

Appalachian Mathematics and Science Partnership (AMSP)

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Background

The Appalachian Mathematics and Science Partnership (AMSP), a five-year, \$22 million project funded by the National Science Foundation (NSF), will contribute to the national vision for education reform. The AMSP mission unites the following partners in rural education reform:

- teachers, administrators, and guidance counselors in **local school districts**;
- administrators and faculty at area **colleges and universities**; and
- **regional agencies**.

NSF, in its efforts to address significant problems in U.S. mathematics and science education through this grant program, emphasizes the active and vital role scientists, engineers, and school administrators and counselors play in the schools, in teacher workforce development, and in improving student achievement. NSF asks all partners to collaborate to leave “no child behind” through

- an innovative linkage of mathematics, science, and/or engineering faculty, their undergraduate, graduate, and postdoctoral students with education faculty and preservice teachers;
- direct involvement of higher education faculty and students in preK-12 classrooms;
- involvement of preK-12 teachers and students in experiences with higher education personnel.

Focus and Goals

The **overall focus** of AMSP is to improve central Appalachian students’ performance in mathematics and science at the preK-16 levels by building a coherent and focused program of activities which are integrated both horizontally across institutions and vertically across instructional levels. Two **broad, long-term goals** are 1) to eliminate the “achievement gap” in science and mathematics for preK-12 students in the partnership region and 2) to build an integrated preK-16 education system in this underserved region which insures the selection, development, and career-long support of a diverse and high quality mathematics and science teacher workforce.

Challenges and Key Components of Rural Education Reform

An assessment of critical issues that impede highly effective education efforts in the partnership region revealed the following specific needs:

- higher student achievement in mathematics and/or science courses,
- larger enrollment in upper level math and science courses,
- more rigorous graduation requirements,
- larger pool of highly qualified and certified math and science teachers,
- recruitment of undergraduates from the region to major in math or science and/or obtain teaching certificates in these disciplines,
- greater numbers of mathematics and science teachers with a major in the content area they teach,
- greater numbers of teachers with an advanced degree in the content area they teach,
- implementation of standards-based, inquiry-oriented teaching.

Four **key components** of the collaboration were designed to address these needs and the specific challenges revealed by the benchmark data.

- 1) preservice teacher and administrator education,
- 2) professional development of preK-12 personnel,
- 3) student-learning opportunities including parent/community engagement,
- 4) research to advance the understanding of education reform in rural school environments.

Program Activities

Each partnership activity is structured so that it clearly focuses on advancing measurable indicators and is conceived as part of a continuum of mathematics, science, and technology (MST) teaching and learning experiences in which **all participants are involved as learners and teachers**—students, teachers, administrators, and professors. This overlap in roles is achieved through collaborative learning, leadership training, and mentor roles at all levels of interaction.

For **preservice education** in mathematics and science, efforts will focus on

- course design and development with focus on content standards and inquiry-based learning;
- adaptation and implementation of courses at partner institutions of higher education through rotating lead partner institutions and a team of “developers;”
- student “teaching” opportunities in schools and/or higher education settings
 - Explorers—undergraduate seminars conducted jointly by higher education faculty and school teachers to allow freshmen, sophomores, and professionals from other disciplines to explore MST teaching careers in the partner districts in a mentored relationship;
 - Undergraduate Teaching Assistantships—teaching experiences in mathematics in AMSP courses and workshops, including active engagement with partner district teachers, master teachers, and students;
 - Peer-Supported Collaborative Learning—teaching and learning through such programs as MathExcel, which engage advanced students as leaders or facilitators of small collaborative groups: advanced high school student facilitators with small middle school groups and high school foundation courses, college students in high school groups, and graduate students at both secondary and undergraduate levels;
- field experiences in partner districts;
- recruitment of secondary and undergraduate students into teacher education programs; and
- alternative certification procedures.

Professional development for inservice teachers and administrators is closely integrated with preservice education efforts through modification of newly designed and implemented coursework and also incorporates unique features designed to bring multiple approaches to partner school needs. These include:

- a three-phase program of teacher training
 - Phase I—development of courses, modules, or workshops closely linked to preservice components
 - Phase II—adaptation, dissemination, and implementation of the inservice opportunities throughout partner schools
 - Phase III—Mentored Implementation, a structured academic year follow-up under the guidance of teacher-leaders;
- leadership training for principals through development of Principal Partners, who advocate for math and science education reform and train administrative leaders in effective leadership strategies to achieve results;
- counselor training for enhanced MST career counseling/advising services in partner districts;
- qualified programs of specialization through nine to fifteen hours of graduate coursework leading to the AMSP Graduate Certificate or Specialist Certificate;
- technology training for distance-learning and support.

AMSP focuses its efforts on enhancing **student-learning opportunities** through a multi-faceted approach combining:

- greater student enrollment in higher level courses through dual credit, Advanced Placement, and on-campus courses;
- teaching and mentoring opportunities for students across levels;
- Appalachian Science and Mathematics Scholars summer program for high school students to promote MST academic preparation, career awareness, and initiation into the higher education setting. This program will be planned cooperatively with Department of Education funded Gear Up partners.

