PhysTEC Recruiting Grants Awarded to Nine Sites

PhysTEC recently selected nine sites to receive recruiting grants in order to explore a new approach for engaging institutions in increasing the number of high school physics teachers. Recruiting grants of up to $10,000 per year for three years were awarded with a goal of establishing a cohort of institutions focused solely on developing successful recruiting strategies that can be implemented at a wide variety of institutions, especially those with bachelor’s-granting physics departments.

The sites awarded include Boise State University; Bowdoin College; East Tennessee State University; Indiana University, South Bend; Northwest Oklahoma State University (a multi-institution site); Salisbury State University; Sonoma State University; University of Massachusetts Dartmouth; and University of Wyoming. The Request for Proposal process began in May 2014 with sites submitting full proposals in June. After the proposal review, sites were selected for funding beginning in September 2014.

The awarded sites plan to use grants to enhance activities directly aimed at increasing the number of physics teachers, including boosting marketing efforts, improving advising, creating streamlined pathways to the physics degrees/certification, providing financial support, and developing early teaching experiences. The new PhysTEC sites are exploring innovative ways to build partnerships across institutions as a way to support physics teacher preparation. Four institutions in Oklahoma will collaborate to develop recruiting materials that can be used by the partner institutions—East Central University, Northwestern Oklahoma State University, Oklahoma State University, and Southwestern Oklahoma State University—at-in-class presentations, through posting on departmental websites, and in visits to high schools and university student events.

Many institutions will be funding part-time positions for a Teacher in Residence to enhance activity directly aimed at increasing the number of physics teachers, including boosting marketing efforts, improving advising, creating streamlined pathways to the physics degrees/certification, providing financial support, and developing early teaching experiences. The new PhysTEC sites are exploring innovative ways to build partnerships across institutions as a way to support physics teacher preparation. Four institutions in Oklahoma will collaborate to develop recruiting materials that can be used by the partner institutions—East Central University, Northwestern Oklahoma State University, Oklahoma State University, and Southwestern Oklahoma State University—at-in-class presentations, through posting on departmental websites, and in visits to high schools and university student events.

PhysTEC Sites Sustain Programs Well Beyond Award Period

The PhysTEC project recently released a detailed, long-term study of project activity and outcomes at eight sites, most of which sustained increased physics teacher production. Moreover, the study identified project leadership and activity that contributed to these successful outcomes.

PhysTEC has supported over 40 institutions to develop model programs that educate high school physics teachers. PhysTEC has identified two factors that characterize sustainable college and university teacher preparation programs: first, one or more faculty members who champion physics teacher education, and second, institutional motivation and commitment. Scherr defines a champion as someone who secures funding and personnel benefiting physics teacher education.

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PhysTEC Graduates Are More Diverse than Physics Teacher Workforce

PhysTEC teachers are more racially and ethnically diverse than the overall US physics teacher workforce. A survey of PhysTEC graduates indicates they include 12% underrepresented minorities (URM), as shown in the upper bar graph on the right. The American Institute of Physics reports that only 5% of US physics teachers are URMs (lower graph), which is out of step with the rapidly growing population of URMs taking physics. (Following the API’s convention for sake of comparison, those who do not self-identify as White or Asian are considered to be URM.) According to the Integrated Postsecondary Education Data System (IPEDS), URMs earn 9.5% of physics bachelor’s degrees and 21% of all bachelor’s degrees. The PhysTEC project has worked with minority-serving institutions to improve physics teacher education; eight of the 41 supported sites fall into this category.

PhysTEC offers travel grants to faculty from minority serving institutions (MSIs) who wish to attend the PhysTEC conference. In 2014, the popular program awarded eight travel grants, which funded 15 faculty members. These faculty members came from eight MSIs: Delaware State University, Mercy College, Southern Arkansas University, Tuskegee University, University of Houston–Clear Lake, University of Houston, University of Texas San Marcos, and William Patterson University.

