Appalachian Support for Specialized Education Training (ASSET)

SEED Grant 2017 Narrative

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Project Narrative

In this Supporting Effective Educator Development (SEED) proposal, Radford University-Appalachian Support for Specialized Education Training (ASSET) addresses Absolute Priority 1: Providing professional development activities to current teachers that will improve pedagogy or content knowledge, Competitive Priority 1: Providing educator development activities designed to improve cultural competency and responsiveness skills that contribute to an inclusive school culture, and the Invitational Priority: Projects that support teachers earning micro-credentials based on demonstrated mastery of competencies and performance-based outcomes. These priorities are addressed in sections A & B of the proposal.

A. Quality of the Project Design

A(1) - Exceptional Approach

The past decade has witnessed a decline in students enrolling in teacher preparation programs throughout the United States. Declining enrollment along with aggregated attrition rates of 30-percent or more in the first few years of teaching is resulting in chronic problems with teacher shortages.[1] By 2018, shortages are estimated to be at 112,000, with supply decreasing and demand increasing. These problems are especially pervasive in special education and STEM disciplines.[2] This shortage of qualified teachers is especially acute in high-poverty, rural communities where the overall teacher supply is limited, the general population is declining, and any attrition creates immediate vacancies in schools that have few incentives to recruit teachers outside of their regional areas. Because schools face challenges filling vacancies in these disciplines, many are forced to hire unqualified teachers. For example, in 2015, nearly

[1] Dan Goldhaber, John Krieg, Roddy Theobald, and Nate Brown, "Refueling the STEM and Special Education Teacher Pipelines," *Phi Delta Kappan* 97, no. 4 (2015): 56-62.
[2] Leib Sutcher, Linda Darling-Hammond, and Desiree Carver-Thomas, "A Coming Crisis in Teaching?," *Teacher Supply, Demand, and Shortages in the US* (2016).

half of entering special education teachers in the United States lacked full preparation for teaching.[3]

To address these challenges, Radford University, simSchool, the Human Resources Research Organization (HumRRO), Rockman et al., and SRI International are partnering to develop, implement and evaluate the ASSET program. This program constitutes online, self-paced, competency-based education (CBE) training designed to increase teacher effectiveness and workforce capacity in underserved rural communities in Appalachia. The ASSET program will include a unique set of 5 micro-credentials in high demand areas based upon the Institute of Educational Sciences (IES) What Works Clearinghouse (WWC) practice guides *(see Appendix A for the IES WWC Micro-credential Competency Alignment spreadsheet.).*

Seventeen IES guides were used to inform the design of the five proposed micro-credentials, which include:

1. Inclusive Literacy Instruction for Elementary General Curriculum Classrooms
2. Inclusive Literacy Instruction for Secondary General Curriculum Content Classrooms
3. Inclusive Math Instruction for Elementary General Curriculum Classrooms
4. Inclusive Math Instruction for Secondary General Curriculum Classrooms
5. Inclusive Problem Solving for High Need Secondary Students

Teachers will earn micro-credentials at their own pace and within their own communities enabling them to immediately apply their evidence-based strategies in their classrooms. simSchool's teacher training and assessment platform will be used to deliver scenario-based CBE modules and micro-credentials. Micro-credentials will be awarded based on assessments within the platform which allow teachers to demonstrate mastery within the simulation

[3] Ibid

environment.[4]This research-based simulated training environment enables participating teachers to engage in a close approximation of "authentic practice" that is associated with deep learning, high retention, and facile transfer.[5] In addition to the assessment role, simSchool will also work collaboratively with Radford University and HumRRO to explore the following research and development objectives:

1. Research and iteratively develop the specific CBE learning design principles that are associated with positive teacher performance and dispositions.
2. Research and iteratively develop the specific learning analytics most effective in informing and enhancing both CBE module design and the resulting classroom teaching practices.
3. Validate the ASSET and simSchool assessments.

Online CBE training situated in teachers' communities will empower participating teachers to attain the skills necessary to increase their effectiveness in teaching diverse students and creating inclusive classroom cultures.

Exceptional Approach Conceptual Framework. The use of simulation and game-based, online CBE training is an exceptional approach that has the potential to address the chronic qualified teacher shortages in high need rural communities where access to student teaching experiences is often limited and it is difficult and costly for institutional instructors and mentors to observe performance. The design of ASSET will be informed by four main components of our conceptual framework: 1. competency-based education; 2. learning sciences; 3. learning analytics; and 4. simulation-based and gamified learning.

[4] Tandra Tyler-Wood, Mary Estes, Rhonda Christensen, Gerald Knezek, and David Gibson, "SimSchool: An Opportunity for Using Serious Gaming for Training Teachers in Rural Areas," *Rural Special Education Quarterly* 34, no. 3 (2015): 17.
[5] R. K. Sawyer ed. *The Cambridge Handbook of the Learning Sciences* (Vol. 2, No. 5), (New York: Cambridge University Press, 2006), 5.

Competency-Based Education (CBE). The first component of the conceptual framework is competency-based education (CBE). CBE is a pedagogical approach that uses the direct assessment of student learning as credit for education rather than a proxy measurement such as seat time.[6,7] This approach decouples learning from time-based models, such as 3-hour courses and 14-week semesters. Proponents of CBE assert that three interdependent outcomes accompany this shift away from time as a metric for learning: 1. increase in education access due to greater flexibility for working adults (e.g., practicing teachers); 2. decrease in time to academic credential; and 3. subsequent decrease in cost for the non-traditional adult learner. When learners demonstrate mastery at the prescribed level, they are awarded credit (e.g., micro-credential) for their learning regardless of how long it may have taken them to attain and demonstrate this mastery. The first research goal for the ASSET program will be to understand the extent to which locally contextualized CBE enhances teacher training, promotes the use of effective teaching practices, and increases overall teacher retention.

Learning Sciences. The second component of the conceptual framework are the learning sciences. This field of study is interdisciplinary and draws upon research in cognitive science, educational psychology, computer science, education, sociology, neuroscience, anthropology, information sciences, design studies and other fields.[8] The learning sciences field provides numerous practical applications for CBE instructional design, and which could potentially increase the effectiveness of this approach at every level.[9] A secondary research goal for the

[6] Council of Independent Colleges, "Competency-Based Education," (2015), https://www.cic.edu/p/Securing-Future/Documents/CICBrief1-CBE.pdf

[7] Robert Kelchen, "The Landscape of Competency-Based Education," (2015), https://www.aei.org/wp-content/uploads/2015/01/Landscape-of-CBE.pdf

[8] J. D. Bransford, A. L. Brown, and R. R. Cocking ed., *How People Learn: Brain, Mind, Experience, and School*, (Washington, DC: National Academy Press, 2000), http://www.nap.edu/openbook.php?isbn=0309070368.

[9] R. K. Sawyer, "Optimizing Learning: Implications of Learning Sciences Research," (2008), http://www.oecd.org/edu/ceri/40805146.Pdf

ASSET program is to identify what applied principles from the Learning Sciences are most effective in informing and enhancing CBE teacher training and the resulting teacher practices.

Learning Analytics. The third component is the development of a learning analytics system for each of the ASSET CBE learning modules. Computer-aided learning analytics can be traced to the analysis of customer behavior and market trends related to web logs and browser tags in the 1990s.[10] Related to analytics is the concept of web-based, networked technologies providing "unprecedented opportunities for people to produce and share data, interact with and remix data, aggregate and organize data."[11] This concept of using "sets of student-related data, to further the advancement of a personalized, supportive system" is at the heart of learning analytics.[12] A third primary research goal for the ASSET program is to address this challenge by documenting what data and visualizations (e.g., dashboards) are most effective in informing and enhancing CBE teacher training and the resulting teaching practices. The data dashboards will encapsulate the key learning analytic strategies that the ASSET team will leverage to enhance the efficacy of our learning environments: *adaptive learning environments/systems*; *visual data analytics; dashboards; metrics; modeling of user knowledge, behavior, and experience; and user profiling.*[13] These analytic strategies will be further discussed in section B of "Training Quality".

Simulation-Based and Gamified Learning. The fourth component of the ASSET program's conceptual framework is simulation and game-based learning. The emergence of CBE and the maturation of learning sciences and analytics has also been accompanied by the evolution of simulation and game-based learning. A number of peer-reviewed meta-analyses

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[10] H. Fournier, R. Kop, and H. Sitlia, "The Value of Learning Analytics to Networked Learning on a Personal Learning Environment," (2011): doi: http://doi.org/10.1145/2090116.2090131.

