Five New Funded Sites Join PhysTEC

The James Madison University (JMU) project plans to build on established programs for current teachers to expand the recruitment, mentoring, and retention of future teachers. PhysTEC funding will support the (1) implementation of a science pedagogy course, (2) development of a sustainable Learning Assistant program, and (3) hiring a Teacher-in-Residence. "It is gratifying to see that many of the newly funded sites are building on previous efforts in physics teacher education and course reform," said Beth Cunningham, Executive Officer of the American Association of Physics Teachers. PhysTEC students at the University of Central Florida (UCF) will have the opportunity to enroll in a dual teacher certification and physics major track and will have more options to experience SCALE-UP classes and Learning Assistants in their introductory physics courses. The UCF project aims to prepare 15 physics teachers during the first four years, helping to fill the current shortage of teachers in Florida.

Georgia State University (GSU) plans to increase the number of minority physics teachers to help meet Georgia’s high need and the only one related to education. The image in the report was the map of all PhysTEC institutions (see right). The PhysTEC highlight can be found on page 14 of the full Report: http://www.nsf.gov/about/budget/fy2014/pdf/fy14.pdf.

PhysTEC Membership

This map represents the 285 PhysTEC Institutions in the United States including 30 Supported sites, 28 Affiliate sites, and 1 Endorsed site, representing 38% of all physics departments that grant a bachelor’s degree. Supported sites receive PhysTEC funding. Endorsed sites have demonstrated that they follow PhysTEC key components. Affiliate members do not have a physics teacher education program. There are 5 additional Member sites outside of the United States. To become a PhysTEC Member Institution, visit www.phystec.org/join.

T-TEP Report Published

"In response to the shortage of physics teachers in the U.S. and concerns about their effectiveness, the American Physical Society, American Association of Physics Teachers, and American Institute of Physics formed the Task Force on Teacher Education in Physics (T-TEP). T-TEP was charged with documenting the state of physics teacher preparation and with making recommendations for the development of exemplary physics teacher education programs. “Except for a few excellent programs, T-TEP found that nationally, physics teacher preparation is inefficient, incoherent, and unprepared to deal with the current and future needs of the nation’s students.” Here are selected T-TEP recommendations:

“1. Physics departments should recognize that they have a responsibility for the professional preparation of pre-service teachers.
PhysTEC Conference Brings Together Physics and Chemistry Teacher Educators

The 2013 Physics Teacher Education Coalition Conference was held in Baltimore on March 16th and 17th. The conference is the largest gathering in the country dedicated to physics teacher preparation, and was attended by 120 science teacher educators, most of whom were physics faculty. Held in collaboration with the American Chemical Society (ACS), it also offered sessions on chemistry teacher preparation.

The theme of the conference was “Preparing the Next Generation of Physics Teachers.” Session leaders brought the theme to life with examples of programs that provide preservice physics teachers with valuable teaching and research experiences. The session “Linking Early Teaching Experiences to In-service Teacher Programs” highlighted programs at Virginia Tech, the University of Missouri, and the University of Alabama that allow undergraduate students to work in local middle and high school physics classes. Another session featured summer research opportunities at federal research facilities, offered to current and future teachers in science and math through the STEM Teacher and Researcher Program.

Plenary speakers addressed a wide range of topics related to physics teacher education. Richard Steinberg, City College of New York, presented a plenary talk on his experiences teaching a year ago at high school in New York City and emphasized the need for physics teacher education to include authentic perspectives on teaching. Michael Marder, the University of Texas at Austin, spoke about how poverty impacts efforts to improve K-12 education. Catherine Goor, City College of New York, discussed research on stereotypes about science ability and how these affect the achievement of females and minorities in STEM disciplines. She described research-based interventions that could help students overcome the impact of negative stereotypes and could strengthen their sense of belonging to science and math disciplines.

The conference also focused on the overlapping goals of chemistry and physics teacher education. A workshop titled “How Physics Departments Can Profit from Working with Chemistry Departments” was run by Gay Stewart and John Stewart, University of Arkansas, and Mary Kirchhoff, American Chemical Society. Participants learned about the advantages and challenges involved in dual teacher certification in chemistry and physics.

