The American Physical Society and the American Association of Physics Teachers recently received a five-year, $6.5 million award from the National Science Foundation (NSF) to continue work on PhysTEC. PhysTEC began in 2001 with a $5.76 million NSF award.

The primary goal of the project is to demonstrate successful models for increasing the number of highly qualified high school physics teachers around the country. Currently, only about one-third of all US physics teachers have a degree in the subject, and many recent reports have identified science teacher shortages—and physics teacher shortages in particular—as a critical threat to US educational and economic competitiveness.

PhysTEC's primary activity is funding institutions to build model physics teacher preparation programs. The new award will provide funding for eighteen new sites to join the fourteen that have already received funding from the project. Six new institutions will join the project each year, for the next three years. PhysTEC institutions have increased the number of teachers they educate by up to ten times the rate at which these teachers were graduating before the project began. Sites have achieved these successes by increasing teacher recruiting efforts; developing engaging early teaching experiences; improving content and pedagogy courses; and fostering collaboration among physics teaching institutions, education schools, and local school districts. Teachers-in-Residence—local master teachers hired with project funds—spurred many of these efforts, and also provide critical mentoring that helps keep teachers in the classroom.

In the last few years, the project has made major strides in engaging physics departments at research universities. As Laurie McNeil, former physics department chair and PhysTEC site leader at the University of North Carolina-Chapel Hill (UNC-CH), says, an institution such as hers “rarely considers the preparation of high school teachers to be a central part of its mission… However, especially at a state institution, this often-overlooked part of the mission statement may be among the most visible and valued parts of what external constituencies expect the institution to do in exchange for the public financial support it receives.”

Thanks to McNeil’s efforts, UNC-CH recently graduated its first physics teacher in over a decade, and has several more in the pipeline. Cornell University, Florida International University, and the University of Minnesota, the project’s other three currently funded institutions, are all physics doctoral-granting universities, and are also making significant progress in viewing teacher preparation as a legitimate activity for a science department.

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PhysTEC Project Award

continued from page 1

In addition to funding nine more tradi-
tional sites, the new award will allow the project to provide smaller grants to nine “pilot” sites to implement experimental and innovative programs such as part-time Teachers-in-Residence, four-year physics education degree tracks, and partnerships with two-year colleges. Through these pilot awards, project leaders hope to develop models that are effective at smaller institutions. The project also hopes to provide funding for PhysTEC sites to improve elementary teacher education by implementing research-based curricula in the physical science courses these teachers take.

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Noyce Scholars

continued from page 1

“My favorite question has always been to ask ‘Why?’, and through physics I have found many answers.”

—Christine Nicholson, University of Arkansas senior and Noyce Scholar

clearly. Yet I understood, and being one of those few meant I helped my neighbors frequently. I realized the gratification of teaching a student, and being a cause for some other student’s success.11

Similarly, Andrew Flye of Cornell says, “I became interested in teaching physics during my junior year in high school, when I took AP Physics. My teacher was new to the subject and was having a hard time, so my classmates would often come to me for help.”

Others hope to change attitudes toward physics, and inspire future generations of students. Tia Plautz of Cornell says, “My future goal is to make physics a more tangible and approachable subject for everyone. I want to teach students that physics is really fun, and show them how physics can help explain the world around them.”

Christine Nicholson of Arkansas speaks of a natural curiosity that physics satisfies: “My favorite question has always been to ask ‘Why?’, and through physics I have found many answers.”

The Robert Noyce Teacher Scholarship Program is a National Science Foundation program to recruit talented science, technology, math, and engineering (STEM) majors into teaching. Noyce Scholars commit to teaching two years in a high-need school for every year of scholarship support they receive.

The PhysTEC Noyce program is run jointly by the American Physical Society and the American Association of Physics Teachers. It is the first Noyce project run by professional societies, and the first to focus on a single science discipline. Along with the four institutions mentioned above, the University of North Carolina at Chapel Hill and Western Michigan University are also PhysTEC Noyce sites.

More information about the PhysTEC Noyce project is available at www.PhysTEC.org/noyce.

PhysTEC Receives $150k in Supplemental Noyce Funding

The PhysTEC Noyce Scholarship Program recently received $150k from the National Science Foundation (NSF) to supplement the initial $750k awarded in 2008. The program, which gives scholarships to future physics teachers at PhysTEC sites, will use part of the supplement to enable PhysTEC Noyce sites to hire part-time Teachers-in-Residence, who will help recruit and mentor future teachers. The part-time TIR model is based on a pilot program at Seattle Pacific University, one of the six PhysTEC Noyce sites. The project will also provide professional development and physics education research opportunities for PhysTEC Noyce teachers, create a video designed to recruit physics teachers, and support learning communities among PhysTEC Noyce scholars.

