Joint NJCTL/Kean Univ. Program Leads the Way to Improved NJ HS Student Achievement in Science

The Progressive Science Initiative (PSI) is a sequential, integrated approach to teaching the interrelated high school science subjects of Physics, Chemistry, and Biology.

PSI begins in 9th grade with an Algebra-based approach to Physics. This provides the necessary foundation for student success in modern Chemistry, which is based on Physics. The sequence then moves to modern Biology, which is, in turn, based on Physics and Chemistry.

As NJ moves to new HS standards requiring 3 years of Science study, the PSI approach makes perfect sense.

PSI was developed over a period of 10 years at Bergen Technical High School-Teterboro. Led by Dr. Robert Goodman, NJ's 2006 Teacher of the Year, PSI has enabled students at the school (who have average SAT scores) to take the AP Physics B exam at a rate 4.5 times the NJ statewide average, and to pass all AP Science exams at a rate 4.5 times the state average.

PSI incorporates technologically advanced pedagogy with hands-on problem solving in a team-oriented environment, while developing student confidence and proficiency in mathematics as the everyday language of all the sciences.

Dr. Goodman now serves as Director of the NJ Center for Teaching and Learning, a nonprofit foundation begun by the NJEA. NJCTL and Kean University have joined to cosponsor a sequence of PSI graduate education courses for current, successful secondary teachers from any discipline.

As the result of an act of the NJ Legislature, these courses qualify teachers for certificate endorsements to teach Physics, Chemistry, or Biology. New teacher cohorts are forming for the Spring 2010 semester.
Enthusiasm, Federal Funding, and Great Results Mark PSI

During the summer of 2009, 42 high school teachers from the school districts of Jersey City, Newark, and Paterson, and from Bergen Tech-Paramus enrolled in PSI Physics courses. They were the first cohort to enroll in the newly launched cooperative program between NJCTL and Kean University. They were prepared to begin teaching their first PSI Physics courses to HS students this September, and will complete their 30 credits for certificate endorsement in the Spring of 2010.

Costs for these teachers’ tuition at Kean, as well as the Physics laboratory equipment, SMART Boards, SMART Response Systems (clickers), and related software were covered by federal ARRA (Recovery) funding.

**New Cohorts Enrolling Now**

PSI plans to enroll a new group of teachers to begin their studies in January 2010, who will teach either Physics or Chemistry in the Fall of 2010. Everyone in this Spring semester group will follow the initial sequence of 3 courses in Physics that is required for all PSI enrollees. At the end of the Spring semester, those pursuing certificate endorsements in Chemistry will continue their studies in that field, while those focused on Physics will continue on that pathway.

**Great Early Student Results**

At Newark’s Technology HS, a December survey revealed that 54 of 140 9th graders plan to take a second year of AP Physics in 2010.

"Currently the production of certified physics teachers in the U.S. is about one third of the need. States like [New Jersey]... have recently legislated additional HS science requirements, but produce only a fraction of the teachers needed to fill the legislated demand."

Theodore Hoddap
Director of Education and Diversity
American Physical Society

When learning that nearly 40% of her 9th grade was planning to take such advanced work as 10th graders, the school’s principal, Ms. Mona Dana, stated, “We’re very impressed that they have such an interest.”

She continued, “The way PSI classes are designed makes them fun and interesting for everyone. The formula is there for kids to succeed. Kids and teachers are volunteering their time. This has helped us do what we’ve wanted to for a long time.”

“Our great teachers and their camaraderie have enabled us to go into PSI full force. The timing is just right for us.”

*For more information, please contact NJCTL Director Robert Goodman at bgoodman33@gmail.com or Kean University PSI Director James Lerman at jlerman@kean.edu.*
Progressive Science Initiative – Spring 2010

Improving student achievement in science is a national priority. To that end, increasing the number of skilled science teachers is also a national priority. New Jersey is taking on the challenge by training a talented corps of teachers who will lead the next generation of high school students to high levels of achievement. The New Jersey Center for Teaching and Learning in collaboration with Kean University has launched a new science teacher certification program designed for currently certified teachers with great teaching skills and an interest in science education.

The PSI course sequence has students participate in an algebra-based physics course first, followed by chemistry, then biology. The physics-chemistry-biology sequence is logical as biology requires a foundation of both chemistry and physics, and chemistry requires a foundation of physics. This sequence also supports higher levels of math achievement as math is embedded in the science program; students taking algebra and geometry experience a practical application of their math skills in their science classes.