Reflecting on the overall conference, Mary Kirchhoff, ACS Education Division Director, said, “The American Chemical Society sincerely appreciated the opportunity to partner with the American Physical Society in offering a chemistry strand during the 2013 PhysTEC Conference. The speakers and workshops catalyzed meaningful discussions about the successes and challenges in preparing chemistry and physics teachers.”

Another highlight of the conference was a panel discussion moderated by Stamatis Vokos, Seattle Pacific University, which examined how participants could contribute to the public discourse on teacher preparation. Panelists included Helen Quinn, Stanford University, Francis Slakey, American Physical Society, Michael Marder, University of Texas at Austin, and Paul Cottle, Florida State University. In their conference evaluations, participants rated the sessions very highly, with 1=not at all and 5=extremely useful. Over 80% of the sessions received an average rating of 4.0 or greater. Monica Plisch, APS Associate Director of Education and Diversity, was pleased with the inviting presentations and participants’ reaction. She reported that, “virtually all participants commented on how appreciative they were to have the opportunity to be together and interact with other like-minded STEM educators.” Presentations from the conference are available at http://www.ptec.org/conferences/2013/schedule.cfm.
Teacher Profile: Paul Turner

Paul Turner, a Middle Tennessee State University (MTSU) PhystEC graduate, is beginning his second year as a physics teacher. Turner teaches in a position that has had a high turnover, so his students jest and call him the “Defense Against the Dark Arts teacher,” in reference to the Harry Potter books. An avid guitar player and musician, Turner came to MTSU as a freshman music major and recording engineer major who then chose teaching physics as his vocation.

In 2012, Turner graduated from MTSU with a physics teaching certification and began teaching physics full time at Arlington High School in Arlington, TN, on the outskirts of Memphis. Arlington High School is a large school of 2,500 students, where Turner teaches five physics classes a day. Turner says, “It is pretty amazing—there were times during my study (when) I was unsure how well I would fit into it [teaching physics].” Turner started and began interacting with students, it clicked. I am constantly busy (and) at the same time loving what I do!” Now beginning his second-year teaching, Turner has a new challenge of teaching an Advanced Placement (AP) Physics class.

Last year Turner also joined the wrestling team as a coach where he enjoyed the opportunity to talk regularly with the head coach, who is the AP Chemistry teacher. Turner said that being part of the wrestling team gave him the opportunity to be a beginner and to see his students from a different perspective than in the classroom. Turner discovered his interest in physics when he took a class titled “Physics of Music.” After talking with Vic Montemayor, a physics professor at MTSU, he decided to change his major to physics. Turner did undergraduate research at North Georgia State University and Oak Ridge National Laboratory on sound processing with cochlear implants. After working as a physics tutor, Turner realized that he enjoyed helping other students, and he enrolled in education courses. Brian Frank, a physics professor at MTSU, was influential in helping Turner realize that there are always new things to learn in physics. He finds this lesson helpful now that he is a teacher.

Turner recently appreciated the difference he was making in his students’ lives when he encountered seniors he had taught last year. He was amazed that, because of his class, some are now planning to study engineering or physics in college. Turner said, “I pushed the students to learn in new ways. One of his greatest challenges has been teaching 220 students while having minimal supplies. Turner said that he learned to be “MacGyver” and spent a lot of time at Lowes and Home Depot finding materials to use for hands on, inquiry-based labs.

Sustainability Study

The PhystEC project is conducting a study on the sustainability of its sites after project funding ends. The questions this study seeks to answer are: (1) To what degree have project elements been sustained? and (2) What are the mechanisms by which project elements have been sustained? Many supported sites have sustained elements of the PhystEC program after project funding ended. Moreover, as Turner has taught last year. He was amazed that, turned out to be “MacGyver” and spent a lot of time at Lowes and Home Depot finding materials to use for hands on, inquiry-based labs.

