Virginia Initiative for Science Teaching and Achievement (VISTA)

Validation Grant Proposal

A. Need for the Project and Quality of the Project Design

Science teaching in Virginia, as in the country, is hindered by two fundamental, unmet needs. Elementary faculty very often have teaching degrees but lack a solid grounding in the inquiry-based nature of science (Akerson & Abd-El-Khalick, 2003; NRC, 1997; NCMSTTC, 2000). On the secondary level, teacher shortages have led to the hiring of many uncertified teachers who have science degrees but little or no teaching experience or training (NCMSTTC, 2000; NRC, 2007). These distinctly different problems in teacher preparation by grade level lead to a common result: Student achievement in science suffers.

The *Virginia Initiative for Science Teaching and Achievement* (VISTA) is a partnership among 47 school districts, six universities, and the Virginia Department of Education to build an infrastructure to provide sustained, intensive science teacher professional development to increase student performance. The goal of VISTA is to improve science teaching and student learning of science throughout Virginia. This proposed program is based on the statistically significant improvement in science instruction and student performance of two teacher professional development programs. We will extend these programs and the ongoing research to other school districts in Virginia. Required matching funds have already been assured.

An Exceptional Approach

VISTA proposes a comprehensive professional development model to improve K-12 science teaching. Our Learn, Try, Implement with Feedback and Research model with a focus on continuous improvement was incorporated into two programs that have produced statistically significant gains in teacher instruction and student achievement in three large Virginia school districts. A graphic representation of this model can be found in appendix H page 4. VISTA continues research on these programs and this model as they are validated for wider distribution in Virginia. The programs target teacher needs by grade level:

- Upper elementary (grades 4-6) teachers receive professional development in scientific, problem-based learning (Delisle, 1997; Hmelo-Silver, 2004; Krynock & Krynock, 1999; Shack, 1993; Stepien & Gallagher, 1993) as well as student-centered inquiry (Brooks & Brooks, 1993). These teachers work in teams as they *learn* about problem-based learning and receive *feedback* as they *try* inquiry-based science teaching in a summer enrichment camp for children. Follow-up professional development helps them *implement* science-based approaches to traditional classroom settings and conduct *research* on their students' learning.
- Uncertified or provisionally licensed secondary (grades 6-12) science teachers have degrees in science but little or no training in teaching. They *learn, try,* and *implement* how to teach on the job. For two years, VISTA provides just-in-time support and "big picture" *research*-based teaching coursework. A unique aspect of this program is the community of practice support, including an in-class coach, a retired science teacher, who provides *feedback* and helps the new teacher plan, teach, and problem-solve about teaching. This is a combined middle and high school program because science teaching licenses are grades 6-12.
- VISTA also builds a state infrastructure involving the State Department of Education, K-12 school district science coordinators, specialists, principals, and science and science education professors. They provide the leadership, resources, and support needed to extend quality teaching to all students, including students from rural areas and students with limited English proficiency and with disabilities and other special needs.

The Learn, Try, Implement with Feedback and Research model with a focus on continuous improvement is unique. Coupling it at the elementary level with in-depth problem-based learning over an extended period of time for students, and at the secondary level with a cohesive community of practice with just- in-time coaching and research-based teaching professional development, is innovative. Research, in the next section, demonstrates that these two programs significantly increase the quality of teaching and student learning.

George Mason University in Fairfax, VA, is the eligible applicant leading this five-year validation program, which will focus on:

- **Absolute Priority 1.** Innovations that support effective teachers and principals
- **Competitive Preference Priority 6.** Innovations that support college access and success
- **Competitive Preference Priority 7.** Innovations to address the unique learning needs of students with disabilities and limited English proficient students
- **Competitive Preference Priority 8.** Innovations that serve schools in rural LEAs

National and State Need for the Project

In January 2010, Virginia revised and adopted K-12 standards in science that build toward college- and career-readiness. The revised Science Standards of Learning (SOL) mark a continuing shift from factual fluency to conceptual understanding. Nonetheless, many teachers lack the skill to teach conceptual understanding of science effectively, and the state lacks a cohesive and informed infrastructure to support teacher professional development in science.

VISTA provides innovative approaches to teaching and learning to bring lasting change to our schools, including high-needs schools, while having teachers investigate and evaluate what works and what can work better to help students learn. This program provides solid grounding in the inquiry-based nature of science for teachers through intensive professional development and evidence-based instructional models and supports. A logic model can be found in appendix H page 3. Our proposal develops and supports effective teachers, with a focus on improving the effectiveness of teaching in high-need (high-poverty, high minority) schools to support college readiness.

Well-prepared teachers have the greatest impact on increasing student achievement (Darling-Hammond 2000, 2003). The Educational Testing Service found in its study *How Teaching Matters* (Wenglinsky 2000) that student achievement increases when teachers are well-versed in effective teaching strategies.

In elementary school, as a result of the increased focus on language arts and mathematics, there is a lack of science teaching and in particular, inquiry-based teaching, as called for in the *Virginia Science Standards of Learning* (2010) and *National Science Education Standards* (1996). VISTA provides intensive support and effective interventions to help teachers learn science content and develop the experience and confidence in teaching inquiry-based science.

In middle and high school, there is a growing shortage of science teachers in Virginia and the nation, so school districts are forced to hire teachers with science degrees, but with little or no teacher training. In Virginia, 8% of science teachers are provisionally licensed (P. Klonowski, VDOE, personal communication, March 25, 2010). Research (Darling-Hammond, 2000, 2003) indicates that 66% of these teachers leave teaching within three years (Ingersoll 2000; Ingersoll and Perda 2009; Marvel, Lyter, Peltola, Strizek, and Morton 2006). High costs are linked to continually hiring, training, and losing teachers, not only in dollars but also in school morale and student achievement. VISTA provides professional development and classroom coaching to provisionally licensed teachers so “learning on the job” is more rewarding and successful, and teachers are more likely to stay in the profession.

The program will also focus on access to college and careers, address the learning needs of students with disabilities and limited English proficiency, and serve schools in rural LEAs.