Recipients of the travel grants reported learning about a variety of physics teacher preparation models and about recruiting students to physics teaching by developing a robust physics student community. The recipients reported that attending the conference inspired them to take action to improve their teacher education programs, including planning a Learning Assistant program and initiating conversations with their College of Education colleagues to develop a more streamlined pathway to physics teaching certification.

Rachel Scherr, Seattle Pacific University, conducted the study to measure the extent to which programs have been sustained after PhysTEC funding ended, and to identify features that ensure sustainable physics teacher education programs. “The programs have so much in common but also such diverse strengths,” said Scherr. “For example, every sustained program has a champion, but each champion has unique expertise and a strong personality that shapes her/him.”

The results of the study strongly suggest that PhysTEC awards help initiate long-term support for physics teacher education at institutions. Nearly all of the studied sites sustained increases in the production of physics teachers and also sustained funding for physics teacher education after PhysTEC project funding ended. Scherr found about half of the programs to be ‘thriving’ in that, even after PhysTEC funding had ceased, these sites continued to increase physics teacher production.

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Sustaining Programs in Physics Teacher Education

A Study of PhyStEC Supported Sites

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PhysTEC Conference Provides Networking Opportunities

The 2014 Physics Teacher Education Coalition Conference, held in Austin, Texas on May 19-20, was attended by over 100 physics teacher educators. The conference is the largest gathering in the country dedicated to physics teacher preparation. Held in conjunction with the UTeach Institute Annual Conference, the conference was attended by physics faculty, education faculty, administrators, and future teachers from over 60 institutions.

The theme of the conference was “Building Leadership” and featured workshops on building and strengthening communities in physics teacher education. Plenary speakers addressed topics in physics teacher education at both the programmatic and historical levels. Arthur Levin of the Woodrow Wilson Foundation presented the joint plenary talk for both conferences, focusing on the power of forces such as demographic, government policy, and technology privatization to shape the future of STEM teacher preparation. David Meltzer of Arizona State University gave a plenary talk on the history of UTeach teacher preparation since 1880, highlighting the continual conflict between expert recommendations and the reality encountered by physics teacher educators. Nicole Gillespie of the Knowles Science Teaching Foundation (KSTF) spoke on the experiences of KSTF in developing and catalyzing STEM teacher leaders. Susan Singer of the National Science Foundation discussed the national state of STEM learning and the Federal STEM Education 5-Year Strategic plan.

Participants said that the most valuable part of the conference was the opportunity to network and connect with the physics teacher education community. Michael Marder, Co-Director of the UTeach Program, University of Texas at Austin, said, “It’s a great pleasure to hold the PhysTEC conference in conjunction with UTeach. No organization in the country does better work than PhysTEC to increase the number of physics teachers, and bringing its enthusiastic members together with the UTeach community lets us both learn from each other.” Similarly, Jon Anderson, PhysTEC Teacher/TIR Coordinator and physics high school teacher at Centennial High School, noted, “The PhysTEC Conference is a unique opportunity for educators to exchange ideas with people sharing their commitment to physics teacher preparation. The workshops and talks lead to dynamic discussions of how to continue to improve physics teacher education programs.”

Teacher Profile: Ricky Farfan

Ricky Farfan, a Georgia State University PhysTEC graduate, is excited about beginning his first year of teaching physics at Berkmar High School in Lilburn, GA. Farfan teaches five physics courses, including one that is co-taught with a special education teacher and which, he says, is one of his hardest-working classes. Farfan, a Latino, identifies with the student body, which is almost half Hispanic and one third African American. Many students are excited to get to know him; he is one of the few Latino teachers at the school. Farfan is a patient and encouraging teacher who strives to help his students understand both the math and the physical concepts and to recognize the value of learning.

