to equity and diversity, and a $135,160 EPA grant to deliver and evaluate the effects of a curriculum on water quality on changes in participants' understanding of factors affecting water quality, participation in actions related to water quality, and engagement in citizen science activities.

Consulting and Contractual Support

Dr. E. Jean Gubbins will serve as an Advisory Board Member. E. Jean Gubbins, PhD is Professor in the Department of Educational Psychology at the University of Connecticut.

Currently, she is the Associate Director and co-Principal Investigator of the National Center for Research on Gifted Education. She is involved in implementing initial, multi-year studies (2014-2019) focusing on exemplary practices in identification and programming for gifted and talented students as well as identification practices of gifted and talented English learners. Dr. Gubbins is also Principal Investigator working with math, research, and evaluation specialists at the University of Connecticut to implement a grant funded by the United States Department of Education, Javits Gifted and Talented Students Education Program. The new curriculum and research project is entitled *Thinking Like Mathematicians: Challenging All Grade 3 Students*. Previously, she implemented quantitative and qualitative research studies with a focus on STEM education through grant funding from the United States Department of Education for The National Research Center on the Gifted and Talented (NRC/GT, 1990-2013).

Dr. Melissa J. Luna will serve as an Advisory Board Member. Dr. Luna is the associate dean for research and an associate professor of science education in the College of Education and Human Services at West Virginia University. She holds a Ph.D. in Learning Sciences from Northwestern University. She is a learning scientist situated in teacher education whose research examines STEM teaching and learning in the elementary grades in both formal and informal learning contexts. Dr. Luna is the PI on an NSF CAREER award investigating elementary teachers' noticing of students' thinking while engaging in the practices of science and engineering in STEM learning contexts. This project takes place in semi-rural and rural Appalachian schools and includes investigating evidence-based STEM teaching practices. Dr. Luna's expertise also involves knowledge of and experience around the design of effective professional development for teachers surrounding STEM teaching and learning, including supporting teachers in bringing computer science experiences into the elementary classroom.

Dr. Afrin Naz will serve as an Advisory Board Member. Dr. Naz is an Associate (

Professor at the Computer Science and Information Systems department at West Virginia Institute of Technology. She received her PhD degree in Computer Science from the University of North Texas. She is also serving as the Regional Co-director of WVU Center for Excellence in STEM Education. Dr. Naz is the Google Ambassador in West Virginia and arranged 6 face to face and online Computer Science workshops for k12 teachers at West Virginia. She is the funding Director of STEM Summer Academy of Girls in West Virginia and has also organized more than 10 workshops and camps for K-12 teachers and students. She serves as the Program Chair of the 126th ASEE Annual Conference and Exposition and served on the Strategic Committee of West Virginia Department of Education. She is the director of West Virginia affiliate of NCWIT (National Center of Women and Information Technology), an ABET IDEAL scholar and West Virginia TECH Golden Bear Scholar. Dr. Naz is also the funding director of EMPOWERS (Establishing Mentoring Pipeline of Women through Education and Research in STEM). https://empowersusa.org/

Gay Stewart, a Professor of Physics and Eberly Professor of STEM Education at WVU will serve as Code.org *Project Appalachian Coders* consultant. She is the Director of the WVU Center for Excellence in STEM Education at West Virginia University, which is also the WV Regional Partner for Code.org. Through this partnership, WVUCE-STEM created WVCode to support increased accessibility of computer science to students in K-12 public schools across the state, in part by offering professional development to educators.

External Evaluator. WVU's Program Evaluation and Research Center (PERC) will provide independent formative and summative evaluation for this project under the direction of Malayna Bernstein, Ph.D. PERC will document evidence of impact on specific outcomes relevant to project objectives to support continuous program improvement and successful achievement of project goals. PERC will provide face-to-face evaluation consultations and an

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annual formative and summative written evaluation report. (

C. Management Plan

Table 3. *Objectives, milestones, timeline & responsibilities*

Objectives	Milestones	Date	Personnel	Deliverables
1a	Modify self-efficacy subscales from the Teacher Attitudes toward Subject-Specific Acceleration Instrument (Rambo & McCoach, 2012) & Mathematics Teaching Efficacy Beliefs Instrument (Enochs, Smith, & Huinker, 2010).	F 2019	Rambo-Hernandez	Modified Instruments
3b & 3c	Modify Science Identity (Chemers et al., 2010, adapted to CS Identity) & Attitudes toward CS- Interest Subscale (Hoegh & Moskal, 2009), adapted for elementary students.	F 2019	Rambo-Hernandez	Modified Instruments
1a	Baseline collection of general and GT teachers CS content knowledge and efficacy to differentiate learning experiences for general and high ability students; number of students identified and served as GT by grade.	F 2019	Brigandi/ Spillane/GA	Data from teacher completed instruments (1)/student counts
3b & 3c	Baseline collection for students' CS	F 2019	Brigandi/	Data from

	interest and identity.		Spillane/GA	student completed instruments (1)
1a	First schoolwide CS PL for all teachers.	*Jan. 2, 2020	Spillane Code.org	Data from teacher completed instruments (2)
1a, 1b	GT & Gen Ed Teachers refine CS lessons for implementation with guidance from the project team.	S 2020-S 2025	Spillane	Completed lesson plans
1a, 1b	GT & Gen Ed Teachers implement CS instruction into the general education classroom.	S 2020-S 2025	Brigandi/ Spillane/ GA	Data from teacher completed instruments (3) /Observation /Self-report
3b	PL for grade 1 and 2 teachers on using SCRBCSS; Grade 1 and 2 teachers assess students using SCRBCSS	*S 2020	Brigandi	Completed SCRBCSS Student Data G 1 & 2
3b	Local Norms established using SCRBCSS data	S 2020	Rambo-Hernandez/ Brigandi/	School-level Norms