Project Design – Clear Goals and an Explicit Strategy

Primary objectives for the *Virginia Initiative for Science Teaching and Achievement:*

- Increase student learning in science including students with special needs and LEP
- Enhance quality of elementary science teaching by including inquiry-based teaching
- Enhance the quality of teaching by new, underprepared secondary science teachers, including having students conduct inquiry-based laboratory activities
- Increase the number of certified middle school and high school science teachers
- Increase access for rural teachers to professional development
- Build the state infrastructure to support effective science teaching and learning
- Conduct research to determine what makes the most significant difference in helping teachers to help students learn

VISTA is designed to increase the number of highly effective teachers, especially those in high-need schools, by identifying, recruiting, developing, rewarding, and retaining highly effective teachers. All school districts in Virginia were invited to participate in VISTA. Forty-seven (covering 61% of the student population) sent letters of commitment. All schools districts and their demographic information are list on pages 1-2 of appendix H. The students in these school districts are 55% white, 45% non-white; 30% qualify for free and reduced-price lunch. VISTA will enlist LEAs to **recruit** teachers to be randomly assigned to treatment or control groups. Treatment teachers receive intensive professional teacher **development** and are **rewarded** by having these institutes and coaches paid for and being part of a cohesive community of practice. To build a broader perspective, they will present at the annual state science conference. Research will be conducted to verify predictions that the teachers receiving support will be **retained** in the profession and have students with higher test scores.

Teacher effectiveness will be determined through a rigorous evaluation system that uses multiple measures of teaching effectiveness, including data on student performance and growth.

VISTA provides an exceptionally strong, multifaceted support system for science teachers (Absolute Priority 1) that includes school district science coordinators, principals, and college faculty and conducts longitudinal research concerning effects of each part of the program on helping students learn. Administrators will be trained so they are an integral part of the support team, and university faculty will collaborate across disciplines and institutions.

Professional development will be offered in the state population centers with the most uncertified teachers: Washington DC area (George Mason), Richmond (Virginia Commonwealth University), and Tidewater (College of William & Mary). Rural teachers will have expenses paid to travel to intensive summer institutes and have follow-up distance learning available.

Elementary Institutes and Secondary Courses Timeline

Institutes/Courses	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Elementary Teachers	3	6	6	6	6	27
Secondary Teachers	3 basic	3 basic 3 advance	3 basic 3 advance	3 basic 3 advance	3 basic 3 advance	15 basic 12 advanced
New Science Coordinators	1	1	1	1	1	5
College Faculty	1	1	1	1	1	5

5 Year Participants Timeline

Participants	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Elementary Teachers	60	120	120	120	120	540
Secondary Teachers	60	120	120	120	120	300
Student Enrichment	72	144	144	144	144	648
Student Impact	9,300	18,600	18,600	18,600	18,600	83,700
Principals	30	60	60	60	60	270
Science Coordinators	15	15	15	15	15	75
College Faculty	12	14	14	14	14	68

Elementary School Teacher Professional Development

The support system includes a four-week summer institute and follow-up academic year support. The summer institute for elementary teachers spends Week 1on learning a particular area of science and how to conduct inquiry-based science teaching, Weeks 2 and 3 on collaboratively teaching inquiry-based science to high-needs students in a problem-based summer camp setting, and Week 4 on reflecting on their summer teaching experience and planning to implement inquiry-based teaching during the academic year. An overarching theme of continuous improvement will permeate the institute (Akerson, Cullen, & Hanson, (2009). With the oversight of the STEM Team (described in section G), science topics will be selected based on the lowest-scoring areas of science on state tests for students and a needs assessment of teachers. Teams of university science educators, scientists, and engineers, along with science classroom teachers and mathematics specialists, will co-plan and co-facilitate the summer learning experiences. Principals and school district science coordinators will attend part of the training to become acculturated with the science teaching and inquiry process. During the academic year, the teachers will implement inquiry-based science in their classrooms and meet to share and analyze samples of student work. They will attend the Virginia Association of Science Teachers (VAST) annual conference to learn about science teaching, learning, and resources on a statewide basis and meet with VISTA teachers for further professional development.

This program features another innovation that supports college access and success (Priority 6). Parents of high-needs children are invited to attend the last day of camp at a university campus, where they spend the morning with college counselors learning about student preparedness, the college admission process, and financial aid. After they eat lunch with their children in a dining hall, the parents hear their children present solutions to the science problems they have been investigating and help celebrate their success. This positive introduction to college starts the process of preparing children for college and meaningful careers.

Elementary Science Institute Timeline

Elementary institute	Summer	Academic year
Grade 4-6 teachers of science	4 week institute	3 follow-up sessions
		Present VAST conference
		Classroom Coaches - 3 visits
Principals	1 day during institute	Newsletters
Science Coordinators	2 days during institute	Attend VSELA conference
Coaches – retired science teachers	5 days during institute	2 days coach training meetings

Secondary School Teacher Professional Development

In the middle and high school program, uncertified teachers receive, for two years, four forms of support: coaches, basic science methods courses (three graduate credits), advanced science methods courses (three graduate credits), and a website to provide resources during and after the program to meet the needs of diverse learners and for using technology in teaching.

The basic science methods course starts with one week of planning before the school year begins and then has seven follow-up sessions during the fall semester where the teachers analyze samples of their students work. The course builds fundamental knowledge of (1) standards-based curriculum design, (2) research-based teaching strategies, (3) inquiry-based lessons for students to investigate science, (4) assessing student understanding of science, and (5) classroom management strategies. The teachers create an annual instructional plan, teach an inquiry-based lesson they would teach the first week of school, and plan a ready-to-teach four-week unit with all support materials. During the fall semester, the teachers observed videotapes of themselves teaching and students' learning. Further, they conducted research on student learning.

Research indicates that a second science methods course is needed to provide teachers the time needed to develop in-depth knowledge of effective science instruction (Abd-El-Khalick, Bell, & Lederman, 1998; Lumpe, Haney, Czerniak, 2000; Roehrig & Luft, 2006). The second course builds on the fundamentals of curriculum design and teaching from the first science methods course. The course focuses on (1) using technology for students to investigate science and (2) adapting inquiry-based lessons to the special needs of students.

The in-class coaches are retired science teachers, who help the new teachers plan, teach, and problem-solve. The courses enable teachers to develop professional knowledge about effective teaching and learning. To provide a broader perspective of teaching and learning, these teachers will attend in Year 1 and present in Year 2 at the annual state science teachers' conference. Based on previous research, we predict this support will improve science instruction and student performance on the Virginia Science Standards of Learning tests.

The school districts involved in the pilot study for the middle and high school program have 54% of the English Language Learners in the entire state enrolled in their schools (Priority 7). In the pilot, 71% of the new teachers served in high-needs schools, thus addressing a largely unmet need. We expect to be able to help other school districts serve their neediest students.