In 2009, although he had already completed his BA and worked for ten years, he again caught the “learning bug” and went to Georgia Perimeter College to study math. With encouragement from his teachers, his interest grew to include physics, which he saw as a tangible application of math. After visiting Georgia State University (GSU) and meeting Brian Thoms, the GSU PhysTEC site leader, Farfan was convinced he wanted to become a physics teacher. In August 2012, Farfan switched to GSU and began working towards a bachelor’s degree in physics with a concentration in education. Farfan feels that as a future teacher, he was given the right advice and set up to be successful from the start. At GSU, he was part of a community of eight to ten future teachers held together by Thoms’s leadership and support. Farfan’s first teaching experience was as a Learning Assistant (LA), serving as a peer instructor in an introductory physics course. Farfan was recruited into the LA program by another GSU physics professor, Joshua Von Korff, who conducts research on LAs.

Farfan clearly remembers feeling intimidated the first time he was in a classroom, “in the trenches,” but he quickly grew to enjoy the experience. Another memorable part of Farfan’s physics teacher education program was having the Teacher in Residence, Elizabeth Walker, observe his student teaching at a local high school. After the class, Walker helped Farfan deconstruct the lesson to improve it and build upon its strengths. Today, Farfan is teaching physics at Berkmar with high success. He can already observe his impact on students. Farfan tells the story of one student who failed the first test but by the second test after studying with him after school. The student was thrilled at his improvement. Farfan relates well to his students, especially those who are tentative learners, as he was in high school. For example, a recent interactive lab on projectile motion inspired his students. If the students correctly calculated where a ball would land, they were allowed to skip writing their lab report. When his students were successful, Farfan said it was if they had won a national championship.​

Sustainability Study

education and negotiates with the institution for changes beneficial to physics teacher education. All the sites Scher studied have at least one champion who is a member of the physics faculty, and about half have a champion with a partial appointment in the College or School of Education. “In our experience with over 30 sites,” said PhysTEC project director Monica Plisch, “we have found that a champion in the physics department is essential to increasing the number of physics teachers.”

Institutional commitment to physics teacher education is evident through funding for physics teacher education programs and personnel, alignment of the institutional mission with physics teacher education, and establishment of infrastructure supporting physics teacher education. Institutions that sustained increases in physics teacher preparation must have a champion in the physics department, a mandate to dedicate people, and a commitment to increasing the number of physics teachers.

PhysTEC has partnered with the American Modeling Teachers Association (AMTA) to offer an online physics pedagogy course for the Fall 2014 semester. Twenty future teachers, in-service teachers, and Teachers in Residence from Coalition member sites registered for the course. Computer technology and insights from physics education research will be integrated into this inquiry approach to high school physics teaching. In the mid-term evaluation, students commented that it was an adjustment to acclimate to the online format, but the skill and support of the instructors and the discussions via online break-out rooms were invaluable. One student said, “Probably the best professional development I’ve been exposed to.” Upon completing the course, the teachers will know how to implement Modeling Instruction in the classroom, know how to use national resources for physics education, and be a part of a newly-established electronic learning community.
Teacher in Residence Profile: Kelli Gamez Warble

Kelli Gamez Warble, a veteran high school physics teacher of 18 years, loves the “aha” moment when students understand ideas for the first time. Gamez Warble’s love of physics began in high school with her teacher, Rex Rice (who is currently a teacher for the PhysTEC online pedagogy course). Gamez Warble has been promoting careers in physics teaching and mentoring future teachers as a Teacher in Residence (TIR) at Arizona State University (ASU) since 2012.

Gamez Warble graduated from Arizona State University with a major in math and a minor in physics and taught physics and math at multiple Title I schools (which have high percentages of students from low-income families). In 1994, while completing her teacher certification program, Gamez Warble was introduced to the high school physics curriculum now known as Modeling Instruction. As a result of her early involvement with this innovative teaching practice, she has implemented it into her teaching during her entire career.

Gamez Warble began her teaching career at Buckeye Union High School, 40 minutes west of Phoenix. In 2010, Gamez Warble began teaching at a small public charter school, Arizona School for the Arts, and was awarded a summer research fellowship position at Arizona University the next summer. Following that experience she was offered and eventually accepted a position as a TIR at ASU.

