

**2003 INNOVATIONS AWARDS PROGRAM**  
**Application Form**

**1. Program Name**

Pennsylvania Basic Education/Higher Education Science and Technology  
Partnership Program (The *Science In Motion* Consortium)

**2. Administering Agency**

Pennsylvania Department of Education

**3. Contact Person (Name & Title)**

Lorraine Mulfinger, Ph.D., Director for Science Outreach &  
Associate Professor of Chemistry

**4. Address:** Juniata College; 1700 Moore Street; Huntingdon, PA 16652

**5. Telephone Number:** 814-641-3718

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**8. Please provide a two-sentence description of the program.**

The Pennsylvania Basic Education/Higher Education Science and Technology Partnership Program has been funded since 1998 to ensure that state-of-the-art, hands-on laboratory experiences in biology and chemistry are a regular part of the science curriculum for secondary students throughout Pennsylvania. These laboratory experiences are ensured for all students in the regional service areas, *regardless of the relative wealth of the school district*, because mobile educators are able to work directly with classroom teachers and deliver fully-prepared experimental materials and equipment to classrooms without charge to individual school districts.

**9. How long has this program been operational (month and year)?**

The program has been funded by the Commonwealth of Pennsylvania through special legislative appropriations since FY 1998-1999. Programs are now funded in eleven regions of the Commonwealth.

**10. Why was the program created? (What problem[s] or issue[s] was it designed to address?)**

The program has been created to: 1) address the lack of up-to-date equipment and training for teachers in secondary schools and enable students to receive current, hands-on (inquiry-based) science curricula in chemistry and biology, 2) ensure that students experience these exemplary science educational practices regardless of the wealth of the students' individual school districts, and 3) provide a system

to effectively share expensive resources among districts in a manner that is both cost effective and convenient for the participating districts and the state. A major reason the program is cost-effective is that it utilizes an extensive infrastructure (higher education) that is already in place and which can provide the expertise in science that is needed to help basic ed teachers. All of these goals will contribute to the development of a better trained workforce for economical development in the Commonwealth.

**11. Describe the specific activities and operations of the program in chronological order.**

- a. 1987-1992 – The National Science Foundation (NSF) funded a pilot program at Juniata College to provide outreach to area school districts to improve chemistry instruction at the high school level. The program consisted of: 1) teacher workshops for professional development, 2) a mobile educator and van to deliver instruction, supplies, and equipment directly to the classroom, and 3) resources and support for updating the high school chemistry curriculum.
- b. 1992-1997 – NSF funded the development of a parallel program for biology.
- c. 1998-2000 – The PA legislature budgeted \$400,000 to create the Pennsylvania Basic Education/Higher Education Science and Technology Partnership Program with a program at Juniata College. This funding continued for two years.
- d. 2000-2002 – The Pennsylvania Basic Education/Higher Education Science and Technology Partnership Program appropriation was expanded to \$2.5M to fund *eleven* separate higher education partnership sites across the commonwealth.
- e. 2003 – The Pennsylvania Basic Education/Higher Education Science and Technology Partnership Program continues to pursue the establishment of permanent statewide funding for the program.

**12. Why is the program a new and creative approach or method?**

The program is unique in that the Pennsylvania educational system is able to provide state-of-the-art educational experiences in science (chemistry and biology) through a program that is both cost efficient and provides equity for all students across the Commonwealth, regardless of the wealth of individual districts. The program also provides the opportunity for science teachers in basic education to work closely with science faculty at higher education institutions. Prior to the program, science teachers reported that they felt isolated. Often they were (and still are) the only teacher in their subject area in their district.

**13. What were the program's start-up costs? (Provide detail about specific purchases for this program, staffing needs and other financial expenditures, as well as existing materials, technology and staff already in place.)**

The program model was developed over a ten year period with two major grants from the National Science Foundation. The current partnership model now

enables a partnership of one higher education and approximately 10 school districts to be established in a given subject area (chemistry or biology) for \$200,000/year. This budget includes funds for 1) the purchase, maintenance and mileage costs of a van, 2) the purchase of major equipment and supplies and 3) payment of salaries for a full-time mobile educator/certified teacher, part-time director, part-time clerical assistant and a student prep staff. Space and general utilities such as steam, distilled water and gas are provided by the higher education institutions. Waste disposal is another major concern that is managed by the higher ed partner.