Secondary Science Methods Courses Timeline

<table>
<tr><th>Secondary science methods courses</th><th>Summer 1</th><th>Academic year 1</th><th>Summer 2</th><th>Academic year 2</th></tr>
<tr><td rowspan="3">Provisionally certified middle and high school science teachers</td><td rowspan="3">basic science methods course
1 week</td><td>7 follow-up sessions</td><td rowspan="3">basic science methods course (if not hired before school starts the first year) - 1 week with 7 follow-up sessions in fall</td><td>advanced science methods course</td></tr>
<tr><td>attend VAST conference</td><td>present at VAST conference</td></tr>
<tr><td>Classroom Coaches
12 visits</td><td>Classroom Coaches
3 visits</td></tr>
<tr><td>Coaches – retired science teachers</td><td>1day during course</td><td>4 coach training meetings</td><td>1day during course</td><td>4 coach training meetings</td></tr>
<tr><td>Science Coordinators</td><td>1day during course</td><td>Attend VSELA conference</td><td>1day during course</td><td>Present VSELA conference</td></tr>
</table>

State Level Infrastructure

This program enhances knowledge and builds a community of practice focused on continuous improvement. This program gives teachers the resources to support student success and moves toward comparability in resources between high- and low-poverty schools.

Infrastructure Participants, Training, Teacher Support, and Networking

Infrastructure Building	**Professional Development**	**Elementary Institutes**	**Secondary Courses**	**VSELA**
School Division Science Coordinators	New Science Coordinators 1 week	2 days participation if teachers from school district attending	1 day participation if teachers from school district attending	2 days
Science Education University Faculty	Science Education Faculty 1 week	Co-instructors for institutes	Co-instructors for courses	2 days
University Science Faculty		Co-instructors for institutes	Science advisors	

School District Science Coordinators: All school districts have a designated science coordinator. The Virginia Science Education Leadership Association (VSELA) consists of science coordinators, department heads, specialists, lead teachers, professional employees of state, regional or governmental science education resource facilities, and faculty members in Virginia institutions of higher learning. Many new members are district leaders with a Master of Education in Administration and Supervision but no focused preparation as a district-level science leader, or science is not their primary job responsibility. VISTA will provide a five-day New Science Leader Academy aimed at: (1) honing science leadership skills, (2) developing a district-level, inquiry-based science strategic plan, (3) creating standards-based curricula, (4) developing effective teachers and leadership capacity through science communities of practice, (5) using data to make program decisions and improve student achievement..

A team of district-level science leaders, university science educators, and other science education experts will plan and deliver the institute instruction. VISTA would provide an extra day to the one-day VSELA Fall meeting to focus on professional growth activities for the entire membership, including new and veteran science education leaders.

Science Education College Faculty: In almost all of Virginia's universities and colleges, the science education faculty consists of a single person, so networking is crucial to them. VISTA will provide a five-day Science Education Faculty Academy aimed at: (1) learning about new research, (2) sharing effective teaching strategies, (3) problem-solving, and (4) networking.

University Science Faculty: Selected science faculty will co-teach with science education faculty members and specialists in math, limited English proficiency, and special education. The university faculty will learn about the challenges that elementary teachers face while contributing to the elementary teachers' knowledge of science and understanding of what a scientist does.

College Access and Success

This program supports college access and readiness (Priority 6) in several ways: (1) As students understand science and technical careers, they understand what skills and knowledge are needed to prepare for college and careers. The elementary teachers will work with practicing scientists, thus becoming more aware of science careers and the necessary preparation. (2) Advising is provided for all parents of children from high needs schools who attend the summer camps. (3) Having secondary science teachers who are certified and effective at teaching science will prepare students for science careers and college through greater understanding of science.

Disabilities and Limited English Proficiency

VISTA will address the unique learning needs of students with disabilities or with limited English proficiency (Priority 7). One Co-PI is a LEP specialist for science, and a support team faculty member is a special educator. They will help embed meeting the needs of LEP and special education students in all professional development. In addition, the second science methods course for secondary teachers will focus on disabilities and LEP for half the course.

Rural and Distance Learning Support

To address the needs of rural LEAs (Priority 8), Virginia Tech will serve as the rural coordinator for VISTA. A blended approach of "face to face" and synchronous distance learning will be used. The VT representative will meet technological needs so rural elementary and secondary teachers can engage in meaningful follow-up through the lead professional development sites. The rural coordinator will provide training and assistance setting up the equipment at home or school. The VT representative will also identify elementary and provisionally qualified secondary science teachers and partner them with qualified coaches.

The technology hub will be located at Mason, but will establish STEM satellite sites at VCU and WM so their courses/initiatives can be broadcast from each site. VISTA technology leadership will be provided by the Mason distance learning team.

Consistent with Research

VISTA is an extension of and consistent with the research described in the next section.

B. Strength of Research and Significant Effects

VISTA will attempt to replicate and expand two programs whose efficacy in improving both teacher quality and student learning have been documented. Much of the research was done by the PI and one co-PI, who were acknowledged by the US Department of Education (2010) as one of four national research programs that met its rigorous research criteria in 2007-2008.

The CREST Science Camp forms the foundation for the elementary institute. For 13 years, preservice and inservice elementary teachers plan and implement a problem-based learning summer enrichment camp for children in grades 4-6. The award-winning camp has been shown to significantly improve the science achievement of the teachers' students. VISTA will replicate the camp in other locations as part of the elementary institute for teachers and expand on the scaffolding needed to help students investigate science like a scientist.

The New Science Teachers' Support Network is a six-year program in which science teaching coursework and retired master science teachers mentor uncertified middle and high school science teachers for two years in meeting the needs of diverse learners. Through a study funded for $932,269 by the National Science Foundation, NSTSN has been shown to improve significantly student achievement and teachers' growth in numerous INTASC standards areas. VISTA will formalize the coach/mentor training so that it is more consistent and replicable.

Prior research

<u>New Science Teachers' Support Network (National Science Foundation; 2003-2010)</u>

Target population: Uncertified secondary science teachers (N=59) in three school districts and 35 schools; 10,367 students; VA Science SOL scores for 5,839 students.

Strategy: Provide two years of support to uncertified teachers, including methods instruction, in-class support by a retired master science teacher, peer mentoring, website support in meeting the needs of diverse learners, and science content support by university science faculty.

Design and results: Quasi-experimental with randomly assigned treatment and controls, mixed methods (T= six years).

- Average pass rate on VA Science SOLs for students of treatment teachers was 8% greater than control and advanced proficiency pass rate was 5% greater. Treatment teachers' students got better course grades. Controlling for GPA, socio-economic status, gender, ethnicity, disability, ELL, treatment teachers' students were 1.225 times more likely to pass SOL tests.