Progress for ACS Initiative

Similar to the way APS was the impetus behind PhystEC, the American Chemical Society formed the Chemistry Teacher Education Coalition (CTEC) in response to the need for highly qualified high school teachers in the field. CTEC’s mission is to actively engage chemistry departments in the preparation of future chemistry teachers. A list of CTEC member institutions is available at www.acs.org/ctec.

ACS submitted a proposal for CTEC to the National Science Foundation. PhystEC project leaders Ted Hodapp and Monica Plisch are members of the CTEC Advisory Board, and they provided guidance on the preparation of the proposal. Following on the success of PhystEC, the proposal includes a grant competition and a national conference for chemistry teacher educators. NSF conducted an external review of the CTEC proposal: after this, NSF requested ACS to revise and resubmit the proposal. Hodapp and Plisch participated in a day-long meeting in July to discuss revisions to the proposal, and ACS plans to resubmit the proposal to NSF shortly.

In addition, ACS conducted a national survey of chemistry departments regarding their engagement in teacher education, based on a similar survey by PhystEC. While a similar number of chemistry departments offer an education program, a significantly smaller number offer rewards, recognition or support to faculty engaged in teacher education. Compared to physics departments, only half as many chemistry department are considering starting a teacher education program.

T-TEP Report

3. Schools of education should recognize that programs to prepare physics teachers must include pedagogical components specific to the preparation of physics teachers: broader ‘science education’ courses are not sufficient for this purpose...

7. Physics teacher preparation program should provide teacher candidates with extensive physics-specific pedagogical training and physics-specific clinical experiences.”

Moreover, ”T-TEP recommends establishing regional centers in physics education.... These centers would be the major regional producers of well-qualified physics teachers and would be a nexus for scholarly work on physics education.” In addition, the centers would help veteran science teachers at all levels deepen their knowledge and skills.

T-TEP has been working to publicize the report and get the message out to the physics community, national and state policy makers, and schools of education. An article on T-TEP was published on The Back Page of the August/September issue of APS News, and there are plans to publish editorials in some of the leading journals in physics education. Conversations with staff at the Office of Science and Technology Policy led to the inclusion of a white paper describing the STEM Master Teacher Corps. APS and AIP will sponsor a fellow at the Department of Education (see article on page 4); this new position is expected to have significant influence on implementation of the STEM Master Teacher Corps, among other programs. An electronic copy of the report is available at www.ptec.org/taskforce.
APS/AIP Science & Technology Fellow and STEM Master Teacher Corps

A PS, AIP, and the Department of Education (ED) have come to a formal agreement to sponsor a Science and Technology Fellow within the Office of Planning, Evaluation, and Policy Development at ED. The Fellow will be one of the AAAS Science and Technology Fellows. While at ED, the Fellow is expected to work on shaping policy priorities and programmatic activities in Science, Technology, Engineering, and Mathematics education (STEM-ED). The Fellow will have a chance to work on interagency coordination to achieve ED’s five-year Federal Strategic Plan, conduct research analysis and develop metrics to assess the impact of various ED initiatives, develop policy priorities for newly proposed programs such as the STEM Master Teacher Corps, perform empirical and qualitative research and attend congressional hearings, and identify new ways for ED to deepen its impact in STEM fields.

Even if there are significant hurdles, administrative priorities such as the STEM Master Teacher Corps (STEM-MTC) will still be pushed in executive branch agencies. The STEM-MTC, in short, creates an opportunity for career advancement for STEM teachers. The proposal includes a growth trajectory for teachers to develop within the profession, avenues for them to engage in further professional development, mechanisms by which Master Teachers would be empowered to make broad improvements in STEM-ed, and significant stipends for Master Teachers. There are multiple paths forward for a priority such as STEM-MTC including realigning existing funding within agencies, public-private partnerships, or a white paper release to state departments of education. A letter in support of the STEM-MTC along with the white paper can be found at: http://bit.ly/1BlmR8R. For more information, contact Tyler Glembo at glembo@aps.org.