**14. What are the program's annual operational costs?**

The ongoing annual operational cost is also \$200,000 per subject area (chemistry or biology). This allows each partnership to support the basic personnel as listed above, as well as replace worn equipment, by new supplies, cover all costs of teacher participation in two-week summer workshops, *and* implement a pick-up/delivery system. The pick-up/delivery system allows trained teachers to use the resources available from the partnership on days when the mobile educator is already booked in other schools.

**15. How is the program funded?**

The program is funded by the Commonwealth of Pennsylvania via a legislative appropriation.

**16. Did this program require the passage of legislation, executive order or regulations? If YES, please indicate the citation number.**

This program is somewhat unique in that it has been funded for four years through the joint efforts of a large number of legislators representing both sides of the aisle and both chambers of the legislature. The appropriation has been *added to the governor's budget* during house and senate negotiations in each of the past four years. Thus, the required legislation has been the passing of the state budget each year.

**17. What equipment, technology and software are used to operate and administer this program?**

The program uses state-of-the art equipment in its daily service to students across the state. Equipment such as gas chromatographs, IR spectrophotometers, nuclear scalars, DNA profiling (electrophoresis) equipment are integrated with laptops and palm devices to perform experiments and record data using the most recent technologies. This training has been cited by several government commissions and industry leaders as key to improving workforce training and development. The most recent of such reports was from the 2001 Keystone Commission on Education for Employment in the 21<sup>st</sup> Century, which recommended full and permanent funding of the program in Pennsylvania. Affiliations and joint grant applications with the Pennsylvania Life Science Greenhouse and Technology Council of Central Pennsylvania also demonstrate the higher level of support that the program receives from industry.

**18. To the best of your knowledge, did this program originate in your state? If YES, please indicate the innovator's name, present address and telephone number.**

This program was originated in Pennsylvania by Dr. Donald Mitchell, Professor of Chemistry, Juniata College, 1700 Moore Street, Huntingdon, PA 16652. 814-641-3566.

**19. Are you aware of similar programs in other states? If YES, which ones and how does this program differ?**

The state of Alabama has adopted a very similar program. Alabama personnel were trained by the personnel at Juniata College. Regional programs also exist in at least seven other states under private funding. (See [www.scienceinmotion.org](http://www.scienceinmotion.org) for more details.)

**20. Has the program been fully implemented? If NO, what actions remain to be taken?**

The program still needs to obtain permanent funding in the Commonwealth by an addition to the school code to enable a permanent appropriation. The program should also be expanded to include an adequate number of partnerships to include/serve all 501 Pennsylvania school districts and to the extended in scope to cover all sciences, including physics and elementary/middle school sciences.

**21. Briefly evaluate (pro and con) the program's effectiveness in addressing the defined problem[s] or issue[s]. Provide tangible examples.**

A third party evaluator has conducted independent assessments of the program (see attached assessment summary report). These assessments show significant differences in content knowledge between students in program and control schools. These differences increase with the number of years that students are involved in the project. Consistent with the goal of improving student performance in science, the independent evaluator also reported from classroom observations a considerably elevated level of higher-order thinking skills among students in the project compared with observations of students in control schools.

Annual reports from the partnerships show the rate of program usage by schools growing rapidly. The program has provided services to approximately 200 school districts in the Commonwealth (see attached 2001-2002 Annual Report Executive Summary).

As a direct result of this program, several small rural schools have been able to offer advanced sciences courses for the first time. These advanced science courses are designed completely around resources delivered to the classroom by this project.

**22. How has the program grown and/or changed since its inception?**

The program has changed mostly in the expansion to new sites (now eleven higher ed hubs) and by the addition of a drop-off/pick-up program. The drop-off/pick-up program was developed at the request of experienced teachers who

wanted more frequent access to the laboratory equipment and resources than mobile educators were able to accommodate. An interesting observation with regard to statewide expansion is that, although the program was first created to serve poor rural school districts, it has been equally effective in serving poorer urban districts such as the City of Philadelphia.

**23. What limitations or obstacles might other states expect to encounter if they attempt to adopt this program?**

Other states should encounter few obstacles implementing the program given that the costs at the state level can easily be justified by the cost-efficacy of the shared resources and reduced science expenditures for individual school districts. The program is readily adaptable to both rural and urban settings. Most importantly, the higher education infrastructure is present in all states to provide expertise and resources for the cost-efficient operation of the program.