- Students in the classes of treatment teachers performed significantly better on Science SOLs than students enrolled in the classes of control teachers who did not receive support (M_T = 37.50, SD_T = 8.26, M_C = 35.80, SD_C = 8.53, t(5837) = 7.61, *p* = .001).
- Treatment teachers' skills improved significantly in INTASC standards areas of instructional skills, classroom management, and planning, according to coach ratings.
- Policy recommendations based on findings: Sterling, D. R., & Frazier, W. M. (2010, March) Annual International Conference of the National Association for Research in Science Teaching, Philadelphia; Frazier, W. M., & Sterling, D. R. (2009). The Science Teacher, 76(5), 34-39; Sterling, D. R., & Frazier, W. M. (2010), Principal Leadership, 10(8), 48-52.

Science Explorers (MSP, Virginia Department of Education; 2007-2008.

Target population: Elementary teachers (N=28) in two schools targeted by the school district as in need of remediation; elementary students (N=730)

Strategy: Provide science content and pedagogical support through summer professional development, in-class support and after school and weekend professional development during the academic year in inquiry-based science instruction, including science content support, problem-based learning, experimental design, and action research on students' learning.

Design and results: Quasi-experimental with treatment and matched controls, mixed methods (T= 1.5 years)

- Students of the treatment teachers made significantly higher gains on teacher-developed content tests as compared with students of matched teachers.
- Received an award in 2009 from the participating school district for outstanding service and extraordinary commitment to all students of the school division.

- Named by U.S. Department of Education as "one of the four final projects whose evaluations passed the rigorous guidelines set forth in the Criteria for Classifying Designs of MSP Evaluations" (p.54) in MSP's Summary of Performance Period 2007 Annual Reports (2010).

Science Problem-Based Learning Camp with High Needs Students

Target population: Elementary teachers (N=6) from one school district and preservice teachers (N=21); elementary students who had recently completed sixth grade (N=60)

Strategy: Students participated in a problem-based learning enrichment camp that was planned and implemented as part of preservice and inservice teachers' training in how to teach inquiry-based science via a problem-based learning approach.

Design and Results: Mixed methods (T=1 summer)

- Student scores (N=50) increased significantly by 9% from pre- to post-test, t (49) = 3.54, *p* = .001 with an effect size of .56 indicative of a medium effect on students' content knowledge.
- Inservice teachers enhanced their ability to articulate what problem-based learning was, what it looked like in the classroom, and how to implement it.
- On average, teachers ranked the experience as a 4.5 on a scale of 1 (poor) to 5 (excellent).
- Research publication with high needs children, Sterling, D. R., Matkins, J. J., Frazier, W. M., & Logerwell, M. G. (2007). Science camp as a transformative experience for students, parents, and teachers in the urban setting. *School Science and Mathematics*, *107*(4), 134-148.

Science Problem-Based Learning Camp

Target population: Elementary students recently completed grades 4-6 (N=116)

Strategy: Students participated in one of three different problem-based learning camps planned and implemented for teacher professional development in how to teach inquiry-based science.

Design and results: Mixed methods (T=3 summers)

- Statistically significant content gains as large as 9% and an associated effect size of .69, indicating larger-than-medium effect of the teacher participants' summer (problem-based learning) curriculum on students' content knowledge and skills.
- Research published in Frazier, W. M., & Sterling, D. R. (2008a). Problem-based learning for science understanding. *Academic Exchange Quarterly, 12*(2), 111-115.

Science Problem-Based Learning Camp Dissertation

Target population: Preservice teachers in three different pedagogical training settings offered at one university, where only one group used camp as the field experience (N=60)

Strategy: Students participated in a problem-based learning enrichment camp planned and implemented as part of one set of teachers' training in how to teach science via a problem-based learning; two control groups got pedagogical instruction but not camp planning and teaching.

Design and results: Quasi-experimental with one treatment group of preservice teachers and two comparison groups (T=1.5 years)

- Teachers exposed to the camp experience showed significant growth in their science content knowledge and were significantly more confident to teach science than a control group.
- Qualitatively, teachers exposed to the camp had significantly greater understanding of the nature of science compared with the other two groups.
- Unpublished dissertation was nominated for an American Educational Research Association (AERA) Division K Outstanding Doctoral Dissertation Award.
- Logerwell, M.G. (2009). *The effects of a summer science camp teaching experience on preservice elementary teachers' science teaching efficacy, science content knowledge, and understanding of the nature of science*. Unpublished dissertation (UMI No. 3367054).

Importance

Improving teacher effectiveness is an intermediate but very important variable strongly correlated with improving student outcomes. The program also calls for developing a state infrastructure to support effective science teaching and learning. Prior research, including the New Science Teachers' Support Network and Science Explorers, provides evidence that a partnership with a school district and university improves science teaching and student learning.

Magnitude of Effect

Virginia is the 12^{th} largest (pop. 7.77 million) and eighth-most diverse state in the country (67% White, 20% Black, 7% Hispanic, 5% Asian, and 2% Other). VISTA will affect hundreds of high-needs students in the science enrichment camps, tens of thousands of students whose classroom teachers receive professional development, and 760,000 students in the districts whose school district science coordinators and other administrators will receive professional development. In addition, VISTA can anticipate cumulative gains in student achievement in the affected schools and school districts as the infrastructure improves science teaching at all levels.

C. Experience of the Eligible Applicant

The lead applicant is George Mason University, a major research university in Northern Virginia, minutes from Washington DC. Since it was founded in 1972, Mason has earned a reputation as an innovative, entrepreneurial institution as demonstrated by its selection in the 2009 *U.S. News and World Report* rankings as the **"top up and coming school in America."**

Mason has more than 32,000 students in nearly 170 degree programs at undergraduate, masters, doctoral, and professional levels. The university has substantial experience with complex projects and each year manages more than 800 sponsored projects funded for more than $100 million. The university has more than 75 research institutes and centers. Mason has everything necessary to conduct large-scale projects and is in full compliance with the Education Department General Administrative Regulations (EDGAR).

The Virginia Initiative for Science Teaching and Achievement (VISTA) will be hosted at George Mason by the Center for Restructuring Education in Science and Technology (CREST) in the College of Education and Human Development (CEHD) and in collaboration with the science and engineering departments.