Program Basics—PSI courses are based on Advanced Placement (AP) Science curricula. Research shows that students in the United States generally perform poorly compared to other nations on the Trends in International Mathematics Science Study or TIMSS. However, students who take, but do NOT PASS the AP Physics B exam (scoring 1 or 2) perform on average as well as students in other countries. And students who take and PASS the AP Physics B exam (scoring 3 and higher) outperform students from all other countries. The PSI initiative incorporates the skills included in the AP curriculum since this curriculum has proven to increase student achievement. PSI raises the science achievement of average US students to international levels.

Research Proven Results—Research has shown that students of average academic aptitude (as measured by SAT scores) have demonstrated remarkable math and science achievement through PSI. By the time these students graduated from high school, they had taken five times as many AP science exams as the average New Jersey student and passed four times as many (with a score of 3, 4, or 5). These results were reported in the peer-reviewed journal of the American Association of Physics Teachers (Goodman & Etkina, The Physics Teacher, April 2008).

A Talented Corps of Science Teachers—The traditional “alternate route” program seeks to recruit science professionals to become teachers. This approach has many flaws, starting with the fact that there is already a shortage of science professionals. This is the core reason why we need to improve science education. Also, it’s not clear that science professionals want to leave their jobs, or that they will be good teachers. We question the assumption that “science is hard; teaching is easy.” The PSI approach to science education is different. PSI has demonstrated that all students can learn science. We extend that to
a strong belief that all teachers can learn science. The PSI approach is to teach science to highly skilled teachers – adults who have a passion for teaching, a commitment to the profession, an interest in science, and the dedication to lead the profession. Our goal is to get the best teachers to become science teachers by taking PSI graduate-level coursework through a collaborative partnership with Kean University.

A 21st century classroom—The PSI curriculum was developed by a talented corps of New Jersey teachers who meet on a regular basis to refine and develop their lessons. An important component of the program is access to SMART technology and a classroom setup that promotes student interaction and the opportunity for teachers to interact in a web-based environment about their lessons. Therefore, districts participating in this program by sending teachers through the certification program are also providing a 21st century classroom to our graduates, including a SMART Board, SMART Responders for students, projectors, laptops, and round tables.

PSI Professional Learning Community—PSI teachers are part of a Professional Learning Community and collaborate through the PSI website where materials such as textbooks, curricula, SMART notebooks and assessments are posted. The same collaborative teacher-led approach that developed PSI in one school is being extended to a virtual PSI community encompassing many schools.

How will we measure success?—Success in the PSI program is measured in several ways. For students, success will be determined by the number of students who pass the mid-term and end-of-course exam in physics. In addition, success will be measured by the number of students who enroll in AP science courses after completing the basic physics course. Success will also be measured by performance on state-developed science exams (when available) and by performance on SAT II content area tests. PSI will also monitor student interest in pursuing science and math majors in college. The measure of PSI's success will also be determined by teachers, including the number who complete the PSI program, the number who pass the exit exam for the program and the Praxis, the number who become fully certified, and teacher and student attitudes about the program.

Current Status – Thirty-nine of the forty-two teachers who began PSI training in summer 2009 entered their final half-year of training in January 2010. These teachers will complete their training in June 2010. Of the 39 teachers, 30 will be earning an endorsement to teach physics (9 entered the program with a physics endorsement, but needed instruction in the PSI model); that is about 3 times as many new physics teachers as are created by all the universities combined in New Jersey in an average year.

Current PSI teachers are primarily from Jersey City, Newark and Paterson; two are from the Paramus campus of Bergen County Technical Schools, a campus whose population is exclusively students with special needs. These new PSI teachers are presently teaching PSI Physics to just over 1200 9th grade students during the 2009/10 academic year. Their graduate tuition is paid by their school districts.

The result has been very positive; over 1/3 of those students have expressed a strong interest is studying AP Physics B in 10th grade, in addition to their required PSI Chemistry course. Since only about 2% of New Jersey students take the AP Physics B exam, this would put these schools on track to being among the highest performing schools in the state in this regard.

Approximately 50 additional teachers began training in January 2010. This is about evenly divided between those who are training to teach chemistry and those training to teach physics. The chemistry teachers will be teaching chemistry next year to the students taking physics this year. The other teachers in this cohort will carry the PSI program into more schools, within the same four participating districts.

PSI continues to attract interest among teachers and school districts throughout New Jersey, and the United States. A new cohort of Physics teachers is planned to begin in May 2010, including teachers from the four initial districts and new districts who commit to adopting PSI. New teachers will begin training in Physics and Chemistry in Fall 2010 to prepare for PSI Biology training in Summer 2011.
New Jersey teachers shift to physics to address shortage

By Jeanette M. Rundquist
October 24, 2009, 10:07PM

NEWARK -- Emmanuel Ikheloa stood at the front of a Newark classroom, carefully measuring a glass marble and a metal spring. Then, with a "ready, set, go!" he flicked the trigger on a table-top marble launcher and sent the small ball flying across the room.