As a TIR at ASU, Gamez Warble worked to bridge a rift between the physics department and high school teachers. She advocated for institutional change based upon physics education research and for increased efforts to recruit future physics teachers. She helped educate the physics department on the scientific study of teaching and to dispel the myth that teaching is merely an art. Gamez Warble has also contributed to the development of physics teacher certification pathways and teaching experiences. In her first year, she encouraged 12 students to take a physics pedagogy course and become LAs. She helped create a Physics BA program with a concentration in physics education. In addition, she developed a one-credit class, Explorations in Science Teaching, which allows students to observe local science classrooms and learn more about teaching.

The impact of a TIR like Gamez Warble is clear. As one example, an LA of Hispanic background was wavering between pursuing engineering or teaching. Partly due to Gamez Warble’s mentoring, the student became a physics teacher and works in the same largely Hispanic high school that he attended.

Gamez Warble encouraged professors to experiment with using LAs in the classrooms and, as a result, there has been rapid growth of the LA program within the ASU physics department. Her continuing connections to practicing high school teachers are strengthened by the professional development she leads for local teachers and by “Red Carpet Day”, when local high school teachers and students considering pursuing a physics degree visit the ASU physics department.

Gamez Warble has also contributed to the growth of the LA Alliance within the ASU physics department. Her continuing connections to practicing high school teachers are strengthened by the professional development she leads for local teachers and by “Red Carpet Day”, when local high school teachers and students considering pursuing a physics degree visit the ASU physics department.

T he 5+ Club is a new initiative to recognize institutions that graduate five or more physics teachers in a given year. The great majority of institutions graduate less than two physics teachers a year, and the most common number of graduates is zero. Thus, graduating five or more physics teachers a year is a significant achievement, helping to address the severe national shortage of high school physics teachers. Institutions designated as a member of The 5+ Club will receive an award and publicity. The recognition is designed to give a boost to outstanding programs and to share information on their strategies for graduating large numbers of physics teachers. Institutions must apply for the recognition and confirm that all graduates have strong content knowledge in physics (i.e., a major, minor or equivalent coursework) and have completed a program of teacher education.

For institutions receiving The 5+ Club award, the PhysTEC project will send a letter cosigned by APS and AAPT presidents to the university president and other administrators commending the institution for helping to address the national physics teacher shortage. In addition, the project will provide a press release and name new members to The 5+ Club in The Chronicle of Higher Education. Physics teacher education leaders from the recognized institutions will be invited to the PhysTEC Conference and will receive a certificate in the opening plenary session. In addition, new members of The 5+ Club will be listed in APS and AAPT publications, including APS News, the AAPT eNOUNCER and society websites. PhysTEC.org will also host profiles of the physics teacher education programs.
PhysTEC Funded Sites Successfully Recruit Future Teachers

PhysTEC sites have more than doubled the number of future teachers they produce, comparing averages for each institution before funding and during funded years (compare the brown and blue bars in graph above). Nineteen sites have been funded through the PhysTEC II grant and have provided future physics teacher data for one to three funded years. PhysTEC supported sites, collectively, have more than doubled the number of future physics teachers compared to pre-funding years. Future teachers are an indicator of teacher graduates and thus an early indicator of successful physics teacher recruitment.

Future teachers are defined as “students at PhysTEC institutions who have committed to completing a program of physics teacher education.” Future teachers are students at PhysTEC-funded institutions who will earn a major or minor in physics (or equivalent coursework) and will complete a teacher education program. Because teacher preparation programs vary, the definition of future teachers is determined locally at each institution. For example, future teachers may be counted once they enroll in a teaching methods course or receive a Noyce scholarship. State University of New York (SUNY), Geneseo, has had excellent results with their recruiting efforts, increasing from an average of eight future teachers in pre-funded years to an average of 16 in PhysTEC funded years. SUNY Geneseo has recruited teachers through their “Build-it, Leave-it, Teach-it” program, where teams of physics majors fabricate physics equipment and use it to teach a local high school class.