The CEHD Graduate School of Education's (GSE) degree, licensure, and certificate programs focus on teacher and counselor preparation, advanced studies for teachers and school leaders, instructional technology, and research training. Mason trains more than a quarter of the educators in Northern Virginia and is the second-highest annual producer of new teachers and school administrators for Virginia. Of special note, CEHD houses the Helen A. Kellar Institute for Human disAbilities (KIHd), with more than 85 special education collaborations and/or partnerships, to serve PreK-12 school needs across Virginia, plus major collaborations with six other state universities. Over the past ten years, KIHd's technology-enhanced distance education infrastructure has spawned increasing collaboration. KIHd has three eLearning classrooms and two eLearning conference rooms, and a virtual conference center.

The Principal Investigator, Donna R. Sterling, is the director of the Center for Restructuring Education in Science and Technology. She and colleagues have published extensively about interventions that have produced statistically significant gains in student achievement, plus teacher knowledge, satisfaction, and retention, as documented in Section B.

Center for Restructuring Education in Science and Technology

CREST focuses on providing quality science, mathematics, and technology education from early childhood through adulthood. Among grant-funded programs are:

1. ***GK-12 SUNRISE*** (NSF DGE-0638680), funded for $3 million from 2007-2012. SUNRISE is a graduate student and K-6 project in which science, technology, engineering, and mathematics graduate students work with teachers in high needs schools from three school districts to implement Information Technology (IT)-rich STEM content-knowledge into grades 4-6 education. Research indicates significant gains among graduate fellows in communications skills and self-reported gains among elementary school teachers.

2. ***New Science Teachers' Support Network*** (NSF DUE-0302050) is funded for $932,269 from 2003-2010. NSTSN, an award winning program, creates an integrated support system for provisionally licensed middle and high school science teachers and researches what affects the success and retention of these teachers. Selected results are detailed in Section B.

3. ***CREST Science Camp*** is a 13-year-old university day camp that offers exciting science exploration for students entering grades 5-7 and teaching experience for Mason pre-service elementary education teachers since 1997. Significant results are detailed in Section B.

4. ***Project Alliance*** (NSF ESI-9355753), funded for $1.3 million, with $793,847 for GMU from 1994-1998, was a multi-state, school, university, and community partnership conducted by the American Association for the Advancement of Science and Mason for interdisciplinary teams to design and pilot standards-based environmental science units. More than 20 presentations included: AERA, NARST, NSTA, AAAS, NMSA. Publications included: Sterling, Olkin, Calinger, Howe, & Bell. (1999); Sterling & Olkin (1997); and Pabst (1994).

5. ***Carnegie Academy for Science Education*** (NSF ESI-9353462, 1994-1999, subcontract for $225,308 for external evaluation) was a teacher enhancement program conducted by the Carnegie Institute of Washington for 445 preK-6 teachers in 63 DC Public Schools. As external evaluator, Dr. Sterling completed yearly reports and final summative report.

6. ***Alliance for Minority Participation*** *research* (NSF HRD-9729401) was funded for $44,393 for 1997-1999. The research identified barriers and facilitators for African American STEM majors in six states. Dr. Sterling was PI with doctoral student A.L. Hall (Ph.D. 1999).

D. Quality of the Project Evaluation

SRI International's Center for Education Policy will conduct the external evaluation of VISTA. With key staff based in Menlo Park, California and Arlington, VA, SRI has extensive expertise in the design of complex evaluations, including innovative approaches to survey administration, case studies, rigorous analysis of instructional strategies for science, technology, and mathematics education, and rigorous studies examining learning outcomes.

Evaluation Purposes

VISTA evaluation objectives: (1) assess the planning, resource allocation, and collaboration between the higher education partners and Virginia Department of Education in support of VISTA; (2) document the implementation of VISTA's elementary and secondary school teacher professional development components and provide formative feedback to the partners to support accomplishment of objectives; (3) track and assess the extent to which the project interventions promote positive outcomes for teachers and students; (4) examine the long-term sustainability and institutionalization of VISTA in Virginia. The evaluation design will collect and analyze data on implementation and on the impact of VISTA on science teaching and student achievement in science.

Evaluation Research Questions

The evaluation questions guide VISTA's implementation (1-5) and outcomes (6-10):

(1) What are the characteristics of the elementary and secondary teacher professional development interventions enacted in the schools and districts where VISTA is being

implemented? (2) How do the collaborating universities and school districts work together to support the development of a strong partnership to implement VISTA? (3) To what extent have participating schools and districts promoted the conditions in which change can occur in elementary and secondary school science instruction? (4) What are the broader contextual factors and school system supports that enhance or hinder implementation of the interventions? (5) What is the evidence that VISTA can be successfully sustained and transferred to other school districts in Virginia? (6) What is the impact of VISTA on elementary teachers' use of inquiry-based instructional practices? (7) How do the interventions support the building of communities of practice in the school districts that participate? (8) What is the impact of VISTA on secondary teachers' use of inquiry-based laboratory activities? (9) What is the impact of VISTA on three-year credential rates for provisionally certified science teachers? (10) What is the impact of VISTA on students' achievement on science SOLs?

Elementary Grades Design

The impact analysis will use an experimental design. Random assignment will be conducted at the school level. Every year, one-third of the schools recruited will be assigned to a control group. The following year, "control" schools will progress into "treatment" status. Such "delayed start" randomized trials can facilitate recruitment because "control" schools know that they will eventually receive the desired treatment. We recognize, however, that some individual teachers in both treatment and control schools will participate in non-VISTA professional development. Using the spring teacher survey, we will gather data on participation in non-VISTA professional development and include these data in our analysis. This design should yield 420 treatment teachers (pooled across grades and years) and 210 control teachers for implementation and teacher outcomes analyses. Because no SOL state exam is given in grades 4 or 6 for science, we will develop an assessment for those grades. The student outcomes analysis would include grades 4 through 6.

Secondary Grades Design

The design for secondary grades is a more basic randomized trial. Random assignment will be done at the teacher level because there is no school-wide component to the secondary program, and randomly assigning teachers provides stronger statistical power than randomly assigning schools. Cohorts 2 and 3 will follow a similar timeline. This design should yield 300 treatment teachers (pooled across grades and years) and 150 control teachers. SOL state exams are given in 8^{th} grade, earth science, biology, and chemistry. Although no SOL exam is given in 7^{th} grade for science or in high school physics, we will develop an assessment for this grade and course. The student outcomes analysis would include grades 7 through 12.

Data Collection and Measures

Interviews. Case studies in the participating school districts will include interviews with coaches, teachers, and school district leaders about perceived effects of VISTA on instruction. A random sample of treatment and control teachers will be interviewed every year for five years.