Specific AMSP Innovations

Parent/Community Involvement

A network of parents will be trained through a nationally recognized parent program advocate, the Prichard Committee for Academic Excellence, to engage other parents and to focus on analyzing school achievement data, project

participation, and community activities to improve student achievement, to increase community involvement, and to promote community support of reform initiatives.

School Counselor Role

Counselors play a pivotal role in course selection and career preparation. Effectively initiating change in student programs requires guidance counselor participation; thus, AMSP counselor training focuses on 1) the need for a technologically capable workforce at all levels of the socioeconomic continuum and 2) motivational strategies to encourage **all** students to enroll in more advanced courses to meet this need. Planned workshops introduce counselors to regional initiatives to develop a knowledge-based economy and to other ongoing workforce development efforts in their region. Through a series of counselor seminars and student assemblies, MST career preparation across all levels of the workforce will be addressed.

Administrator and Principal Role

AMSP recognizes the integral role principals play in all factors which directly impact student achievement and so provides a training and support system that enables principals to become “principal partners”—science and mathematics advocates, resources for other principals in their districts, and leaders for district-wide MST program improvement efforts. Through this district leadership cadre, all principals will be engaged in promoting education reform in their schools. Additionally, superintendents and principals will be integrally involved in implementing curricular reform and in creating policies that increase the rigor of graduation requirements, particularly in mathematics and science.

Mentored Implementation

Teacher leaders will be trained to provide in-class support to teachers implementing a structured academic year follow-up to workshop or course participants. Additional in-school support from college and university workshop leaders will help guarantee successful implementation of standards-based content and methodology. Assistance will include sample lesson plans and instructional materials to conduct course activities.

Mentored Internships

The Mathematics and Science Teacher Mentored Internship offers advanced preparation and leadership opportunities through a professional improvement plan developed collaboratively by a teacher, the school district, and a supervising partner university. A wide range of options for internships include:

- service to the AMSP in course or workshop development;
- service to the home school district through professional development, mentoring, or curriculum development;
- professional advancement through graduate coursework leading to an advanced degree, enhanced certification, increased content preparation, National Certification, or research related to education reform or use of innovative resources.

Overview of Partnership Structure

Activities are accomplished through two major administrative components: planning and development of **academic partner program activities** and **program delivery activities**. The first will be achieved under the direction of two **Initiative Advisory Councils**, one dedicated to science, the other to mathematics initiatives. Additionally, each **school** will develop an **MST Leadership Team** for development, implementation, and assessment efforts.

Program delivery will be coordinated through a regional network of **resource collaboratives** or centers located at strategic university sites in close proximity to partner school districts. Designated sites are the University of Tennessee-Knoxville, University of Virginia College at Wise, and the University of Kentucky. An AMSP project coordinator will be housed at each center for the purpose of building and maintaining the bridge between development and implementation, theory and practice.

Project leaders are Principal Investigator Paul Eakin and Co-Principal Investigators Wimberly Royster, project director; Ron Atwood, science program director; Carl Lee, mathematics program director; and Stephen Henderson, director of program delivery.

The Partners

- 38 central and eastern Kentucky school districts (Bath County, Breathitt County, Carter County, Casey County, Clark County, Clay County, Clinton County, Corbin Independent, Estill County, Floyd County, Frankfort Independent, Garrard County, Harlan County, Jackson Independent, Jessamine County, Johnson County, Knott County, Lee County, Letcher County, Lewis County, Lincoln County, Madison County, Martin County, McCreary County, Montgomery County, Morgan County, Owsley County, Paris Independent, Pike County, Pikeville Independent, Powell County, Pulaski County, Rockcastle County, Rowan County, Washington County, Wayne County, Whitley County, and Woodford County)
- 9 Tennessee school districts (Alvin C. York Agricultural Institute, Anderson County, Campbell County, Cumberland County, Grainger County, Harriman City, Johnson county, Oneida Special School, and Scott County)
- 5 western Virginia school districts (Dickenson County, Russell County, Scott County, Tazewell County, and Wise County)
- 9 institutions of higher education (University of Kentucky, Eastern Kentucky University, Kentucky State University, Morehead State University, Pikeville College, Union College, University of Virginia College at Wise, University of Tennessee, Somerset Community College)
- Kentucky Science and Technology Corporation—Appalachian Rural Systemic Initiative (ARSI)

Partner Commitments

School district partners have committed to MST program improvement efforts, implementation of MST professional development and leadership training, implementation of standards-based practices, and assistance in recruitment and development of MST teachers. **Higher education partners** have committed to significant program improvement efforts in preservice programs for teachers and administrators, inservice training for teachers and administrators, provision of programs for high ability SMT students, and research on factors which impact preK-12 science and mathematics programs.

Sustainability and Lasting Impact

A unique **Partnership Institute for Mathematics and Science Reform** at the University of Kentucky will be established as a permanent center for the development, dissemination, and implementation of mathematics and science professional development and program improvement initiatives. The creation of two permanent outreach positions for tenured faculty at UK will augment the work of the center and provide a lasting impact. In addition, AMSP expects lasting curricular reform at all partner institutions, greater numbers of highly qualified instructional and leadership MST personnel in the partner region, increased collaboration in educational reform efforts, and additional personnel at higher education institutions specifically assigned to outreach functions.