[11] D. Boyd, " Privacy and Publicity in the context of Big Data," available at http://www.danah.org/papers/talks/2010/WWW2010.html , Raleigh, North Carolina, April 29th 2010 (Accessed, 16th October, 2010). P. 1

[12] L. Johnson, S. Adams Becker, M. Cummins, V. Estrada, A. Freeman, and H. Ludgate, " NMC Horizon Report: 2013 Higher Education Edition," (2013): 5

[13] Ibid

have documented generalizable findings on the effectiveness of instructional simulation and games.[14,15,16]

A.2 - Sufficient Training Quality, Intensity, and Duration

Training Quality. As outlined above, the ASSET team will design all of the online CBE training and corresponding assessments in alignment with the learning sciences and informed by learning analytics as well as simulation-based learning evidence-based practices. Although CBE is, by design, decoupled from time spent in the learning environment as a requirement for completion, experience teaching similar content in traditional online courses suggests that the typical ASSET participant will need approximately 100-150 hours to complete all of the module components required to earn a micro-credential. Each micro-credential is comprised of approximately 3-5 modules (see Appendix A). To illustrate the design approach and the quality of the training, a sample module is described below.

Sample Module Design. A participating teacher logs into the learning management system (LMS). The LMS contains the teacher's profile, which consists of attributes used to: 1) inform a predictive analytic model; and 2) customize and configure the learning environment (i.e., content and assessments) to reflect that specific teacher's actual classroom grade level and demographic composition. For example, if Mrs. Smith, a second grade teacher from Giles County, Virginia, logged into the LMS, the learning environment would provide scenarios, learning activities and content relevant for that grade level and reflect the age and demographic composition of 2nd grade children from that region of the country. Within the simulated classroom, simSchool provides information about relevant demographic variables in the

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[14] Fengfeng Ke, "A Qualitative Meta-Analysis of Computer Games as Learning Tools," *Handbook of Research on Effective Electronic Gaming in Education*, *1*, (2009): 1-32. (Note: Cited in 49)

[15] T. Sitzmann, "A Meta- Analytic Examination of the Instructional Effectiveness of Computer- Based Simulation Games," *Personnel Psychology*, *64*(2), (2011): 489-528. (Note: Cited by 34)

[16] J. J. Vogel, D. S. Vogel, J. Cannon-Bowers, C. A. Bowers, K. Muse, and M. Wright, "Computer Gaming and Interactive Simulations for Learning: A Meta-Analysis," *Journal of Educational Computing Research*, *34*(3), (2006): 229-243. (Note: Cited by 165)

classroom. Each teaching simulation is designed to support the teacher participant's application of the IES practice guide content within the module. (See Appendix A for information about the grade level alignment of the Practice Guide content within the 5 micro-credentials). This customization of the learning environment and the "situativity" of the information therein engages the teacher in "authentic practice" that is associated with deep learning, high retention, and facile transfer.[17]

Mrs. Smith is then presented with a short two-minute video introducing a fictional, game-based scenario within which she needs to address a specific classroom challenge (e.g. she has a subgroup of students in her inclusive elementary math class who are struggling to learn key math concepts and problem-solving skills). After watching the video, Mrs. Smith would then be able to use the simSchool environment to practice the identified skills.

As Mrs. Smith works through the specific scenario-based learning activities, she receives a continuous stream of *performance feedback*, which she can use to reflect upon and revise her understanding and problem-solving strategies. Researchers in the areas of adaptive expertise, learning, and transfer have documented the critical importance of feedback and formative assessment for student learning.[18,19] Other related strategies include helping learners engage in reflection over their own learning processes, and providing guidance toward progressive revisions in personal cognitive strategies.[20]

The presentation of the scenario (i.e., story), content and assessment components will follow formulaic structure (figure 1). For example, after Mrs. Smith is presented with a

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[17] R. K. Sawyer ed. *The Cambridge Handbook of the Learning Sciences* (Vol. 2, No. 5) (New York: Cambridge University Press, 2006), p. 5.

[18] J. Bransford, S. Brophy, and S. William, "When Computer Technologies Meet the Learning Sciences," *Journal of Applied Developmental Psychology, 21*(1), (2000): 59.

[19] J. D. Bransford, A. L. Brown, and R. R. Cocking ed., *How People Learn: Brain, Mind, Experience, and School*, (Washington, DC: National Academy Press, 2000), 243.

[20] J. D. Bransford, A. L. Brown, and R. R. Cocking ed., *How People Learn: Brain, Mind, Experience, and School*, (Washington, DC: National Academy Press, 2000), 243.

fictionalized classroom challenge, she is then presented with instructional strategies that align with Gagne's theory of instruction and nine events of instruction.[21,22]

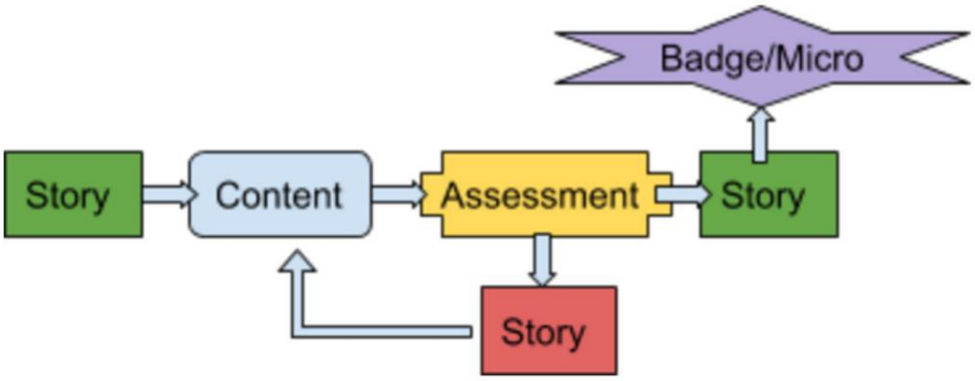

Figure 1: CBE Module scenario (i.e., story), content and assessment presentation structure

These instructional events are general in nature, but when applied to individual modules reflect strategies specific to the targeted skills, knowledge or attitudes facilitated in the module. Below is an abbreviated example of module activities designed to facilitate skills associated with effective math instruction:

1. **Gain the attention of the students**: A video is presented depicting a "typical" whole class math instruction experience, with students completing slot notes, independent practice using worksheets, and assessment without opportunities for reteaching. Many of the students are obviously struggling. The classroom scenario will reflect the academic and demographic composition of rural Appalachian classrooms, including students with disabilities, low achieving students who demonstrate indicators of high poverty, and ELL status (simSchool provides information about all simStudents as part of the simulation). Available resources for teachers to use for their instruction in this scene will reflect resources typical of rural (often

[21] Robert M. Gagné and Karen L. Medsker. *The Conditions of Learning: Training Applications*, (1996).
[22] Marcy P. Driscoll, *Psychology of Learning for Instruction*, (2005).

high poverty) Appalachian classrooms.

2. **Inform the students of the objective**s: An introductory video connects the attention-getting presentation to the module objectives. Modules are based on recommendations from the IES Practice Guides as described in Appendix A. A sample modules based on IES Guide *Assisting students struggling with Mathematics: Response to Intervention (RTI) for Elementary and Middle School Students* may include, in part*:*

   i. Describe importance and identify examples of systematic explicit instruction for struggling elementary school students.

   ii. Given a scenario in which students in an Appalachian elementary classroom are struggling to learn math skills, recommend strategies for improving the effectiveness of the math instruction.

3. **Stimulate recall of prior learning:** Ask participating teacher learners to identify and describe elements of systematic, explicit instruction as well as review components they might already be familiar with in literacy models for struggling readers (or other models). Ask participating teacher learners to recall common strategies for teaching problem-solving and/or critical thinking skills.

4. **Present informational content:** An overview of all the information components for the module is provided. Following this, a short video presenting an overview of dyscalculia is played [i.e. Sheldon Horowitz from the Harvard School of Education]. Information about specific research-based strategies is presented, such as:

   i. Content from Center on Instruction[23], Excerpts from *Designing and Implementing Mathematics Instruction for Students with Diverse Learning Need*s (Hudson & Miller,

[23] Russell Gersten, David J. Chard, Madhavi Jayanthi, Scott K. Baker, Paul Morphy, and Jonathan Flojo, "Mathematics Instruction for Students with Learning Disabilities: A Meta-Analysis of Instructional Components." *Review of Educational Research* 79, no. 3 (2009): 1202-1242.