Summer Workshop Teacher Survey. The survey of all treatment teachers will be conducted annually to inform refinements and improvements to the summer workshop program or to the science methods courses delivered at each university site.

Annual Spring Teacher Survey. The annual spring survey will document the professional supports teachers receive and garner teacher reports on practices. This survey will be administered to all teachers in treatment and control groups and will include descriptive questions that will tap attendance and content of professional supports received, including but not limited to VISTA; perceived quality; and relevance of those supports.

Observations. SRI will collaborate with researchers from the Curry School at the University of Virginia (UVA) to conduct observations of all elementary teachers and secondary teachers in both treatment and control groups annually. Data will be collected via the Collaboratives for Excellence in Teacher Preparation classroom observation protocol, including key aspects of the Horizon Research Observational Protocol developed the National Science Foundation Local Systemic Change program (Banilower, Boyd, Pasley, & Weiss, 2006). Each year, we will train observers from SRI and UVA and test for inter-rater reliability before they go into the field.

Standards of Learning (SOL) Tests. We will obtain student SOL scores linked to teachers from the Virginia Department of Education. SOL science exams are administered in only some of the courses that participating teachers are likely to teach (grades 5 and 8, earth science, biology, and chemistry), so analyses of VISTA impact on SOL student outcomes will be limited to these teachers. We assume this is approximately a third of study participants teaching in elementary schools and four-fifths of study participants in secondary schools. For grades 4, 6, 7, where no science SOLs are given, as well as for physics, appropriate assessments will be developed. Covariate analyses will use science assessment scores or prior achievement in other subjects, as English and math scores serve as a proxy for general prior academic achievement.

Data Analysis: Implementation Study

The analysis of interview data from teachers will examine system supports as well as the extent to which new instructional practices in science are being enacted. The Summer Workshop Teacher Survey will be analyzed to see how teachers perceive the most intensive portion of the VISTA intervention. Annual Spring Surveys will be used in the implementation study to examine whether VISTA treatment teachers receive more professional supports than teachers in the control group and whether there are perceived differences in the quality of the supports.

Data Analysis: Outcomes study

Elementary and secondary level analyses will rely on teacher surveys and classroom observations and prior year test scores (in available subjects) to examine whether treatment and comparison groups are equivalent at baseline. We will also use of hierarchical linear modeling for student outcomes analyses to account for nesting of students within teachers.

Teacher Outcomes Impact Analysis. To estimate the effect of VISTA on teacher outcomes, we will use regression models with a variable indicating assignment to participate in VISTA and covariates to indicate teachers' practice at baseline as well as other measures of teacher characteristics (e.g., years of teaching experience, PRAXIS II scores). Outcome measures will be derived from teachers' reports of practice on the annual spring survey (e.g., frequency of inquiry-oriented assignments) and teacher observations (e.g. the form of instruction, student grouping, percentage of students engaged in the lesson, and the cognitive activity in instruction). Data will be pooled across years to generate sufficient statistical power for analyses, and variables indicating cohort and year will be added to the model to distinguish their respective effects. With treatment status modeled at the teacher level, the minimum detectable effect size (MDES) for elementary analyses (with 420 treatment and 210 control teachers) is estimated to be .24, sufficient power to detect a moderate effect. The MDES for the secondary analyses (with 300 treatment teacher and 150 control teachers) is .28, sufficient power to detect a modest effect.

Student Outcomes Impact Analysis. We will conduct student achievement analyses for tested grades. Analyses will be conducted using hierarchical linear modeling, where students are nested within teachers within schools[1]. In these analyses, the outcome variable will be standardized scores on science SOLs. Standardization is necessary because the SOLs are not vertically

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[1] Given the small likelihood that more than two 5th grade teachers will participate from any given school, we may not include a school level for the elementary student achievement analysis.

equated, and scale scores are not comparable across grades or subjects. We will be able to make inferences about the difference in achievement between students of treatment teachers relative to students of control teachers. We will also look at students with disabilities, LEP, and rural students. We will use students' prior year test data in science, English or mathematics (whichever is available) to adjust for differences in initial student performance, thus improving statistical power. Assuming that teachers are divided equally across grade level, we will have an MDES of .15 for the elementary analysis and an MDES of .10 for the secondary analysis.

***Coordinating with Program Evaluations*.** Because the U.S. Department's Institute of Education Sciences (IES) will be involved in evaluating the i3 program, SRI will coordinate its VISTA evaluation efforts with the i3 program evaluation. SRI will use the Department's guidelines and technical assistance to maintain consistency. SRI will add to the existing knowledge on the efficacy of VISTA and the broader educational innovations being studied under the i3 program.

Reporting

Quarterly analysis memoranda and annual reports will synthesize findings from the data analysis. Initial reports will focus on identifying trends and patterns of implementation across the participating schools and institutions, implementation challenges, levels of participation, and the extent to which VISTA educators are being supported. Later reports will examine the cumulative evidence of VISTA's impact on student and educator outcomes. The SRI team will collaborate with the VISTA leaders to disseminate lessons learned to regional and state stakeholders.

An internal research team will also conduct a rigorous, well-designed experimental study with quality implementation data and performance feedback to permit periodic assessment of progress and data about the key elements and approach to facilitate replication. The PI and Co-

PIs will use a continuous improvement model and supervise doctoral candidates assisting on this program. VISTA may offer additional opportunities for dissertation research.

E. Strategy and Capacity to Bring to Scale

Number of Students

This program will affect students on three different levels: student enrichment, student impact, and student instruction. By affecting the teachers and school district science coordinators, the program will ultimately affect 61% (760,949) of K-12 students in Virginia.

- **Student enrichment.** As part of the teacher professional development during the summer, 648 high-needs elementary students will take part in the student enrichment camp. High-needs students will be the first to benefit from this science enrichment.
- **Student impact:** During the academic year, 83,700 students of teachers who received professional development will benefit directly. Previous research has indicated that this group of students will perform significantly better on SOL science tests. In addition, teacher gains in content knowledge and pedagogy, as well as the greater likelihood they will stay in the classroom, stand to directly benefit a generation of their future students.
- **Student instruction.** The project creates a strong community of practice for school district science coordinators, who receive professional development in research-based effective science teaching and overcoming challenges in school districts to implement this kind of teaching. These science coordinators will work with all science teachers in their school districts, champion effective science teachings, and provide and support professional development and the change process. This will have an impact on 760,949 students.

Capacity

The universities involved are all fully accredited colleges and education programs. The faculty will also co-plan and co-teach at other professional development sites to help maintain fidelity of program delivery at each site. Smaller colleges will be invited to teacher professional development programs and to co-teach during summer so that they are not working in isolation.