# Pennsylvania Basic Education/Higher Education Science and Technology Partnership

**Institutions of Higher Education:** Juniata College; Cedar Crest College, Clarion University; Drexel University, Gannon University; Gettysburg College; Juniata College; Susquehanna University; University Of Pittsburgh at Bradford; Ursinus College; Westminster College; and Wilkes University

## Results from Prior Funding

Juniata College received funding from NSF for the period 1987–1997 under the Teacher Enhancement Program and from the **Commonwealth of Pennsylvania for the period 1998–2003**. The core feature the program is a basic-ed / higher-ed partnership to improve science and technology education. The project has met with overwhelming success in several areas, but first and foremost is student achievement. Assessments by third party evaluators of the Juniata College program have shown major gains in student achievement among students in participating schools based on comparisons with students who did not have access to the program. Test results are summarized in Figure 1.

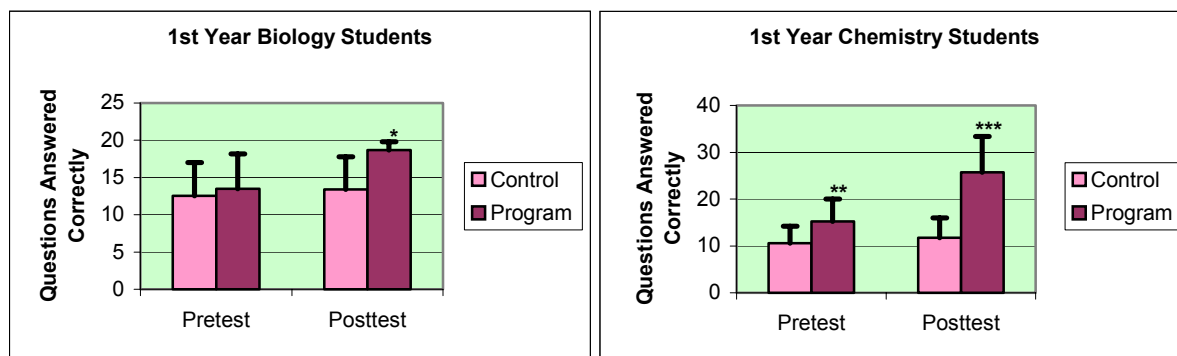


Figure 1: 1999-2000 Assessment Results: Number of questions (out of 44) answered correctly in pre- and post-tests of student achievement in biology and chemistry. (Note: Asterisks indicate significant differences ( $P < 0.0001$ ) between Control and Program student averages.)

As can be seen from the figure, students in participating schools answered more than twice as many questions correctly on year-end assessments in chemistry relative to those from control schools, even though beginning-of-the-the-year assessments in biology showed the two student populations to be statistically equivalent. Moreover, the difference between Control and Program students in Pretest performance in chemistry suggests that the participating students' prior year's experience in biology contributed to a transfer of learning that better prepared these students to begin studies in chemistry. These outcomes were attributed both to equipment and materials provided for the

classrooms and to carefully-designed professional development activities organized for the teachers.

Also as a result of this program, several small rural schools were able to offer advanced sciences courses for the first time. These advanced science courses were designed completely around resources delivered to the classroom by this project.

Consistent with the goal of improving student performance in science, the independent evaluator for the current project reported from classroom observations a considerably elevated level of higher-order thinking skills among students in the project compared with observations of students in control schools. Statewide evaluations of the expanded partnership are being developed. Complete evaluation reports are available from the program office at Juniata College.

At an early date the Juniata College Science In Motion Program became the model for a number of similar programs instituted around the country. Thus, the Alabama state legislature; Purdue University in Indiana; Occidental College in Los Angeles, California; Chicago State University in Illinois; Dupont Corporation and the Delaware Department of Education in Delaware; Virginia Polytechnical Institute in Virginia; Marist College in Poughkeepsie, New York; and Gettysburg College in Pennsylvania all contacted Juniata College for assistance in designing and implementing similar programs in their areas. All proved successful in obtaining funding to establish sustained programs. In particular, Gettysburg College has become a leader in providing pre-service teachers with classroom experience in inquiry-based methods. New requests for partnerships continue to be received by Juniata College and other members of the existing consortium.