2006), IRIS Module for ELLs[24], Resources from Intervention Central[25], and Iris Module for Math[26]

5. **Provide learning guidance:** A clear example is presented of the scenario within a simSchool simulation where students in an Appalachian elementary classroom are struggling to learn math skills, and provide an expert example of recommending strategies for improving the effectiveness of the math instruction based on the information and models provided.
6. **Elicit performance:** Practice items addressing the "Describe importance and identify examples of" are presented. Teacher learners are presented with a simSchool simulation in which they must implement strategies to improve math instruction.
7. **Provide feedback** [simSchool performance data]: The simSchool program provides basic performance data on the exercise. Additionally, simSchool exercise reports and recorded simulations can be posted to a discussion board site to elicit feedback from the community on things that may need further refinement. Coaches comment on simSchool reports and provide feedback. Points are assigned based on learners' use of evidence-based practices covered in the module.
8. **Assess performance:** A post-module assessment is presented that includes items measuring all module objectives. In addition to a variety of selected-response items, the assessment will include scenarios in which effective math strategies are recommended based on the particulars of the situation. A simSchool component may be used for assessment as well. For example, points can be earned for players choosing effective instructional strategies in response to simSchool students' academic behaviors and responses. Teacher learners must reach a specific

[24] The Iris Center, "What Do Teachers Need to Know About Students Who Are Learning to Speak English," accessed on June 21, 2017, https://iris.peabody.vanderbilt.edu/module/ell/cresource/q1/p02/#content

[25] Intervention Central, "Academic Interventions," accessed on June 21, 2017, http://www.interventioncentral.org/response-to-intervention

[26] The Iris Center, "High-Quality Mathematics Instruction: What Teachers Should Know," accessed on June 21, 2017, https://iris.peabody.vanderbilt.edu/module/math/

number of points across the sims, including a capstone demonstration of utilizing all three strategies, a) systematic, explicit instruction, (b) provide opportunities to solve problems in a group and communicate problem solving strategies, (c) ensure that instructional materials include cumulative review in each session, in a single sim. If enough points are earned, learners receive a badge for their mastery of the module and progress toward the micro-credential.

9. **Enhance retention and transfer to job:** Learners are encouraged to reflect on the application of any strategies learned to their own current jobs, or their own personal struggles learning math in the past. Further readings are provided that reinforce the successes other teachers had after implementing the strategies.

This ability to personalize the learning environment in an ongoing and adaptive manner is a main research and development objective for the ASSET program. The personalized learning environment research and development agenda will focus on modeling participating teachers' knowledge, behavior, and experience in conjunction with the teacher profiling, and then adapting the environment accordingly to maximize learning outcomes.[27]

The fundamental research focus includes determining what features of the ASSET CBE learning environment lead to deep learning and high retention. The specific research questions will be further discussed in "Methods to Produce Evidence of Project's Effectiveness" in section D.

A.3 - Collaboration of Partners to Maximize Effectiveness

To maximize the effectiveness of the ASSET program, the collaborative team will be comprised of Radford University, simSchool, HumRRO, Rockman et al., and SRI/Rural

[27] M. Bienkowski, M. Feng, and B. Means, "Enhancing Teaching and Learning Through Educational Data Mining and Learning Analytics: An Issue Brief," *Washington, DC: Office of Educational Technology, US Department of Education*, (2012): 18

Educational Laboratory - Appalachia. This collaborative ASSET team will also partner with State Education Agencies (SEAs), Local Education Agencies (LEAs) and consortia, such as state and regional superintendents, and the Training and Technical Assistance Center at Radford University (RU-TTAC).

Radford University (RU) is one of 15 four-year public higher education institutions in the Commonwealth of Virginia. It is a nationally recognized co-educational, comprehensive public institution and has consistently been ranked in the top twenty public master's universities in the south in U.S. News and World Report rankings and has been named one of the best colleges and universities in the Southeast by The Princeton Review. RU offers a diverse curriculum of more than 140 undergraduate and graduate degree programs or areas of concentration focused on student achievement and career preparation. In 2017, approximately 25% of all undergraduates were first-generation students, and 33% were from from ethnically diverse backgrounds. With historical roots as a Normal School, RU retains an excellent reputation in training teachers and principals, as well as for being an affordably priced, rural institution.

simSchool uses bleeding edge artificial intelligence (AI) to catalyze a paradigm shift in education: using simulation-based training to help teachers teach better, with greater empathy, improved skill, and enhanced expectations for what every child can achieve in his or her own unique way. Powered by over a decade of validation research, the artificial intelligence simEngine™ can deliver 10 trillion learner profiles and 10 trillion instructional tasks on demand into simSchool while enabling customization through life authoring tools.

simSchool will provide an ideal performance space for the ASSET program because of its existing history and reputation coupled with its proven utility and scalability factors. simSchool is:

- Cloud-based and multi-device compatible, eliminating the necessity for programs or individuals to upgrade existing systems, purchase peripheral devices, or install software
- Accepted by numerous state and federal accreditation agencies for use in fulfilling practicum and pre-practicum certification requirements
- A cost-effective turnkey system with live authoring giving SEED researchers full flexibility to both design simulation experiences directly aligned to curriculum, to make iterative improvements as necessary without "rebuilding" or coding simulations from scratch, and to enable SEED participants on their own to experience content creation in online and simulated environments should they choose.

HumRRO. Founded in 1951, HumRRO is an independent, U.S.-based, non-profit organization with experience collaborating with government, private, and nonprofit agencies to design, implement, and evaluate education, training, and personnel systems. HumRRO's professional staff is composed primarily of education researchers, industrial-organizational psychologists, statisticians, and measurement experts. The depth and breadth of HumRRO's full suite of capabilities ensures that it can effectively, and objectively, evaluate programs and assessments across a broad range of arenas.

SRI International. SRI has a long track record of large-scale recruitment and evaluation efforts and has worked extensively in the Appalachian Region. For example, SRI holds the contract for the current Regional Educational Laboratory Appalachia. SRI also leads the evaluation of an IES-funded randomized controlled trial (RCT) aimed at assessing the efficacy of Reasoning Mind, a digital mathematics instructional program, in 47 West Virginia schools, including remote rural locales.

Rockman et al. Over its 25-year history, REA has evaluated the impacts of large-scale educational initiatives as well as links between implementation and impact. REA has designed and conducted various studies to evaluate and to inform program development for teacher professional development programs in pK-12 schools. REA has conducted multi-year evaluations of federally-funded efforts to improve both teaching quality and student achievement, such as, Investing in Innovation Fund, TQP and Star Schools initiatives. We have also conducted formative evaluations for teacher development programs using blended digital and face-to-face components. In our proposed evaluation, we describe data collection strategies for teachers, and district- and school-level administrators.

All four of these organizations have a common interest in increasing teacher effectiveness and workforce capacity in underserved rural communities in Appalachia through CBE teacher training modules, and each organization has complementary capabilities focused on this common interest. One of the unique strengths of the proposed partnership is the cyclical and iterative development process. It provides a pipeline through which CBE modules are produced to increase educators' knowledge and skills in evidence based practices that contribute to inclusive school culture. The partnership's shared goal is to increase access to the general curriculum for students with diverse learning needs in K-12 high-need schools. This production and preparation pipeline consists of four separate stages working together (Figure 2):

1. Development/refinement of CBE modules and analytics system
2. Recruitment of participating teachers
3. Implementation of CBE modules
4. Data collection and analysis

Each stage of development plays a critical role in the production and training process, creating an environment where the output of the pipeline feeds into the beginning of the pipeline, building and strengthening the overall process and resulting products over time.