Replication

The innovative science camp at Mason for 13 years forms the foundation and experience to launch the elementary institute of VISTA (CREST, 2010). This program was so successful that the entire elementary faculty in the pre-service teacher education program scheduled science education courses during the summer. Multiple faculty have implemented the program, including the PI and Co-PI at Mason and the Co-PI at WM, who previously worked at Mason.

The secondary program is a replicable model that has proved successful for increasing student learning on state standardized science tests for more than 10,000 middle and high school students in 35 schools in three school districts over four years (Sterling & Frazier, 2010).

Cost Per Student

	Per student	**Per 100,000**	**Per 250,000**	**Per 500,000**
Enrichment	$650/student	NA	NA	NA
Impact:	$405/student,	$40,500,000	$101,250,000	$202,500,000
Instruction:	$45/student	$4,500,000	$11,250,000	$22,500,000

Dissemination

1. **Website**. A VISTA website will be created for recruitment, registration, teacher and student resources, examples of teacher products, and dissemination of information and research. Research data will be collected in a controlled access area.

2. **Newsletter**. A newsletter will be sent twice a year to all participating teachers and principals, as well as all 133 science coordinators and 133 superintendants in Virginia.
3. **National Research Presentations**. Institute leaders and doctoral students will present sessions on VISTA, effective science teaching and learning, and research findings at annual conferences including National Association for Research in Science Teaching (NARST), Association for Science Teacher Education (ASTE), National Science Teachers Association (NSTA), and American Education Research Association (AERA).
4. **Teacher Presentations**. Teachers will present sessions on effective science teaching and learning at the annual state teacher (VAST) and leadership (VSELA) conferences.
5. **Publications**. The researchers and leadership team will publish research findings and examples of student activities in national peer-reviewed journals such as *Journal of Research in Science Teaching*, *Science Education*, *Journal of Science Teacher Education*, *Science & Children*, *Science Scope*, and *The Science Teacher*. In addition, we will disseminate program findings by sponsoring an entire issue of the Virginia *Journal of Mathematics and Science*.
6. **Policy**. The Virginia Mathematics and Science Coalition (VMSC) will assist with policy implications and institutionalization of the findings. The VMSC includes business leaders, government officials, and educators at all levels. The coalition meets three times a year to further K-12 science and math education policy in Virginia. The PI, one Co-PI, and two members of the support team are in the coalition and are planning this program with VMSC.
7. **Public**. University Relations will produce public forums designed to attract media coverage; briefings with national education writers for mainstream and trade press; panel discussions for regulators and elected officials; and report distribution to the education leadership. Video

footage will be edited into several multipurpose vehicles, including short video clips for web sites, longer video for presentations, and TV programs for the research channel or public TV.

F. Sustainability

Resources and Support of Stakeholders

VISTA has the support of 47 LEAs, Virginia Department of Education, Virginia Science Education Leadership Association (VSELA), Virginia Association of Science Teachers (VAST), and Virginia Mathematics and Science Coalition (VMSC) as indicated by the attached support letters. These organizations have helped plan VISTA and will be involved in its implementation.

Mason, VCU, and WM have the science and technology lab resources to conduct the professional development institutes and coursework, plus the fiscal management support structure. UVA has leading researchers in science education and statistics. VT is in rural Virginia and has the expertise to unify and support rural teachers. JMU has science faculty interested in K-12 science teaching who can provide STEM leadership along with the other universities.

Required matching funds for this program are assured. The not-for-profit George Mason Intellectual Properties has pledged the match if other funds have not been raised. Mason is asking a number of private entities for the cash match and has also applied for private foundation match support using the Wallace Foundation portal for applicants to the i3 program.

Benefits to Ongoing Work

VISTA has built on previous research findings on teacher professional development and increased student achievement, and the next program will build on the enhanced infrastructure in science education in Virginia from VISTA. The camp part of the elementary model has been self-sustaining at Mason for 13 years, and therefore should be self-sustaining when replicated, especially with the cross training of faculty and staff and the support scaffolding. With the professional development of school district science coordinators and college science educators, elements of this program, if not the whole program, can be replicated in new locations.

G. Quality of the Management Plan and Personnel

Management Plan and Timeline

Donna R. Sterling (PI) at George Mason will oversee all professional development, research, fiscal management, cite coordination, and interface with the U.S. Department of Education.

Leadership Team. The leadership team is the PI and the three Co-PIs who are the site coordinators. They will have monthly conference calls to plan and review progress in meeting project milestones and utilize evaluation feedback to modify project activities. Parallel institutes and courses for teachers will be conducted at Mason, VCU, and WM. The team will oversee cross instructor training to increase fidelity of implementation. Mason will lead science education faculty academies with guidance from the leadership team.

Support Team. There are three support teams: technology/special education, rural, and science coordinators. During the first year, these team members will join part of the monthly leadership meetings for planning and implementation of the support systems and training.

STEM Team. The six-member STEM team (biology, chemistry, physics, earth science, math, engineering) will meet quarterly to oversee teaching of STEM content and selection of science topics for the elementary institutes based on student test scores and teacher needs assessments.

Evaluation Team. SRI, as an independent evaluator, will plan and conduct on-going evaluation in collaboration with the VISTA research coordinator at UVA. They will meet quarterly with the leadership team to share analysis memoranda and reports to inform and guide future plans.

Advisory Board. The advisory board meets annually and as subcommittees as needed throughout the VISTA program to provide advice, guidance, and problem solve challenges.

Year 1 Timeline for Planning and Conducting Professional Development and Evaluation

Year 1	**Fall**	**Spring**	**Summer**
Professional Development • Mason • VCU • WM	• Recruit instructors • Select elementary science topics • VSELA conference dissemination • VAST conference dissemination	• Instructor planning • Recruit teachers • Recruit coaches • Recruit science coordinators • Set up online registration	• Instructor training • 3 elementary institutes • 3 secondary basic courses • 1 new science coordinators academy • 1 science education faculty academy
Research and Evaluation • SRI • UVA	• Finalize instruments • Finalize research design	• Set up online data collection • Train observers	• Collect baseline data • Observe institutes and courses • Evaluation report

Years 2-5 Timeline for Planning and Conducting Professional Development and Evaluation