AAPT to continue supporting its members in their efforts to provide excellent teaching for all students at all levels in all teaching environments. Of particular importance is the inclusion of funding to support pilot projects at the two-year college level, which is a significant constituency in AAPT.”

Ted Hodapp, Director of Education and Diversity at APS, directs the PhysTEC proj-

ect. He says, “One of the most rewarding aspects of this project is helping physics faculty and their institutions realize their ability to have a significant impact in this area. We are looking forward to supporting a new cadre of physicists who are engaged in these issues. With this new grant, we are particularly looking to target areas and populations of critical need—those students who have traditionally not had access to a high-quality physics education.”

Perspectives on Teaching: Chase Martin

Chase Martin, now teaching at North Mecklenburg High School near Charlotte, NC, is the first teacher certified in high school physics to graduate from the University of North Carolina at Chapel Hill (UNC) in over a decade. Chase is also a member of the first graduating class from the brand new UNC-Baccalaureate Education in Science and Teaching (UNC-BEST) program, which received some of its initial funding from PhysTEC. PhysTEC News caught up with Chase at the AAPT Summer Meeting in Ann Arbor, MI.

Q: What inspired you to become a physics teacher?
A: In high school, I was tutoring the star of the basketball team, because if he didn’t pass his next math test, he wasn’t going to be able to play. After I tutored him he did manage to pass, and we won the big game. And I felt like I really had a chance to contribute to something.

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few career paths are perfectly straight, but rarely do you meet someone who has taken quite as many turns as Jorge Gibert. Gibert just finished a year as Teacher-in-Residence (TIR) at Florida International University (FIU) in Miami, where he shepherded students through the university’s nascent physics teacher preparation program. Although he says that “learning and teaching have always been my passion and I can’t find myself doing something else,” he has certainly found a variety of different ways and places in which to pursue these passions.

Gibert grew up in Cuba, and by the time he graduated high school he knew that “a physicist was what [he] wanted to be.” After “wasting” a year in the Cuban army, Gibert entered a program where he says he studied physics “USSR style… Most of the time I spent studying for exams and writing lab reports I was either hungry or reading under the light of a candle. Despite all the obstacles, I was determined to be the first college graduate of my family.”

In Cuba, the educational tracks for teachers and researchers diverge much earlier than in the US. Nevertheless, Gibert got his start in teaching at the university, because physics students in Cuba are routinely expected to teach physics to their peers. “Through my years as a university student, I realized that the best way to learn something was by teaching it, and teaching it well,” he says. “My peers and I didn’t have pedagogical skills but we tried very hard to get our message through.” The experience surely prepared Gibert to direct FIU’s Learning Assistant program, which recruits talented undergraduates to mentor their fellow students in introductory courses.

Gibert came to the US in 1996 via the visa lottery and got a job as a ramp agent at Miami International Airport. At the same time he started the physics master’s program at FIU and began working toward his teaching certification—all while supporting his family back in Cuba. “I can describe my first two and a half years in the program as ‘painful,’” he says.

In 2001 Gibert started teaching AP and honors physics while continuing to work on his master’s degree. “This double experience helped a lot, since I was able to mentor my own students in my biophysics lab at FIU,” he says. He earned his master’s in 2004, and jumped right into a PhD project focusing on the distribution of light in the human retina, while still teaching physics in the morning. Gibert got recruited to be FIU’s TIR in the summer of 2008, and despite some initial reluctance he accepted the position, which thrust him into the middle of a variety of educational reform efforts within the physics department. His many roles included teaching a science pedagogy course to Learning Assistants, mentoring future teachers, and teaching an introductory physics course using a method known as “Modeling,” which encourages students to construct their own understanding of physical concepts (see PTEC and Modeling Instruction, below).

As a TIR, Gibert says he was able to both have an influence on his environment and to grow professionally. “Being a TIR exposed me to a lot of new ideas about teaching and education research, and really showed me how the system works. The TIR seems to change the mood of the professors toward teaching, and once students interact with a TIR, they gain respect for teaching and become more likely to consider it as a career.”

Jorge says he hopes to go back to teaching, but at the moment he is focusing on his thesis project, which he plans to complete this fall. “I have always loved physics,” he says. “It is the science that doesn’t discriminate—it is the most humble and noble science.”

PTEC and Modeling Instruction

Modeling Instruction—origins and growth

The Modeling Instruction Program, developed at PTEC member Arizona State University by David Hestenes and colleagues, has come to be widely recognized as one of the nation’s best programs for helping teachers develop physics content and pedagogical knowledge. According to program leaders, Modeling emphasizes “making and using conceptual models of physical phenomena as central to learning and doing science.”