PhysTEC Supported Sites Make Big Gains

PhysTEC supported sites, collectively, have increased the number of future physics teachers by a factor of 2.5 compared to pre-funding years. There are 13 PhysTEC supported sites (in the PhysTEC-II grant) for which the future physics data is available. The graph above illustrates the total number of future teachers enrolled, first before PhysTEC funding (in tan) and then during PhysTEC funding (in blue). This number averages 43 teachers per year before the start of program funding, compared to an average of 17 future teachers enrolled during the funding period. Please note that the numbers at each time interval show project activity at a different set of Selected Sites. The growth in future teachers varies considerably by site. Middle Tennessee State University (MTSU) had the highest growth, with an average of one future teacher each year before funding compared to an average of 17 future teachers in each of the three funding years. Also notable are the University of Alabama and University of Missouri; the increase from before to during funding was 6 and 5 times the number of future teachers respectively. Not all sites showed increases after project funding began; two sites have yet to show any measurable increase and plan to rev up recruitment efforts in order to attract more future teachers. Future teachers are defined as “students at PhysTEC Institutions who have committed to completing a program of physics teacher education.” As future PhysTEC graduates, they will earn a major or minor in physics (or equivalent coursework), and will have completed a teacher education program. The precise definition of future teachers is determined locally at each institution, since teacher preparation programs vary in their specific requirements. Each site’s definition is comprised of specific actions students may take to show their commitment to becoming a high school physics teacher. These unique definitions may include enrollment in a Physics Education BA or MAT program, receiving a Noyce scholarship, or enrollment in specific courses in the Education department. Recruitment is a key component of the PhysTEC program. Successful sites have varied recruiting strategies that have included professional advertising campaigns with posters, brochures and a website; classroom visits and presentations; open houses; one-on-one interaction with students by the TIR or faculty; and emailing all physics majors about their interest in teaching. MTSU’s strong success in recruiting future teachers is due to a multi-faceted plan that includes many of the activities listed above, as well as a new Physics Education Research faculty member who teaches a physics pedagogy class and serves as an intellectual leader for students in physics education. The success of the PhysTEC program at MTSU also builds upon an existing Noyce scholarship program for future physics and math teachers, and the UTeach replication program (MTeach), which has reformd the certification program.

PhysTEC Graduate Survey

How many PhysTEC graduate become high school physics teachers? How long do they remain in the profession? And what impact do Learning Assistant or mentoring programs have on students that become teachers? In order to better answer questions like these, the project initiated a new web-based survey to follow PhysTEC graduates in the 2012-13 academic year. The survey will be sent to all graduates via email on an annual basis. The survey results show that a very large percentage of PhysTEC graduates enter physics teaching and after three years, these new teachers have a high retention rate. As shown in the graph on the left, 87% of graduates become a teacher after completing the program and 3% are not teaching but intend to teach. Nearly all (99%) of those in K-12 schools are teaching physics and/or physical science, as seen in the graph on the right. Other commonly taught subjects include math and chemistry. The three-year retention rate calculated from the survey data of PhysTEC teachers is 76%; for comparison, the national average reported by the U.S. Department of Education for the academic year 2007-2008 is 74%.

These results are considered preliminary, and the project will work to increase response rates from this initial year. Of the 273 PhysTEC graduates, a survey link was sent to the 222 graduates for whom there was an email address. Of these, 96 responded to the survey for a response rate of 43%. Thirteen percent of the respondents were from underrepresented minority groups, which is more than double the national average of 4-5% of all US high school physics teachers, according to a report from the American Institute of Physics Statistical Research Center.

About PhysTEC

The PhysTEC project funds selected universities (Supported Sites) to develop physics teacher preparation programs into national models. The project began in 2001 with an initial cohort of six sites. Twelve years later, the project has grown significantly, and now has a total of 30 PhysTEC Supported Sites, which have collectively more than doubled the number of graduates highly qualified to teach physics.

The project aims to improve and promote the education of future physics teachers through a variety of additional activities. These include a coalition of more than 280 major institutions, workshops, an email discussion list, publications and presentations, and multiple special initiatives.

Employment Outcomes

- Not teaching, do not intend to teach: 3%
- Not teaching, intend to teach: 10%
- Secondary teacher: 87%

Teaching Assignments

- One or more physical science classes (no physics): 9%
- One or more physics classes: 82%