## Goals, Objectives And Benchmarks

### **Goals and Objectives of the Project**

1. To improve the performance of all students, including students traditionally left behind (i.e., from districts with poor, rural, and high minority populations) in science, as demonstrated by improved test scores for students in project schools compared to students in control schools.
2. To improve student performance on standardized assessments in science and technology, including the PSSA and achievement tests.
3. To increase the likelihood that no student is left behind by ensuring that *no teacher is left behind* in updating his or her knowledge base as science and technology continue to advance.
4. To provide all students with an opportunity to learn science by *doing* science, using state-of-the-art equipment.
5. To augment pre-service teacher experiences in the teaching of science using hands-on, technology-based methods.
6. To show a cumulative or synergistic effect on individual student achievement for students taking multiple science courses in participating schools.

**SCIENCE IN MOTION**  
**2001-2002 PROGRAM REPORT**

TO

**THE COMMONWEALTH OF PENNSYLVANIA**

**AND THE**

**PENNSYLVANIA DEPARTMENT OF EDUCATION**

August 15, 2002

Dr. Lorraine Mulfinger and  
Dr. Donald J. Mitchell,  
Directors  
Juniata College  
1700 Moore Street  
Huntingdon, PA 16652

## EXECUTIVE SUMMARY

This is a report on the Sciences in Motion project for the period July 1, 2001 to June 30, 2002. It shows the activities and results of all eleven sites, which includes the nine sites funded the previous year (Clarion University of Pennsylvania, Drexel University, Gannon University, Gettysburg College, Juniata College, University of Pittsburgh at Bradford, Ursinus College, Westminster College, and Wilkes University) and two new sites (Susquehanna University and Cedar Crest College).

Summary Reports show that Science In Motion Mobile Educators visited and taught 2,601 classes. Equipment loans accompanied by prepared experiments were delivered to an additional 2,198 classrooms. Altogether there were 108,111 student experiences using the resources provided by the Science in Motion Program. Because most of the sites were in at least their second year of operation, all of the above numbers are significantly higher than the previous year. We expect this trend of serving more students and teachers to continue as sites further develops their programs.

In addition to the statewide summary report on activities, there are individual activity reports for each site. Complete financial reports both for the entire state and for each individual site are also provided.

Two problems arose in the current fiscal year that somewhat limited the effectiveness of the program. First, \$500,000 or 20% of the consortium's funding was frozen because of the Commonwealth's shortfall in revenues. The second problem was the length of time before funds were actually received by the higher education institutions. Some of the higher education institutions, particularly new partners, would not allow the program to proceed at their institutions until funds were received. This limited the time these programs could be in the schools in their areas. We are delighted and appreciative that we have been told that this will be remedied in the coming year.

A major initiative that began this year was a project wide (statewide) assessment of impact on student learning. This involved testing students at the beginning and end of their science courses, both in projects schools and control schools. The year was useful in organizing the logistics of this ambitious assessment initiative, and the results will be used to refine the assessment instruments and administration process for the coming year. These first year results have limited usefulness in demonstrating the statewide impact of the project on student learning due to several factors, most importantly the limited amount of time that many projects had in the schools due to the funding delay. In many cases, tests were not administered because they would not have been effectively evaluating a full year of service. Details of the evaluation are included in this report.

Effort was also directed toward developing a website for Science in Motion, with links to individual websites at all of the partnership higher education institutions. These websites are in operation and further described in this report.

**SCHOOL DISTRICTS SERVED IN 2002-2003**  
(Listed By Higher Ed Partners)

**Cedar Crest College**

Allentown SD  
Bangor SD  
Bethlehem SD  
Carbon County Vo-Tech  
Catsauqua SD  
East Penn SD  
Easton SD  
Jim Thorpe SD  
Lehigh Co. Vo-Tech  
Lehigh SD  
Northern Lehigh SD  
Northwestern Lehigh SD  
Palmerton SD  
Panther Valley SD  
Parkland SD  
Salisbury SD  
Southern Lehigh SD  
Whitehall-Copley SD

**Clarion University**

Allegheny-Valley SD  
Brockway SD  
Brookville SD  
Clarion SD  
Clarion-Limestone SD  
Cranberry SD  
DuBois SD  
East Forest SD  
Elderton SD  
Ford City SD  
Franklin SD  
Kittanning SD  
Keystone SD  
North Clarion SD  
Oil City SD  
Punxsyutany SD  
Redbank SD  
Rocky Grove SD  
Titusville SD  
Union SD  
Venango Christian HS

West Forest SD  
West Shamokin SD

**Drexel University**  
Philadelphia City SD

**Gannon University**

Corry SD  
Erie SD  
Fairview SD  
Fort LeBoeuf SD  
General McLane SD  
Girard SD  
Harbor Creek SD  
Iroquois SD  
McDowell SD  
North East SD  
Northwestern SD  
Seneca SD  
Union City SD