A math teacher at Barringer High School in Newark, Ikheloa is one of about 40 teachers taking an evening class in physics at Newark's Technology High School.

Physics teacher MaryRose DiBlasio works with Emmanuel Ikheloa on a lab with a marble launcher to study energy principles. Ikheloa, a math teacher at Barringer 9th Grade Academy in Newark, is a student in the NJEA program which is teaching teachers to be physics teachers.

When they're finished, the teachers, who are now certified in subjects ranging from biology to special education, also will be physics teachers. And with that, New Jersey will be closer to filling a crucial gap in its teaching ranks.

"There's currently a shortage of physics teachers. You may have 200 applicants for a social studies job, and one for a physics job," said Robert Goodman, director of the N.J. Center for Teaching and Learning, which is offering the class in partnership with Kean University.

Chris Callahan, a teacher at Bergen County Technical School in Paramus, is one of the students in the class. While he usually teaches math, he said he welcomed the chance to try a new subject. "Physics is basically math with real-life examples," he said.

A cornerstone of the U.S. high school science curriculum since at least the 19th century, physics is the class where students learn about motion and energy and learn about what matter is made of. It's the study of a subject some have described as "the foundation for most of what we take for granted."

But try finding someone to teach it.
Montclair State University graduated 955 prospective teachers in 2007-08, but only one is certified to teach physical science. Last year, there were none, a school spokeswoman said.

At The College of New Jersey, just 40 would-be physics teachers graduated in the past 12 years. Across the state, the state Department of Education issued 4,050 new certificates to high school teachers last year, but only 67 in either physical science, which qualifies a teacher in physics and chemistry, or in physics alone.

The shortage may be about to worsen. New Jersey recently adopted tougher new high school standards, requiring more years of lab science for all students. An increasing number of school districts are also trying to increase the overall number of students taking physics by offering a version of the class to freshmen.

"I think it will worsen regardless of the requirements," said Sandra Alberti, director of the state Office of Math and Science Education. "In New Jersey as well as in the nation, we've been preparing fewer and fewer physics teachers."

Math, science and engineering education has long been a concern in the United States. Only 5 percent of U.S. undergraduates nowadays earn college degrees in science and engineering, compared to 42 percent in China, according to the National Math and Science Initiative.

Among those students who do go into the sciences, many choose career paths more lucrative than teaching. And while good teachers can be hard to find in other sciences — chemistry, for example — experts say the situation is worst in physics.

Almost four times as many people became biology teachers as physics teachers in New Jersey last year.

"Science teachers are more comfortable teaching biology and chemistry. It's as simple as that," said Gregg Fleisher, national director of AP training and incentive programs for the National Math & Science Initiative. "The difference between biology and physics is like the difference between calculus and art."

There are efforts to start turning the situation around, however.

The New Jersey Center for Teaching and Learning, which was started by the New Jersey Education Association, this summer began a teacher training program with Kean University called the Progressive Science Initiative. It is one of several programs around the state working to fast-track math and science teachers.

The teacher-students, most of whom work in schools in Newark, Jersey City or Paterson, began by spending five weeks in an intensive summer course, which qualified them to teach a freshman physics class. After completing the yearlong physics course in June and passing the state's Praxis teacher exam, they will be fully certified to teach the subject. They also will earn 30 graduate credits from Kean.

Their districts pay the tuition of $560 per credit, or about $16,800 each, according to officials at Kean.

In class, the teachers are like any other students. They do labs — with equipment such as the marble launchers — listen to lectures, and take tests. They work in groups, seated at round tables.

One recent night, they shared a box of doughnuts.

They also watch material appear on classroom "Smart Boards," and use hand-held "clickers" that let their answers to questions appear onscreen, something like a TV game show.

Korey Castillo, a biology teacher at West Side High School in Newark, said she is glad to be taking part in the class.

"I like physics," she said. "I think it's a good lab course for the students because it's so much fun. The kids are like me — they want to shoot the marble launcher."
Susan Polirstok, dean of the College of Education at Kean University, said instead of recruiting "alternate route" science teachers from industry, the idea was to take people who already know how to teach and give them the content to make them physics teachers.

She said the program seems to be succeeding so far: No one has dropped out of the initial class, and about 80 more teachers have expressed interest in a new session beginning this spring, which will involve chemistry and physics.

Polirstok said the program is also providing qualified teachers to urban districts, where attrition is high. She said it would be open to suburban districts, too, if they wanted to participate.

"We hope it's going to make an extraordinary difference," she said.

Goodman, of the Center for Teaching and Learning, said the ultimate is to expose more students to physics and to "build science and technology in the United States because we want to stay competitive as a country."

"The better job we can do teaching high school science, the more we can motivate people to go into science as a career," Aliperti said.

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