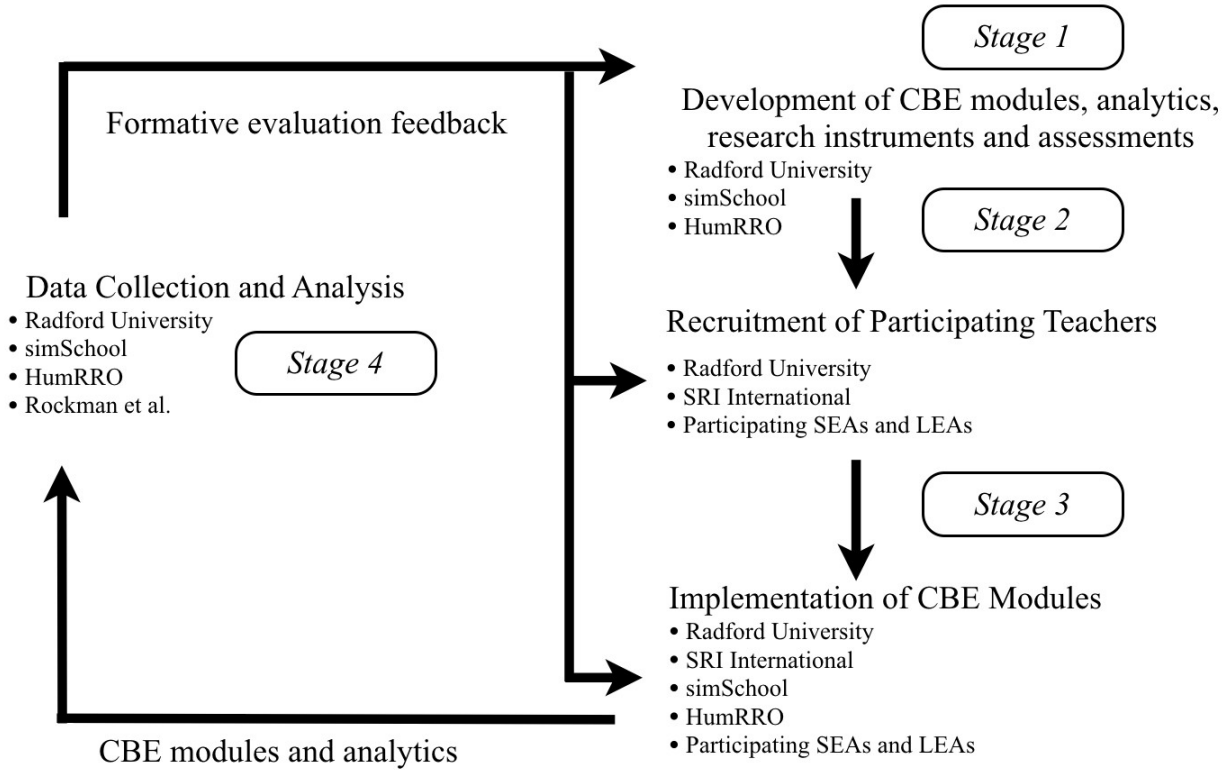

Figure 2: CBE Module Production and Teacher Training Partnership Cycle

Stage 1/Year 1: Development/refinement of CBE modules and analytics system. In the first stage, Radford University and simSchool will develop the learning environment content and assessments in alignment with the conceptual framework.

Stage 2/Years 1 & 2: Recruitment of participating teachers. In the second stage, Radford University and SRI International will recruit participating teachers in underserved rural communities in Appalachia

Stage 3/Years 2 & 3: Implementation of CBE modules. In the third stage, the CBE modules and underlying analytics system developed in stage 1 are made available to the participating teachers recruited throughout rural Appalachia in stage 2.

Stage 4/ Years 1, 2, & 3: Data collection and analysis. In the fourth stage, as the CBE modules and analytics are field tested in the classroom, qualitative case study data and formative evaluation data will be collected to determine the design strengths and weaknesses of both the modules and the overall production model. Once collected, this data is fed back into the research and development pipeline to continue an iterative process of progressive CBE module refinement. Finally, as the analytics system is built, efficacy studies will be conducted in year 3 to determine how effective the individual CBE modules are at enhancing teacher effectiveness, learning and retention.

Working with our partners from each of the four stages, the aims of this ASSET program's research and development process will be to create an active, collaborative, and sustainable learning community, revealing a circular development of knowledge and products, which have formed underneath.[28] Additionally, the content that is developed at each level of the collaborative process will be made available to additional rural partners across Appalachia through our partnership with SRI International. ASSET will explore opportunities to work with SRI International to work with other RELs serving rural areas across the country. ASSET will explore potential partnerships with other organizations focused on rural education to extend the ASSET model for developing place-responsive CBE professional development in other rural regions across the country. These place-responsive tools will provide important professional development resources for teachers, and evidence-based CBE instructional design practices that

[28] Katerine Bielaczyc and Allan Collins, "Learning Communities in Classrooms: A Reconceptualization of Educational Practice," *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory* 2, (1999): 269-292.

researchers, policymakers, and administration can leverage in their own schools and communities throughout the country.

A.4 - Focused on Serving the Population with Greatest Needs

The context of rural Appalachia. Teachers who live and work in rural areas must meet increasingly diverse needs of students in general education classrooms, but have less access than their urban and suburban peers to high quality professional development for the increasingly diverse needs of students in general education classrooms.[29,30,31] Rural school districts struggle to provide all students with highly qualified teachers and this problem is compounded by increasing diversity in students' learning needs in inclusive classrooms.[32,33] Rural "Appalachia" comprises more than 205,000 square miles across 13 states from New York to Mississippi with over 250,000 educators. Forty-two percent of the overall population is rural, compared with 20 percent of the national population.[34] Within these 13 states, 253 counties have poverty rates from 15.7% to 43% (the national average is 15.5%). Thus, ASSET uses rural or near rural status and poverty as indicators of high need.

Need for teacher development in rural Appalachia. Rural Appalachian students with the highest needs may have the least access to teachers who are likely to be highly effective. Students in high poverty, rural schools are most likely to feel the effects of teacher shortages, where the overall teacher supply is limited, and any attrition risks creating a vacancy. This is particularly true in rural Appalachian communities. Teacher attrition is associated with the high

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[29] Jo Nell Wood, Kim Finch, and Rachel M. Mirecki, "If We Get You, How Can We Keep You? Problems with Recruiting and Retaining Rural Administrators," *The Rural Educator* 34, no. 2 (2013).

[30] Ruth Chung Wei, Linda Darling-Hammond, and Frank Adamson, *Professional Development in the United States: Trends and Challenges*, Vol. 28. Dallas, TX: National Staff Development Council, 2010.

[31] Gretchen G. Robinson, William D. Bursuck, and Kristin D. Sinclair, "Implementing RTI in two Rural Elementary Schools: Encouraging Beginnings and Challenges for the Future," *The Rural Educator* 34, no. 3 (2013).

[32] Hernán Cuervo, "Enlarging the Social Justice Agenda in Education: An Analysis of Rural Teachers' Narratives Beyond the Distributive Dimension," *Asia-Pacific Journal of Teacher Education* 40, no. 2 (2012): 83-95.

[33] Patrick Renihan and Brian Noonan, "Principals as Assessment Leaders in Rural Schools." *The Rural Educator* 33, no. 3 (2012).

[34] The Appalachian Regional Commission, "The Appalachian Region," *ARC.gov*, accessed June 20, 2017, https://www.arc.gov/appalachian_region/TheAppalachianRegion.asp

levels of poverty and low levels of spending on professional development widely found in rural Appalachian communities, both of which are associated with lower levels of student achievement for those with diverse learning needs in inclusive classrooms.[35] The literature clearly indicates that poverty, disability, limited English proficiency, and low academic achievement are comorbid conditions.[36] This speaks to the need for ongoing professional development for teachers willing to stay and work in these rural Appalachian communities. ASSET offers effective professional development to rural Appalachian teachers to increase their competence to deal effectively with the rapidly changing and increasingly diverse needs of the students in their classrooms as they live and work in communities that have limited access (financially, geographically, culturally) to high quality professional development opportunities.

A.5 - Appropriate Design to Successfully Address Needs of Target Population

Rationale for micro-credentialing. Rural schools and communities value local solutions that encourage autonomy and are place-responsive.[37] Four essential features of effective educator micro-credentials are that they are: (a) competency-based, (b) on-demand, (c) personalized, and (d) shareable. They must allow educators to focus on specific skills directly related to their professional practice which are tied to their K-12 students' needs and the goals of schools in which they work.[38] Micro-credentials to support capacity building for inclusive classrooms is an approach that is particularly well suited to the rural Appalachian context because it allows schools and teachers to define their context specific needs and then choose the

[35] Chad R. Lochmiller, Eishi Adachi, Colleen E. Chesnut, and Jerry Johnson, "Retention, Attrition, and Mobility among Teachers and Administrators in West Virginia. REL 2016-161," *Regional Educational Laboratory Appalachia* (2016).

[36] L. M. Baker, *The Relationship Between Local Fiscal Capacity and Student Achievement in Virginia Public School Divisions* (Doctoral dissertation, The George Washington University, 2015).

[37] Amy Price Azano and Trevor Thomas Stewart, "Exploring Place and Practicing Justice: Preparing Pre-service Teachers for Success in Rural Schools," *Journal of Research in Rural Education (Online)* 30, no. 9 (2015): 1.

[38] L. Acree, "Seven Lessons Learned From Implementing Micro-credentials," Raliegh NC: Friday Institute for Educational Innovation at the NC State University College of Education, 2016.

specific competencies that they want or need to develop.[39] The online, asynchronous, self-paced learning environment, is well positioned to ameliorate the constraints that geography and changing professional demands impose on rural Appalachian educators.