**Gettysburg College**

Bermudian Springs SD  
Big Spring SD  
Camp Hill SD  
Carlisle Area SD  
Central Dauphin SD  
Central York SD  
Conewago Valley SD  
Cumberland Valley SD  
Dauphin County Technical School  
East Pennsboro Area SD  
Fairfield Area SD  
Gettysburg Area SD  
Greencastle-Antrim Area SD  
Greenwood SD  
Halifax Area SD  
Hanover Area SD  
Harrisburg Area SD  
Littlestown Area SD  
Lower Dauphin SD  
Mechanicsburg Area SD  
Millersburg Area SD  
Northern York SD  
Red Lion Area SD  
Shippensburg Area SD

South Middleton SD  
South Western SD  
Southern York SD  
Susquenita SD  
Tuscarora SD  
Upper Adams SD  
Upper Dauphin SD  
Waynesboro Area SD  
West Perry SD  
West Shore SD  
York Suburban SD

### **Juniata College**

Altoona Area SD  
Bald Eagle Area SD  
Bellefonte Area SD  
Bellwood Antis SD  
Claysburg-Kimmel SD  
Forbes Road SD  
Hollidaysburg Area SD  
Huntingdon Area SD  
Juniata Valley Area SD  
Mifflin County SD  
Moshannon Valley SD  
Mt. Union Area SD  
Northern Bedford County SD  
Penn Cambria SD  
Penns Valley SD  
Southern Huntingdon County SD  
State College Area SD  
Tussey Mountain SD  
Tyrone Area SD  
West Branch Area SD  
West Perry SD  
Williamsburg Community SD  
Spring Cove SD

### **Susquehanna University**

Benton SD  
Berwick SD  
Central Columbia SD  
Columbia Montour VoTech  
Danville SD  
East Juniata SD  
Jersey Shore SD  
Lewisburg SD

Line Mountain SD  
Middleburg / West Snyder SD  
Milton Area SD  
Montoursville SD  
Mt. Carmel Area SD  
Muncy SD  
Northwest Academy  
Selinsgrove SD  
Shamokin SD  
Shikellamy SD  
South Williamsport SD  
Southern Columbia SD  
Warrior Run SD  
Williamsport Area SD

### **University of Pittsburgh at Bradford**

Austin SD  
Bradford SD  
Cameron County SD  
Coudersport SD  
Galeton SD  
Johnsonburg SD  
Norther Potter SD  
Oswayo Valley SD  
Otto-Eldred SD  
Port Allegany SD  
Ridgway SD  
Smethport SD  
St. Marys SD

### **Ursinus College**

Abington SD  
Boyertown Area SD  
Coatesville Area SD  
Downingtown Area SD  
Methacton SD  
Norristown Area SD  
North Penn SD  
Perkiomen Valley SD  
Phoenixville Area SD  
Radnor Township SD  
Souderton Area SD  
Spring-Ford SD  
Tredyffrin-Easttown SD  
Unionville-Chadds Ford SD  
Upper Merion SD

Upper Moreland SD  
William Penn SD  
Wissahickon SD  
Westminster  
Farrell SD  
Grove City SD  
Hermitage SD  
Highlands SD  
Jamestown SD  
Lakeview SD  
Mercer SD  
Mohawk SD  
Neshannock SD  
New Castle SD  
Saegertown SD  
Seneca Valley Intermediate  
Sharon SD  
Sharpsville SD  
Slippery Rock SD  
Wilmington SD

**Wilkes University**

Abington Heights SD  
Carbondale SD  
Crestwood SD  
Dallas SD  
Dunmore SD  
Hanover SD  
Hazleton SD  
Lackawanna Trail SD  
Lakeland SD  
Lake-Lehman SD  
Mid Valley SD  
North Pocono SD  
Northwest SD  
Old Forge SD  
Pittston SD  
Riverside SD  
Scranton SD  
Tunkhannock SD  
Valley View SD  
Wilkes-Barre Area SD  
Wyoming Area SD  
Wyoming Valley West SD

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The Council of State Governments

2760 Research Park Drive, P.O. Box 11910

Lexington, KY 40578-1910

[innovations@csg.org](mailto:innovations@csg.org)

DEADLINE: All original applications must be postmarked or e-mailed by April 11, 2003, to be considered for an Innovations Award for 2003.