Many teachers who complete the program become committed “Modelers,” using the techniques in their classroom, and leading workshops for other teachers.

The first Modeling workshops were held in Arizona in 1990, and they have since spread around the country. A number of PTEC institutions now run summer Modeling workshops for area teachers, including Buffalo State College (NY), Cal Poly San Luis Obispo (CA), Emporia State University (KS), Florida International University (FIU—also a PTEC site), Fort Hayes State University (KS), Middle Tennessee State University, North Carolina State University, the University of Northern Iowa, and the University of Wisconsin-River Falls. For a full list of workshops, see http://modeling.asu.edu/MW_nation.html

Bringing Modeling to the undergraduate classroom

FIU faculty have taken the Modeling Instruction program to a new level by adapting it to the undergraduate classroom, as part of their Center for High Energy Physics Research and Education Outreach (CHEPREO) project. The university offers three sections of Modeling-based introductory physics each semester, where students work in groups to develop and refine models of physical concepts. This instructional paradigm is well-suited to the demographic profile of FIU’s student body, which is more than half Hispanic, because, as project leaders write, “Cooperative learning is thought to better support under-represented minorities and women than traditional classrooms.”

FIU faculty report that their modeling courses “have been extremely successful, in terms of student learning outcomes, faculty assessments, and recruiting. The average student performance on the Force Concept Inventory in the Modeling-based courses is roughly a factor of 2.5 better than in our traditional courses. Also, the DWF rate (drop, withdraw, fail) in Modeling-based classes is 1/4th the DWF rate in traditional classes. We also find 10-20% of the students pursue physics minors and majors after taking the course, either adding a second major/minor or switching majors.”

Project leaders have also collected evidence that Modeling Instruction leaves students with more positive attitudes toward science than “traditional” instruction.

When FIU became a PhysTEC site in 2007, project leaders were able to build on the learning community infrastructure that already existed in the Modeling classroom. Around a dozen undergraduate Learning Assistants (LAs) now work in the classroom or in labs, assisting their peers in developing their understanding of physics.

Project leaders write that the LA experience allows prospective teachers to “test drive” teaching immediately upon joining the program. FIU’s program is adapted from the Learning Assistant programs developed at the University of Colorado, which has begun to demonstrate success at recruiting students into teaching careers.

Further information on PhysTEC and Modeling programs, see the article by Kramer, Brewe, and O’Brien in the Summer 2008 APS Forum on Education Newsletter.
Teacher Education: The Big Picture

By Theodore Hodapp

The past year has seen one of the most substantial shifts in the climate for funding teacher education in recent memory. The election of Barack Obama and the many appointments he has made, along with the US Congress’s continued willingness to supply funds to increase the number and preparation of Science, Technology, Engineering, and Mathematics (STEM) teachers, is producing the “perfect storm” of money, focus on the critical issues, and a willingness to take on the serious problem of providing well-qualified teachers to US schools.

The complicating factor, of course, is the economy. Loss of tax revenue has driven many states to cut back on funding education. Salaries have been frozen in many places, and although things seem to be improving as of this writing, education funding still has a fairly large hole to climb out of.

Despite these issues (and in some cases because of them), the federal government has stepped up to address the situation. Starting last summer with supplemental funds legislation, and in this calendar year with both stimulus money (the American Recovery and Reinvestment Act) and the FY2009 budget, the funds available for STEM teacher education have increased dramatically. Consider that in the 2007 budget, the NSF was allocated less than $10 million for the Robert Noyce Teacher Scholarship Program (a program to provide money for students wishing to become STEM teachers in high-needs school districts). As of this spring, the funding for that program (in FY2009) had increased by more than an order of magnitude, to $115 million. Congress and the administration clearly see this as a significant area to which to devote resources. The 2010 administration request is $55 million, but it is unclear how that will shake out when the appropriation bill snakes its way through Congress—so stay tuned.

As we consider the changes made at the federal level, we also need to think about how physics fits into the larger scheme of things. Policy makers need to consider the size of the various constituent groups affected by their decisions, and physics with its 5,700 bachelor degrees each year pales in comparison to the total number of STEM undergraduates, which is about 270,000. As we think about how to enhance our own efforts in educating physics teachers, we need to reach out to our colleagues in chemistry, biology, and math to see how we might work together to improve the bigger picture of preparing not only highly-qualified K-12 teachers, but highly motivated ones as well.

Recent actions by the Association of Public and Land Grant Universities (APLU) and the American Chemical Society (ACS) are pointing to productive relationships that will enhance teacher education in all STEM disciplines, but especially in physics, chemistry, and mathematics, where the need is the greatest. PhysTEC has already set up a working collaboration with APLU, and is exploring a joint effort with ACS.