			Spillane	
3b	Grade 1 and 2 CS talent pool students identified using local SCRBCSS norms (annually)	S 2020-S 24	Rambo-Hernandez/ Brigandi/ Spillane/GA	List of talent pool students
2a, 2b	Hour of Code (annually)	S 2020-S 24	Brigandi/ Spillane/GA	Count of attendees; survey
1c	PL on Differentiation and Flexible Grouping for Grade 2 teachers	F 2020	Brigandi	
1c, 2b	PLCs for Grade 1 & 2 teachers	F 2020-S24	Brigandi/ Spillane/GA	Observation
3a	Collect WVGSA data	S 2020-S24	Rambo-Hernandez	Baseline / Local norms
1b, 2a, 3c	In school CS Clubs & Clusters	F 2020-S25	Brigandi/ Spillane/GA	Observation/ #Participants
1a	GT teachers attend CS Fundamentals express	2020/ 2021	Spillane/ Brigandi	Self-report
1a	GT teachers attend CS Discoveries	2021/ 2022	Spillane/ Brigandi	Self-report
	GT Teachers design and implement lessons for GT classroom	S2020-S2024	Brigandi/ Spillane	Lesson plans/ Observation/ Self report
2a, 2b	Enrichment Fair	S 2022/	Brigandi/	Number of

		S23/ S24	Spillane/GA	participants & attendees; survey
4a	Disseminate information via conferences and journal articles	F 2021- S 2024		Articles & Presentations
	Advisory Board Meetings (semi annually)	2019 2024	Research Team & Advisors	
	Evaluation Perc Center (annually)	2019- 2024	Research Team	
	Project management- PIs and co-PIs by phone (Monthly)	2019- 2024	Rambo-Hernandez/ Brigandi/ Spillane	

Evaluation. Since we are already conducting research about the effects of interventions on student identities, interest, and nomination/identification, we seek to use evaluation as a process for reflecting on whether we are actually carrying out the responsibilities we propose herein. Dr. Rambo-Hernandez will lead the evaluation efforts. The process evaluation will gather evidence about how successfully the plans and policies of the project were executed as planned as well as to consider its impact on the intended population. This evaluation is intended only to assess the outcome of the project and the data will inform how students, teachers, and families are affected by program activities. The data within this evaluation will be limited to data describing:

- Creation and delivery of faculty trainings
- Development of program activities
- Implementation of program activities

- Assessment activities on the intended target student population

The following key questions will be assessed:

1. Were the activities created and implemented as planned?
2. Were the PL trainings implemented for teachers?
3. How many classrooms (by campus and grade level) implemented program activities?
4. Did the SEM/RtI framework effectively support students in rural and low SES schools?

Summative evaluations will be conducted by WVU's PERC center under the direction of Malayna Bernstein, Ph.D. as previously noted.

D. Project Services

All state and local agencies involved in *Project Appalachian Coders,* including WVU, WV BOE, and Fayette County Schools, are committed to equality of opportunity as evidenced by equity statements and non-discrimination policies. All program activities will comply with Section 427 of the General Education Provisions Act. No participant will be denied participation in program activities based upon their gender, race, national origin, age, color, or any disability. The *Project Appalachian Coders* Project Director will monitor program activities to ensure that equitable participation in program activities is not limited due to gender, race, national origin, color, disability, or age. In fact, the purpose of *Project Appalachian Coders* is to provide more equitable access to educational services to students who live in a rural, low SES, and low education community. The following provides specific examples of how *Project Appalachian Coders* personnel intend to address barriers that could potentially impede active participation of students, students' family members, or teachers in program activities.

Barrier 1: Fayette County has large numbers of students who live in poverty.

Solution 1: Students who live in rural poverty are less likely to be identified as GT. We propose to use multiple criteria and alternative methods of identification to increase the number of

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identified students from low income homes based on local as opposed to statewide norms. (

Barrier 2: Low income students in rural counties have less access to enrichment opportunities. (

Solution 2: Through *Project Appalachian Coders* we will provide students with increased access (to enrichment opportunities both during and after school.

Barrier 3: Students in rural and low SES school systems have less access to high-quality education given the lack of funding for teacher development. (

Solution 3: We will build teacher capacity by providing teachers with access to PL that supports (rigorous student learning in fun and engaging ways.

Barrier 4: Students in rural and low income schools are more likely to also live in low education households. Parents with low levels of education are less likely to value education, including education in CS, which may not seem culturally relevant. (

Solution 4: We will build school and home capacity by hosting communal CS events that bring together students, teachers, and students' families, such as Hour of Code.

The **quality** and **sufficiency** of this research is discussed in depth throughout the proposal. We use a quasi experimental design with lagged cohorts to implement interventions grounded in evidence-based practices to support learning for all students, including GT students, in one rural and low SES school district. The likely **impact** of services provided by *Project Appalachian Coders* on recipients includes increased interest in and awareness of CS, increased parental awareness of GT services, increased teacher capacity to engage students in CS coursework and activities, and student development of a STEM identity that potentially influences future career choice. Increased student identification as GT and student achievement in math and science is a desired outcome. In the long term, *Project Appalachian Coders* helps to prepare Fayette County students for higher education and the 1,190 currently open computing jobs in West Virginia (Conferenceboard, 2019). (

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