B. Significance (15 points)

Tens of thousands of general educators currently work in 253 rural counties with poverty rates significantly greater than the national average (15.7% to 43%).[40] These rural general educators face at least two significant challenges that ASSET will address. First, rural Appalachian poverty is associated with chronic academic underachievement for students with disabilities, English Language Learners, and other struggling students.[41] Second, rural educators have limited access to professional development that is (a) consistent with learning sciences, or (b) focused on evidence-based practices, general education teachers often lack adequate knowledge and skills to provide instruction designed for the diverse culture of inclusive classrooms.[42] *Appalachian Support for Specialized Education Training* (ASSET) at Radford University's IMPACT[43] Program, a comprehensive center of innovative excellence for Competency-Based Education (CBE) will be a regionally significant, externally validated program to build capacity among rural Appalachian general education teachers for inclusive practices. The program will support increased access to the general curriculum for some of the highest-need students (students with disabilities, ELLs, and high-poverty students with chronic

[39] L. Acree, "Seven Lessons Learned From Implementing Micro-credentials," Raliegh NC: Friday Institute for Educational Innovation at the NC State University College of Education, 2016.
[40] U.S. Census Bureau, "New Census Data Show Differences Between Urban and Rural Populations," (2016), https://www.census.gov/newsroom/press-releases/2016/cb16-210.html
[41] Matthew J. Irvin, Soo-yong Byun, Judith L. Meece, Thomas W. Farmer, and Bryan C. Hutchins, "Educational Barriers of Rural Youth: Relation of Individual and Contextual Difference Variables," *Journal of Career Assessment* 20, no. 1 (2012): 71-87.
[42] Mary T. Brownell, Dorene D. Ross, Elayne P. Colón, and Cynthia L. McCallum, "Critical Features of Special Education Teacher Preparation: A Comparison with General Teacher Education," *The Journal of Special Education* 38, no. 4 (2005): 242-252.
[43] Innovative Mobile Personalized Accelerated Competency Training

underachievement) in one of the most underserved geographic/cultural regions in the country, rural Appalachia.

Radford University is well positioned to meet the needs of rural Appalachian teachers struggling to implement inclusive practices for diverse learners. In the last decade, our professional development programs and traditional teacher education programs at Radford University have provided training and ongoing professional support in inclusive strategies for diverse learners to more than 43,000 teachers in the 34 rural Appalachian school divisions that comprise Virginia Superintendent's Regions 6 & 7. ASSET requests a $14,048,697 SEED grant to:

- Plan, implement, and evaluate 5 CBE micro-credentials in Inclusive Teaching for Diverse Learners for rural general educators in multiple states that comprise Appalachia, including Tennessee, Virginia, and West Virginia.
- Develop and pilot a scalable model of simulation-based, gamified professional development and practice improvement that is personalized for the unique regional demands and challenges of rural classrooms.
- Support the creation and implementation of place-responsive, cloud-based and multi-device compatible asynchronous professional development for rural general educators.
- Develop and implement professional development for evidence-based inclusive teaching practices for rural general educators that is grounded in the IES/WWC practice guides.

A SEED grant will help build capacity for evidence-based, inclusive and effective, general education for at least 5000 general educators working in rural Appalachia.

B.1 - Magnitude of Results

Many states are working with the educational organizations Achieve and the Council for Chief State School Officers (CCSSO) to develop career-readiness approaches for K-12 students that include competency-based pathways. Reflecting these partnerships, the CCSSO has developed a tool to assist state and district policy makers in determining the steps needed to progress toward a competency-based system, suggesting that K-12 CBE implementation will continue to grow in coming years. Educators are also poised to benefit from this model. In particular, CBE benefits teachers who need to increase their effectiveness with diverse populations but are working and live in rural areas where in-person professional development is geographically challenging.

As ASSET is brought to scale, it can serve as a model for leveraging technology to deliver personalized, learning science based professional development for teachers in hard-to-reach rural districts. Through the SEED grant, ASSET will serve 5,000 practicing teachers. However, beyond the timeline of grant funding, it is anticipated that the module templates developed with SEED grant support for ASSET could be the foundation for personalized, place-responsive professional development for rural teachers across the country.

As an alternative approach to teacher development, ASSET's design and implementation are grounded in the literature on successful alternative models of effective teacher preparation and training, including Teach for America (TFA). Two studies that meet What Works Clearinghouse standards for strong evidence without reservation suggest that TFA's approach to professional learning for teachers yields significant positive impacts on student achievement. However, findings also suggest that TFA's approach to training provides access to professional learning opportunities in content pedagogy and practice that may not be available to "typical"

general educators.[44,45] However, demand for highly effective teachers in inclusive rural Appalachian classrooms far outpaces the supply of available program participants and their ability to build sustainable capacity in remote rural Appalachian schools. Through our partnership with simSchool, ASSET can leverage technology to translate the foundational elements of TFA's successful *"Regional Institute"* program, including an emphasis on content pedagogy and practice, into place-responsive, just-in-time CBE modules that extend our reach and relevance into remote rural Appalachian communities (see Table 1).

Table 1. ASSET's Alignment with the TFA Regional Institutes Approach

TFA Regional Institute Elements	ASSET Approach
350-385 hours of formal teacher training	Equivalent of 135 hours formal contact time per micro-credential; 675 hours for all 5 micro-credentials
Supervised/coached apprentice teaching with feedback to ensure quality performance	simSchool simulated teaching provides immediate feedback and an error free learning environment in which ASSET participants can experiment with research based techniques and make adjustments in real time to their teaching. Participants can immediately see the impact of their teaching choices on student learning outcomes in simSchool.
Ongoing seminars and courses to build and apply knowledge; opportunities for reflection and applied practice in their classrooms.	Ongoing access to research based pedagogy through module content. Personalized coaching and support from CBE coaches for all module components, including assigned tasks and interpretation of simSchool reports; applied practice in simSchool with immediate corrective feedback; badge system in CBE provides ongoing feedback and reinforcement of progress towards learning outcomes and mastery of module content.
Training curriculum is grounded in rigorous standards that are most relevant locally	CBE Module content is grounded in best practices described in 17 IES practice guides. Our partnership with simSchool allows ultimate nimbleness such that ASSET modules can be updated "on the fly" to reflect ongoing changes in local standards,

[44] Melissa A. Clark, Hanley S. Chiang, Tim Silva, Sheena McConnell, Kathy Sonnenfeld, Anastasia Erbe, and Michael Puma, "The Effectiveness of Secondary Math Teachers from Teach For America and the Teaching Fellows Programs," *Princeton, NJ: Mathematica Policy Research* (2013).

[45] Melissa A. Clark, Eric Isenberg, Albert Y. Liu, Libby Makowsky, and Marykate Zukiewicz, "Assessing the Effectiveness of Teach For America's Investing in Innovation Scale-Up," *READING* 35 (2015):34.

needs, and other environmental and/or policy conditions.

All components of ASSET are informed by research supporting the efficacy of the various components including: simSchool[46], gamification[47],CBE[48]. Indeed, the foundation for all content draws directly from recommendations for effective teaching with moderate to strong evidence from 17 IES practice Guides (see Appendix A)

B.2 - Costs are Reasonable

CBE development costs vary depending on breadth of reach; however, development costs of other CBE programs equivalent to ASSET's goals are comparable and the funding request for the ASSET proposal is well within this range for content and technical development,[49] and also reflects the additional costs associated with critical research related to the efficacy of simulated learning environments within CBE.

B.3 - Potential for Sustainability

The ASSET program is highly sustainable because of the online CBE environment in which it exists. Once the curricular and technical development is complete by the end of Year 1, the only ongoing costs are driven by the need for instructional coaches and for maintenance and revision based on the external evaluation and research findings. CBE's appeal is, in part, tied to cost effectiveness. In the long-term, teachers will be able to access a high-quality professional development product tailored to their specific needs, for a low cost. Further, the trend in shortage

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[46] Tandra Tyler-Wood, Mary Estes, Rhonda Christensen, Gerald Knezek, and David Gibson, "SimSchool: An Opportunity for Using Serious Gaming for Training Teachers in Rural Areas," *Rural Special Education Quarterly* 34, no. 3 (2015): 17

[47] T. Sitzmann, "A Meta- Analytic Examination of the Instructional Effectiveness of Computer- Based Simulation Games," *Personnel Psychology*, *64*(2), (2011): 489-528. (Note: Cited by 34)

[48] Robert Kelchen, "The Landscape of Competency-Based Education," (2015), https://www.aei.org/wp-content/uploads/2015/01/Landscape-of-CBE.pdf

[49] Donna M. Desrochers and Richard L. Staisloff, "Competency-Based Education: A Study of Four New Models and Their Implications for Bending the Higher Education Curve," (2016), http://rpkgroup.com/wp-content/uploads/2016/10/rpkgroup_cbe_business_model_report_20161018.pdf

areas and attrition rates for teachers over the past quarter of a century suggests that the field will continue to struggle with these professional development needs in the foreseeable future.