Finally, we note that it is likely that the Obama administration is planning a large policy push in the near future that will feature STEM education and an adequate supply of teachers in these disciplines. Now is the time to get involved. We recommend that you join PhysTEC and attend the annual meeting (see article below) to meet many of the individuals working on these issues in physics. If no program exists at your institution, speak with faculty in your school of education or in the administration to see what you can do to advance physics teacher education. Physics teachers become your emissaries to attracting the next generation of physics majors and science-literate students. The perfect storm has arrived, and we need to take advantage of the energy behind it.

PTEC Conferences

The 2009 Physics Teacher Education Coalition (PTEC) Conference was held in Pittsburgh on March 13 and 14 with the theme of “Institutional Transformation: How do we change departments and universities to embrace the mission of preparing tomorrow’s teachers?” As in previous years, the conference was organized in four-parallel workshop tracks, with lunchtime plenary talks each day. Over 100 physics and education faculty members, teachers, and professional societies attended workshops, panels, and talks by leaders in physics teacher preparation. Twenty-five attendees presented posters at the conference.

Among the most popular workshops were “Pedagogical content knowledge needed to teach physics,” led by Eugenia Erikina of Rutgers, who discussed the need for teachers to be familiar not just with physics content but also with physics-specific pedagogy; and “Facilitating change in undergraduate STEM,” given by Noah Finkelstein of the University of Colorado and Charles Henderson of Western Michigan University, who led a conversation on “the need to provide new models and approaches to change.” Also well-attended was a panel on “The university role in teacher preparation,” which was led by Howard Gobstein of the Association of Public and Land-Grant Universities (APLU, formerly NASULGC), and included the perspectives of a physics department chair, an arts and sciences dean, and a university provost. Many conference attendees commented that they also appreciated the opportunity to network with others engaged in teacher preparation.

On March 12, immediately prior to the PTEC Conference, the project hosted a full-day workshop in partnership with APLU. The purpose of the workshop was to help faculty and administrators from institutions in the APLU Leadership Collaborative develop plans to ramp up teacher education activities in their departments. The program included presentations by leaders in teacher preparation and several hours for guided brainstorming and program planning.

The 2010 PTEC Conference will be held in Washington, DC on February 12 and 13, in conjunction with the APS “April” Meeting, the AAPT Winter Meeting, and the National Society of Black Physicists and National Society of Hispanic Physicists meeting. The theme will be Diversity in Physics Education: Preparing Teachers for the 21st Century. For more information, see www.PTEC.org/conferences/2010

Teacher Preparation Quiz

How engaged are physics departments in teacher education? (answers appear at the bottom)

1. What percent of physics departments have an education program (i.e. concentration, track, or specialization) specifically designed to prepare students to become high school teachers?

2. What percent of physics departments have an education program with at least one graduate enrolled in the past two years?

3. What percent of physics departments created a new education program in the last two years?

4. What type of department is more likely to have an education program with recent graduates: Ph.D-granting departments or bachelor’s and master’s granting departments?

5. What fraction of physics departments that have a program with recent graduates employ a master teacher?

These results are from a survey conducted by the American Institute of Physics Statistical Research Center on behalf of the Task Force on Teacher Education in Physics. 77% of the 754 physics departments in the US awarding a bachelor’s degree in physics responded to the survey. The full report of the task force will be available in February 2010 at www.PTEC.org.

Philip Hammer Joins PhysTEC Leadership

Philip (Bo) Hammer, the new Associate Executive Officer for AAPT, recently joined the project as co-Principal Investigator. Hammer was most recently AAPT’s Associate Executive Officer with his position as Vice President of the Franklin Institute Science Museum’s Benjamin Franklin Center, where he was responsible for the institute’s Science Education Programs, journal, collections and library, and public astronomy programs. Hammer also has a strong background in the professional society world, having served as director of the Society of Physics Students and Sigma Pi Sigma, and assistant manager of the Education Division of the American Institute of Physics.

Hammer will be taking the lead on a number of PhysTEC initiatives, including managing the Teacher Residency and teacher tracking components of the project, developing professional development opportunities for PhysTEC teachers, and building alliances with two-year colleges.

“The PhysTEC project is on the front lines of improving K-12 science education in the US. I am excited to represent the AAPT community in this effort and I particularly look forward to making two-year and community colleges critical components of our success,” Hammer says.

PhysTEC

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Valerie Otero of Colorado and Rob Thorne of Cornell discuss teacher preparation at the 2009 PTEC Conference. Photo by Warren Hein, AAPT.

ANSWERS

1. 20% 2. 4% 3. 60% 4. 2% 5. 1%