Years 2-5	**Fall**	**Spring**	**Summer**
Professional Development • Mason • VCU • WM	• Follow-up sessions • Recruit instructors • Select elementary science topics • VSELA conference dissemination • VAST conference dissemination • Coach training • In-class coaching	• Follow-up sessions • Instructor planning • Recruit teachers • Recruit coaches • Recruit science coordinators • Online registration • Coach training • In-class coaching	• Instructor training • 6 elementary institutes • 3 secondary basic courses • 3 secondary advanced courses • 1 new science coordinators academy • 1 science education faculty academy
Research and Evaluation • SRI • UVA	• Online data collection • Train observers • Classroom observations	• Online data collection • Train observers • Classroom observations • Student testing • Evaluation report	• Collect new participant data • Observe institutes and courses • Collect student test scores

Leadership Team

Donna R. Sterling (PI) is a Professor of Science Education and Director of the Center for Restructuring Education in Science and Technology (CREST) at George Mason University. Recognized for her award-winning work in improving the teaching of science and technology in elementary and secondary schools, Dr. Sterling has been PI on over 25 grants for STEM teacher professional development and research. She will provide the overall leadership for VISTA, including communication of the vision for effective science teaching and learning needed to increase student performance, coordination with the professional development programs for teachers and science leaders, and improving the quality of the program through research.

Jacqueline T. McDonnough (**Co-PI**) is an Associate Professor of Science Education and Director of the Center for Life Sciences Education at Virginia Commonwealth University. Dr. McDonnough is the PI of a National Science Foundation Robert Noyce Scholarship grant and has an impressive record of research in the areas of preparing secondary science teachers for service in high need schools and best practices for teaching science to English Language Learners (ELL). She will lead the VCU regional component and provide expertise in adapting science instruction for limited English proficiency to the statewide partners.

Juanita Jo Matkins (**Co-PI**) is an Associate Professor of Science Education at the College of William & Mary, 2010 President of the Virginia Association of Science Teachers, and a Presidential Awardee for Excellence in Secondary Science Teaching. She has been PI or Co-PI on 11 grants for STEM student and teacher preparation and served in leadership capacities on ten other grants focused on STEM teacher preparation; to date she has been directly involved with grants totaling over $8 million. Dr. Matkins will provide leadership for the College of

William & Mary components of VISTA, serve as liaison with school divisions in the Tidewater area of Virginia, and will oversee coordination with other sites.

Wendy M. Frazier (Co-PI) is an Assistant Professor of Science Education and Associate Director of CREST at George Mason University. Dr. Frazier is the PI of a U.S. State Department cooperative agreement for Russian and American science, technology, and math teachers. She has extensive research at the elementary and secondary levels in diverse, urban school districts. She will lead the Northern Virginia regional component and will provide implementation expertise to the statewide partners specific to at-risk schools, the use of problem-based learning summer enrichment experiences to support elementary teachers' development, and Communities of Practice to support provisionally-licensed and unlicensed science teachers.

Support Team

Michael M. Behrmann is a Professor of Special Education in the Graduate School of Education and Director of the Helen A. Kellar Institute for Human disAbilities. He will provide expertise on using this technology to conduct teacher training throughout the state.

Amy T. Parlo, Ph.D., is the STEM K-12 Outreach Initiative Coordinator and a Clinical Assistant Professor of Science Education at Virginia Polytechnic and State University. Dr. Parlo will serve as the rural VISTA coordinator, identifying participants throughout rural areas of Virginia and facilitating their involvement in the VISTA program.

Eric Rhoades is the Supervisor of Mathematics and Science for Stafford County Public Schools and President of the Virginia Science Education Leadership Association (VSELA) and former the Science Coordinator for the Virginia Department of Education. Mr. Rhoades will lead the school district science coordinator professional development portion of VISTA.

STEM Team

Rajesh Ganesan is an Assistant Professor of Systems Engineering and Operations Research at George Mason University. He will infuse engineering into STEM training.

Harold A. Geller is a Visiting Assistant Professor at George Mason University in the Department of Physics and Astronomy. He will serve as a VISTA science advisor for the physical science and physics teachers.

Paul D. Heideman is a Professor of Biology at the College of William & Mary. He will assist VISTA with scientific expertise and mentoring in the professional development programs for teachers and specifically provide advising and leadership for biology content.

Sally S. Hunnicutt is an Associate Professor and Assistant Chair in the Virginia Commonwealth University Department of Chemistry. She will be the chemistry specialist.

Eric Pyle is an Associate Professor of Geology in the Department of Geology & Environmental Science and Co-Director of the Center for STEM Education and Outreach at James Madison University. Dr. Pyle will serve as STEM coordinator and Earth Science advisor.

Jennifer Suh is assistant professor of Mathematics Education and Associate Director for the Mathematics Education Center at George Mason University. She will support math teaching and professional development embedded in meaningful and interdisciplinary ways and will help coordinate recruiting highly qualified mathematics specialists to support teachers.

Research and Evaluation Team

Raymond McGhee, a senior research social scientist in SRI International’s Center for Education Policy, conducts research and program evaluation activities examining school improvement efforts K-12 schools as well as postsecondary schools. He has led national and state program evaluations studying teacher preparation, the use of technology, teacher professional development, after school programs in K12 schools and districts. Dr. McGhee will lead of the project evaluation, working with a multidisciplinary team of SRI researchers.

Patrick Shields, Center for Education Policy Director at SRI International, will be the PI and Supervisor of the VISTA evaluation. He will ensure that the independent evaluation moves forward, support the development of strategies to overcome challenges, and work with the task leaders managing the VISTA implementation study and the impact study.

Randy L. Bell (Co-PI) is Associate Professor of Science Education at the University of Virginia's Curry School of Education. Dr. Bell has authored more than 100 science education publications and has been PI or Co-PI on over a dozen externally funded projects related to STEM education. He will direct VISTA research efforts, including qualitative and quantitative assessments of student achievement and teacher knowledge and instructional practices.

Timothy R. Konold is an Associate Professor and Director of the Research, Statistics, and Evaluation at the University of Virginia. Dr. Konold has been PI, Co-PI, and evaluator on grants from the U.S. Department of Education, NICHD Early Child Care, Carnegie Corporation of New York, Ford Foundation, and Annenberg Foundation. He will provide leadership to VISTA for design, database management, statistical analyses, and dissemination of findings.

Advisory Board

In addition to the leadership team listed above, the advisory board will be: Julia Cothron, Director, Math Science Innovation Center; George DeBoer, AAAS, Deputy Director Project 2061; James Duffey, Virginia Secretary of Technology; Paula Klonowski, Virginia Department of Education, Science Coordinator; Eric Rhoades, Stafford County Schools, School District Math and Science Coordinator, Elementary Teacher, Secondary Teacher, and Principal.