B.4 - Dissemination of Information and Strategies

Dissemination of information will occur internally, with our formal partners as well as externally, with our informal partners and the broader field.

Internal dissemination. We are intent on sharing information about the outcomes of ASSET with our internal partners, HumRRO and simSchool. Information will be shared internally at monthly partner meetings through discussion and through written briefs. Particularly, we anticipate sharing information about how participants engage with simSchool, how simSchool impacts the WWC practice guide competency development, and how the design of the online environment affects learner outcomes.

External dissemination. We anticipate sharing information about best practices in CBE and simulated learning environments with our informal partners-- RELs, SEAs, and LEAs who have supported the project and who have encouraged teacher participation in the project. We will do this through a variety of means, including quarterly update flyers and bi-annual webinars for our informal partners. Additionally, the external evaluator and the research team will proactively share the final report and seek to publish research findings in peer-reviewed professional publications and to present to broad teacher education audiences at national conferences. We look forward to sharing our knowledge about professional development in rural areas using CBE with broader educational communities, including other IHEs and P-12 schools.

C. Quality of the Management Plan

C.1 - Goals, Objectives, and Outcomes

Table 2. Goals, Objectives, and Outcomes for ASSET

Goal: Micro-credential module design, development, and beta-testing

Objectives for the Goal	Measurable Outcomes
ASSET staff will: Develop content for identified micro-credentials	3-5 modules will be developed for each of the 5 micro-credentials
simSchool staff will: Develop simSchool environment to reflect ASSET needs	1 simSchool environment developed for each of the 5 micro-credentials
ASSET staff will: Beta-test of CBE module prototypes with feedback	30 ASSET staff, teacher education faculty, and selected teachers complete prototype modules and provide specific feedback for module improvements
ASSET staff will: Train professional education coaches	10 coaches will be trained to answer questions, provide feedback, and review assessments for competency in the beta environment
Goal: Micro-credential module implementation, initial evaluation, and revision-1.0	
Objectives for the Goal	**Measurable Outcomes**
ASSET staff will: Recruit teacher participants through SRI	1,000-2,500 teachers in the Appalachian region participate
Participants will: complete micro-credentials	1-5 micro-credentials earned by each participant
Rockman et al staff will: Conduct formative evaluation of CBE implementation and make appropriate recommendations	1 interim evaluation report that includes:attitudes toward learning in CBE, perceived transfer of PCK to classroom instruction, strengths/weaknesses/value of materials used, participation management, etc.
ASSET staff will: make revisions prior to second round of implementation	Based on input from participants, HumRRO, and Rockman et al, ASSET staff will make revisions to the five micro-credentials and their modules
Goal: Micro-credential module implementation, evaluation, recommendations-2.0	
Objectives for the Goal	**Measurable Outcomes**
ASSET staff will: Recruit teacher participants through SRI	2,500 teachers in the Appalachian region participate
Participants will: complete micro-credentials	1-5 micro-credentials earned by each participant
Rockman et al staff will: Conduct outcome evaluation of CBE implementation	1 Outcome evaluation report that includes: fidelity to proposal and plan, efficacy of the program for teacher learning and outcomes

ASSET staff will: assess feasibility of scale	Based on input from participants, HumRRO, and Rockman et al, ASSET staff will determine if the modules are scalable (dependent on the outcome efficacy for participants)
Goal: Research question data collection, analysis, interpretation, and dissemination	
Objectives for the Goal	**Measurable Outcomes**
ASSET staff and HumRRO staff will: Identify and develop methodology for collecting, analyzing, and interpreting data reflective of the research questions	Dissemination of the research questions and the outcomes at national conferences and in peer-reviewed publications
HumRRO staff will: Identify case study sites and collect case study data	5-10 case-study sites engaging 30 teachers/administrators will provide an understanding the phenomena of CBE in teacher training

C.2 - Responsibilities, Timelines, and Milestones

To establish and execute on goals and objectives, the partnership team has established the following timeline with accompanying activities and deliverables (Table 3).

Table 3: Project timeline with activities and deliverables

Project Activity (Principal Investigators will be representatives from RU, simSchool, HumRRO, SRI, Rockman)	Year	Time Period
● Principal investigators (PIs) purchase and install hardware and software (e.g., LMS and simSchool licenses) ● PIs begin development of first set of CBE modules (5). ● PIs define instrumentation for evaluation to establish data collection and evaluation protocols. ● PIs begin implementation case study data collection via interviews & observations to establish pre-existing conditions. ● CBE Module prototypes are beta-tested with local teachers and ASSET staff. ● simSchool team begins integrating data specific to regional demographics, classroom configurations, etc., and begins to develop streamlined “regional virtualization” pipeline ● simSchool team begins improvements on UX/UI/ID to improve	1	Fall 2017

responsiveness in tablet and mobile environments ● Post purchase of LMS, simSchool team will implement a single-sign on protocol so that the (a) applicable simulations are playable seamlessly for learners and (b) any reporting data is delivered in a real-time stream into the learner's primary experience space, i.e. the LMS ● simSchool and HumRRO identify strategies for psychometric analysis of simulation performance data for formative and summative assessment purposes		
● PIs collect formative evaluation data from local teachers and ASSET staff to inform revisions to first set of CBE modules (5). ● PIs purposefully sample high-end and low-end implementation classrooms for case study analysis ● PIs analyze Spring 2018 qualitative data and formative evaluation assessments. ● simSchool completes introductory development efforts ● simSchool begins construction of learning tasks in simulations aligned to ASSET-specific content and planned areas of measurement /assessment ● simSchool and HumRRO vett assessment methodology through play testing improved simulations		Spring 2018
● PIs identify elements for program modification and update. ● PIs begin to develop second set of CBE modules (10). ● CBE modules implemented in participating schools. ● PIs conduct 1st year assessments.		Summer 2018
● Project utilizes data from 1st year to inform development of program.Selected participating teachers meet to suggest program refinements. ● PIs continue training 10 participating teachers and staff. ● simSchool analyzes data from prior year to determine iterative UX/UI/ID improvements to be made ● simSchool begins evaluation of VR feasibility for simulations	2	Fall 2018
● PIs continue implementation case study data collection via interviews & observations. ● PIs conduct mid year assessments. ● simSchool begins development of ASSET VR prototype.		Spring 2019

• PIs begin to develop third set of CBE modules (15). • PIs conduct final 2nd year assessments. • PIs file 2nd formative evaluation report. • PIs continue implementation case study data collection via interviews & observations. • Selected participating teachers meet to suggest program refinements. • PIs identify elements for program modification and update. • PIs file summative evaluation report.		Summer 2019
• Project utilizes data from 1st year to inform development of program. • Selected participating teachers meet to suggest program refinements. • PIs continue training 10 participating teachers and staff. • simSchool completes ASSET VR prototype	2	Fall 2019
• PIs continue implementation case study data collection via interviews & observations. • PIs conduct mid year assessments.		Spring 2020
• PIs conduct final 2nd year assessments. • PIs file 2nd formative evaluation report. • PIs continue implementation case study data collection via interviews & observations. • Selected participating teachers meet to suggest program refinements. • PIs identify elements for program modification and update. • PIs file summative evaluation report.		Summer 2020

C.3 - Feedback and Continuous Improvement

Formative evaluation. While developers will have an obligation to capture feedback from teachers as they are developing the modules, Rockman et al (REA) will provide additional independent feedback to support module development during the preparation of instructional materials. REA will conduct limited pilots with teacher participants to explore issues of appeal, usability, comprehension, barriers to use, perceptions of cultural appropriateness, and other issues. Methods of data collection will include observations and think-alouds as teachers work through the course simulations and materials, interviews, diaries, and focus groups (both online

and face-to-face). School and district administrators, especially PD leaders, will also have an opportunity to review the pilot materials and provide their perspective on its perceived value to the participating school systems. Using the critical incident technique, REA will monitor the entire processes of curriculum design and dissemination and training program delivery. REA will report of project progress towards timely, high quality achievement of program milestones.

A primary goal of the formative evaluation will be to develop sensitive assessments of the value and impact of the program in place for use in the implementation phase, and in the outcome plan. Radford University and HumRRO will design and pilot tools that are used for in-field validation of assessments, but to preserve the independence of the evaluation, Rockman will collect and analyze the data. REA will also review the assessments and provide feedback on the validity and reliability of the instrumentation and its implementation.