Comparing pre-funded and funded teacher production, the University of Missouri-Columbia (UM) has increased its number of future teachers by a factor of six. MU’s most distinctive recruiting tool is its high school-based LA program, in which undergraduates assist in ninth-grade physics classes. Sixty percent of LAs reported an increased interest in high school teaching after participating in the program. Recruiting posters and visits to education and physics classes have also been effective tools for MU recruitment.

Recruitment, a key component of the PhysTEC program, is a comprehensive activity that includes sharing information about teaching careers, encouraging students to consider teaching, providing early teaching experiences to future teachers, and streamlining pathways to certification. Successful PhysTEC sites regard recruitment as going beyond convincing students to commit to a teaching program; committed students also need opportunities to see teaching as a viable and rewarding career. The American Physical Society (APS) is working with members of Congress in order to allow Title II funding to be used for pre-service teacher recruitment and development. Members of Congress are being asked to sign on to a letter being sent to the Department of Education (ED) requesting the change in Title II guidance. Full details on APS efforts and the letter are located under the Policy tab at aps.org.

For the last few years, Congress has been debating how best to move forward with the Elementary & Secondary Education Act (ESEA) reauthorization, known as No Child Left Behind, and the Higher Education Act (HEA) reauthorization. While there is plenty of debate on how to proceed, both Republicans and Democrats agree that there are onerous policy restrictions that should be undone. In fact, during a hearing this summer, Sen. Elizabeth Warren (D-MA) termed the hearing a “love-fest” for high levels of agreement over repealing certain policy provisions.

The future for both ESEA and HEA reauthorizations, however, is clear. Due to other policy disagreements, neither will be marked anytime soon, no matter how outdated the old bills become. The APS Office of Public Affairs is working on non-legislative strategies to address the policy concerns with both ESEA and HEA. Specifically, APS is examining how to change the guidance from Department of Education (ED) that prohibits state agencies of higher education from using Title II funds for teacher pre-service recruitment and development. Teacher pre-service recruitment and development programs like PhysTEC, UTeach, and the LA program are currently unable to access Title II funds to grow and expand. By changing the guidance at ED, Title II funds would become available for use, thus allowing for scale-up of teacher recruitment and development programs that produce and improve retention of high-quality physical science teachers in K-12 classrooms.

APS is working with multiple Congressional offices to send a letter to ED requesting a change in the guidance for Title II funds. Upon delivery of the letter, APS will continue to work on both legislative and non-legislative actions surrounding STEM education.

PhysTEC Recruiting Grants

PhysTEC has awarded grants to 34 institutions that produce and improve high school physics teachers. In total, the PhysTEC grants have been used to: expand recruitment efforts at 23 institutions; develop new recruitment efforts or expand existing ones at 11 institutions; and serve as a supplement to existing recruitment and development efforts at 10 institutions. Among these, 8 of the 34 grant recipients are multi-site programs that are supported by more than one grant.

The PhysTEC project has a mission to improve and promote the education of future physics teachers. The project funds selected universities or Supported Sites to develop physics teacher preparation programs into national models. The project began in 2001 with an initial cohort of six sites. Thirteen years later the project has grown significantly, and now has a total of 41 Supported Sites, which have collectively more than doubled the number of their graduates who are highly qualified to teach physics.

The Coalition (pictured in map) now has more than 300 institutions committed to the PhysTEC mission. (The Endorsed Site has met all the PhysTEC requirements for a model physics teacher education program.) These institutions include all graduate physics teachers and comprise 38% of all U.S. physics departments that grant a bachelor's degree. All Coalition members have a full physics teacher education program, except Affiliate Institutions.

To learn more about PhysTEC go to www.phystec.org. To become a PhysTEC Member Institution, visit www.phystec.org/join.