C.4 - Dissemination of Information and Strategies

There are two audiences for the dissemination of ASSET related information and strategies: internal and external.

Internal ASSET Audience. In addition to the activities, processes and infrastructure represented in Figure 1 and Table 2, the partnership will also use social networked technologies, such as wikis, blogs, social networking, and chat rooms to support the teachers in the field and provide a collaborative online environment.

Online communication will be facilitated by utilizing a Facebook Group page, a customizable, social networking platform that allows members to share their experiences and ideas, receive feedback, and decide upon and communicate needed modifications to the project in a secure environment integrating wikis, blogs and chat rooms. Collaborating online will allow the participants in several locations across Appalachia to share ideas and strategies.

A YouTube channel (http://www.youtube.com/user/RadfordEducation) created by will be populated with video tutorials and exemplar teaching models related to the proposed initiative. To date, the existing videos from previous educational technology projects have been viewed 1,136,884 times and have 1,787 subscribers from ten different countries providing the ASSET team with a national and global platform to share the products and practices developed during the proposed activities.

D. Project Evaluation

D.1 - Performance Feedback and Periodic Assessment of Progress

As the external evaluation partner, Rockman et al (REA) will report on the project team's progress towards key project milestones, fidelity of implementation of the key program components, outcomes in teacher knowledge and skills that support inclusive classrooms, and outcomes related to teacher effectiveness and retention. Formative evaluation efforts will focus on creation of modules and feedback on the validity of constructs used to represent teacher knowledge and skills in the learning management system. Implementation research and evaluation will incorporate both process measures and feedback for further development of the modules and their dissemination. Outcome studies will emphasize impacts on teachers' knowledge and skills in the classroom, teacher self-efficacy, and teacher retention. In collaboration with the project partners, REA will oversee and manage a delayed treatment study, using a cluster-randomized trial at the school or district level.

Implementation evaluation. During the second and third years, REA will examine one or more full modules being used in an asynchronous environment. During this phase of the evaluation, REA will evaluate implementation of the program and provide the project team with feedback on the following issues:

- Attitudes towards and engagement with this approach to learning
- Perceived transfer of learning in the online system to classroom instruction
- Strengths and weaknesses (and value) of the curriculum and materials
- Issues of materials and participation management (scheduling, time commitments, etc.)
- Development of a useful dashboard for program management and participant feedback

REA will conduct surveys, focus groups, and in-depth interviews with teachers and school and district administrators to identify implementation challenges and successes and provide the project team with recommendations for program development.

Beginning with Year 2, REA will monitor the LMS and project data sets to identify those teachers who have successfully achieved one of the micro-credentials. A sample of 10 teachers from the population of participants will be selected for an interview every other month for a total of 60 interviews in both Years 2 and 3. The interviews will solicit a reflection on the process of achieving the micro-credential, the level of support required, the perceived benefits to the individual, the perceived value to the school and the district, and plans for further professional development. Another 10 teachers who have initiated participation, but not engaged online for the past two months will also be interviewed to explore barriers to participation and sufficiency of benefits.

During the second and third year, REA will also collect and analyze data to validate the in-simulation assessments (triangulating them with evidence from other sources). Instruments will include: a) Pre-post survey of teacher knowledge (components covered by curriculum) and b) Observations of teacher skill (components covered by curriculum).

Outcome evaluation. During the third and final year of this initiative, evaluators and researchers will investigate the impacts of the project and the implications of what has been

learned for further efforts. REA will conduct a survey of all teachers participating in the study each semester to assess teacher participation, and variations in levels of participation by teacher characteristics and organizational variables (e.g., state and district support, evolution of teacher networks, etc.), levels of engagement (i.e., time to completion, selection and number of modules completed) and contagion of the curriculum within the regional teacher community.

Utilizing a delayed-treatment randomized controlled trial approach, REA will randomly select a subset of 15 schools assigned to the treatment group and 15 schools assigned to a delayed treatment group (i.e., "waitlist"), during Year 3. REA will provide a comprehensive external summative evaluation study during the third year to identify the overall impact of the project on teacher learning and performance, including an efficacy/fidelity analysis of the project as implemented. REA will analyze a minimum of 192 classrooms in each of the treatment and control schools in order to provide sufficient statistical power to detect impact of the program on teacher learning outcomes.[50] Data to be collected in each setting includes teachers' self-reported participation in and learning from professional development programming, and teacher and administrator perceptions of the professional development programming, instructional/learning strategies, and value for further dissemination. REA will also interview district/building administrators to get their feedback on how professional development activities have influenced teacher preparedness, effectiveness, and retention, and their interest in investing in this resource for teachers.

To assess impact on teachers' skills and knowledge, REA will gather pre-post surveys of teacher knowledge, self-assessment and self-efficacy for various components covered by the curriculum, and classroom observations of teachers' skill in implementing components covered

[50] B. Kelcey and G. Phelps, "Strategies for Improving Power in School-Randomized Studies of Professional Development," *Evaluation Review, 37(6),* (2013): 520-554.

by the curriculum (and/or focus groups in which teachers discuss their own level of skill) as well as the extent to which classrooms are inclusive to diverse learners. REA will also collect reports from teachers' superiors (i.e., performance evaluations and/or interviews with teachers' superiors) to understand teachers' level of skill on various components covered by the curriculum.

Implications of outcome studies will inform strategies for scaling, recruitment, and local/regional support: the need for further funding to develop additional modules; and dissemination of findings to a broader community.

D.2 - Valid and Reliable Performance Data on Relevant Outcomes

Validation and Research Activities for ASSET Program

Radford University and their partners recommend an argument-based validation strategy.[51] The logic model describes inputs, outputs, and outcomes for the program. The logic model specifies activities and participation information under outputs, and includes short, medium, and long term outcomes. The final long term outcome of the logic model, "Increase workforce capacity for inclusive education and teacher retention in rural Appalachia and in other rural areas beyond the grant-funded region," is supported by each intermediate outcome and output of the program. The team will construct a validity argument, collecting evidence that each successive aspect of the logic model is supported. This evidence can then be presented in conjunction with the logic model to support the overall validity of the assessment components of the program and to gauge the success of the program in achieving its goals.

The team includes an evaluation partner that will verify the main components of the program that are met. HumRRO, as the research partner, will conduct investigations into how

[51] Michael T. Kane, "Validating the Interpretations and Uses of Test Scores," *Journal of Educational Measurement* 50, no. 1 (2013): 1-73.

well the program is meeting its goals and how the assessment components contribute to meeting those goals. An excerpt from the left side of the logic model is presented as Figure 3 below.

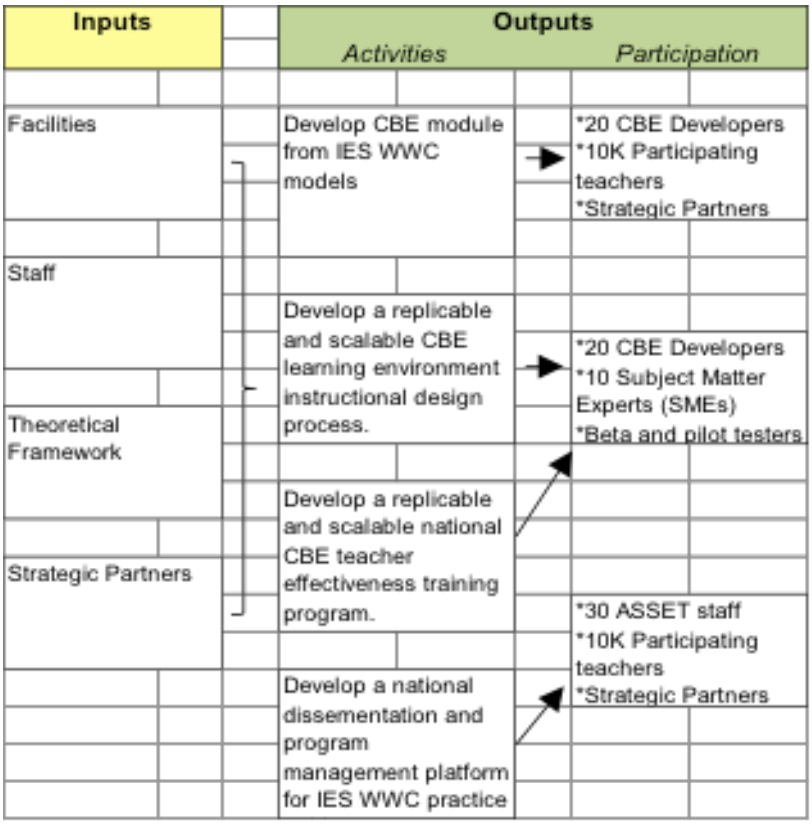

Figure 3. Excerpt of Left Side of the Logic Model

Reading the Activities column from top to bottom, the activities include the development of Competency-Based Education (CBE) Module, followed by the development of a learning environment, a national training program, and then a dissemination and management platform. Each successive activity depends on the success of the activity above it. The CBE module must be of high quality and sufficiently compelling for educators to use the learning environment to design and implement their own CBE instruction. The module and the learning environment must support the development of the training program. Beta and pilot testers should agree that CBE can be successfully implemented based on the success of the module and that the learning environment supports implementation of CBE. Finally, before national dissemination, the results

from the training program should provide evidence of improved teaching and learning. If any of these activities fail to produce the expected results, it would undermine all the activities that fall under it.

The dependencies are even more obvious when looking at Program Goals (see Figure 4). The attainment of the long-term goal is dependent on accomplishing the medium-term goals, which are in turn dependent on accomplishing the short-term goals. HumRRO will develop a research agenda indicating specific studies or evidence necessary to support each dependent step toward the program goals. The validity argument will answer a series of "if, then" statements designed to support the logic model. These statements are testable by direct data collection from participants (e.g. surveys, interviews, etc.).

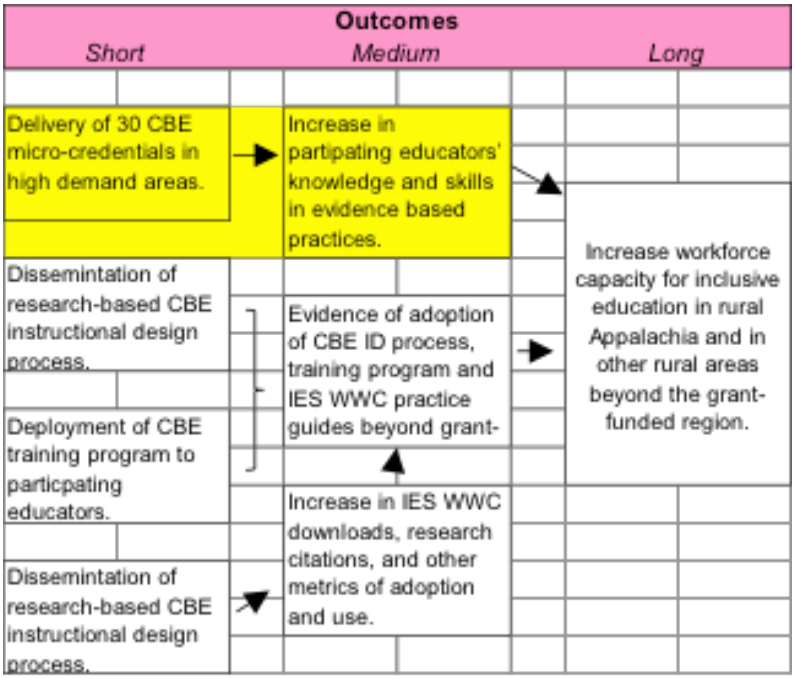

Figure 4. Excerpt of Right Side of the Logic Model

HumRRO will develop the series of "if, then" statements suitable for inclusion in an overall validity argument in parallel with program activities. Earlier activities will necessarily be investigated before those occurring later in the project. These statements will be investigated and

evidence for their veracity documented. Any instance of weak or poor evidence will create a "feedback loop" whereby the evidence will be shared among the partners and efforts will be made to improve or bolster the evidence before that aspect of the logic model can undermine subsequent activities or goals. HumRRO will act as an active research partner, invested in ensuring program success. This allows the combining of rigorous research methods and advocacy without compromising either. Our goal is to provide reasoned internal criticism of the program before widespread implementation, to provide actionable recommendations to address any criticism, and to help the team prepare for external scrutiny.

HumRRO's timeline will follow the development schedule for the full project, focusing on module and assessment development in Year 1, implementation, impact, and assessment validation in Year 2, and attainment of short- and medium-term goals in Year 3. A full validity plan and research agenda will develop in cooperation with the team during the first six month of the project. Specific studies will be carried out, and accompanying reports delivered according to that plan. A sample of proposed studies for Year 1 are outlined below.

Study 1: Alignment of Modules and simSchool Assessments

One early study that we present, in brief, as an example is an alignment study linking the content of the modules and the associated simSchool assessments. To be valid, the simSchool assessments must measure key aspects of the modules. The assessment must have demonstrated variance that coincides with participants' levels of attainment of the knowledge, skills and abilities inherent in the module, and badging must be indicative of competency of the knowledge, skills, and abilities. This study will be conducted as soon as the first 5 modules are complete and ready to field test. The methodology, briefly, will require content experts to review the modules and identify the knowledge, skills, and abilities they are designed to improve among

participants. This review will include simple coverage (is it there) as well as depth (how much/how deeply) is this content expected to be learned/acquired. The content experts will then conduct much the same review for the simSchool assessment(s) associated with the model. The areas of consistency and areas unique to either the modules or assessment will be documented. From this recommendations for improving the modules, the assessments, or both will be generated. This study will help the team improve the models prior to field testing and limit the necessary revisions required before operational use. This study, and others, will be carried out based on the prioritization of the team. A full study plan will be submitted to the team for review and discussion before any study is carried out. This will ensure that the most relevant aspects of the ASSET program are investigated and that no duplication of effort occurs among the team members. All reviews will be carried out via email and during the monthly team meetings.

Study 2: simSchool Assessment Psychometric Review

HumRRO will review the data collected by simSchool related to the ASSET program for common classical assessment statistics. We will flag items[52] for poor performance (p-values, biserial correlations, etc.). In addition, the information from the simSchool assessments is used to create feedback for participants. It is important that this feedback represents reliable unique information. HumRRO will conduct confirmatory factor analyses to verify that any sub-score data are appropriate and provide valid information for teachers to act on.

Analyses may also be conducted based on Item Response Theory (IRT). Scaling and equating should ensure that participants' information is comparable from participant to participant, and from year to year. Scale scores allow us to gauge improvement irrespective of what part of the scale a candidate's score falls on. It is important that these scales are sufficient

[52] Items refer to any data gathering point that is aggregated into a score. This could be any selected variable the candidate chooses in the simulation.

for their purpose (e.g. have enough range to accommodate any cut scores and provide sufficient detail to accurately depict growth), and that they are easily understood by the field. HumRRO psychometricians will review scaling and equating procedures (including efforts to maintain scale stability over time), data from IRT analyses, and score/profile reports for best practice based on the Standards for Educational and Psychological Testing (AERA, APA, & NCME, 2014).

D.3 - Methods to Produce Evidence of Project's Effectiveness

Study 3: Planning for Direct Measures of Impact

One of the most important roles HumRRO will take on during the course of this work is that of research consultant. As participants and schools are recruited, it will be important to keep records of important characteristics of individuals and institutions who implement ASSET. This will allow us to select an appropriate comparison sample using propensity matching to satisfy the requirements of Quasi-Experimental Design (QED). We will monitor changes in the endorsement rates for competency education among participants. We will monitor performance of students and teachers based on qualitative data (interviews and surveys), and quantitative data (e.g. test scores, grades or grade point average, retention, etc.) when such data can be made available. We will also help the team characterize the data in the most meaningful ways. Statistical significance is important, but rarely helps us determine how well an intervention is working. We will compute effect size statistics, characterize changes in variance by group, and display changes in participants' perceptions of their own capabilities, as well as the impact of ASSET on their students. These measures should be ongoing throughout the program so that any unexpected changes in the way ASSET is perceived, or any changes in the impact of the

program, are discovered prior to them becoming a threat to the validity and success of the program.

At the beginning of each year of the program, HumRRO will create a research agenda. The agenda will indicate the evidence and research needed to support the program. We anticipate that the research agenda will include a large number of potential studies. The team will then prioritize the research and create a research plan for the year. HumRRO will create research study white papers based on the prioritized list. These studies will be reviewed by the team and finalized. They will then guide the research for that year. Specific deadlines for each research study report will be set. Any important or time sensitive preliminary findings will be shared at the monthly meetings.

Human Subjects

Human subject research approval will be obtained through Radford University's Institutional Review Board (IRB). The process for the research is described in the Nonexempt Research Narrative. Specific questions concerning the IRB approval process at Radford University in relation to this grant application can be addressed through the IRB Coordinator's office at irb-iacuc@radford.edu or (540) 831-5290.