

A Request for a Letter of Support:

National Institute for Physics Teacher Educators

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What: National Science Foundation funding soon will be requested to support an initiative – the *National Institute for Physics Teacher Educators* (NIPTE). The proposal is for a \$2,500,000, five-year targeted MSP grant (1 year planning phase, 4 year implementation phase) that would partner faculty of successful physics teacher education (PTE) programs – as well as master high school physics teachers – with less experienced physics teacher educators (and eventually generic science teacher educators) whose universities' PTE programs show commitment to and potential for programmatic change and growth. The measurable outcomes will be to significantly increase the competence of 96 PTE coordinators to administer and teach within their PTE programs, to build both quality and quantity of their PTE courses in comparison to specified indicators, to significantly improve high school physics teacher candidate performance as measured on a variety of assessments, and to increase enrollment in those programs by a minimum of 200% - all within the lifetime of the grant. (N.B. Because we have chosen not to widely disseminate this pre-proposal, we have only solicited interest for planning team and faculty positions to date, but no other participants.)

The short-term goal of NIPTE is to educate four cohorts (each consisting of 24 physics teacher educators per year recruited on a nationwide basis) that can result in each state in the Union having on average two physics teacher education programs of excellence. The idea is to help university-level physics teacher educators to work within their own institutions and organizational structures to create top quality high school physics teacher education programs using other successful programs as a guide. Many of these physics educators probably will have taught physics for a number of years, but they might never have had formal training in how to most effectively pass on their physics knowledge to others. These faculty members will thus profit from a course in education theory and practice, in cognitive psychology, in a review of the results from basic science education research literature, in practicing non-traditional teaching and learning strategies, in learning about the needs and challenges of middle and high school teachers, and in a long-term mentoring program. NIPTE also will provide participating university physics faculty members with further insights of how to reform their own university-level physics teaching to make it more compliant with the *National Science Teaching Standards*.

The long-term goal of NIPTE is to help participating teacher educators better recruit and retain, prepare and support teacher candidates, and provide professional development for all high school science teachers. Another long-term goal would be to permanently house this Institute as one or two courses in several doctoral-level programs across the country leading to an MS Ed., Ed.D. or Ph.D. degree for science teacher educators. The aim of the course(s) would be the preparation of science teacher educators who would teach in community colleges and universities. Other educators, such as non-science teacher educators, classroom teachers, and school administrators, might also find this course to be of value in their professional preparation/development. Institutions that host NIPTE would be expected to eventually institutionalize the Institute as a summer course.

It is our belief that NIPTE can improve the current situation of too few authentically qualified high school physics teachers by bringing together the best people and resources to develop a program that would not only improve the programs of participants, but the very programs that will serve as models.

Why:

- America’s universities currently are not graduating adequate numbers of new high school physics teachers to meet the needs of public school systems that are now facing a critical and growing shortage in this area.
- This shortage stems in part from the fact that there are few PTE programs of sufficient quality to attract and retain adequate numbers of undergraduate majors.
- PTE programs with highly qualified personnel ARE attracting and graduating comparatively large numbers of PTE majors, but such programs are rare.
- While university programs do exist for the general preparation of teacher educators, there are very few if any programs currently available designed specifically to prepare physics teacher educators.
- In order to increase the number of high school physics teachers, we first need a program to address the critical shortage of physics teacher educators.
- NIPTE is designed to prepare educational leaders for high school physics teacher programs.

In addition, it should be noted that many PTE programs exist that do graduate small numbers of new physics teachers annually who are often inadequately prepared to teach in ways that align with the science education reform movement as outlined in the *National Science Education Standards* and *Project 2061*. Many graduates of such programs frequently teach using the college model – teaching by telling – that has been shown by research to be ineffective with most students. In addition, many of these program graduates often drop out of high school teaching within a few years, ostensibly due to the fact that they are under prepared to deal with the day-to-day realities of the modern classroom.

Who: Faculty consisting of experienced physics teacher educators and master teachers of high school physics will lead this project. The teacher educator preparation team – the faculty of NIPTE – ostensibly would be drawn from or with the assistance of the AAPT’s Teacher Preparation and High School Committees and participating teacher education projects. This would provide for an experienced team, university commitment to the long-term health of the program, and potential for expansion into institutionalized courses. It is anticipated that Dr. Carl J. Wenning of Illinois State University will serve as lead grant writer and project director.

The following leading physics teacher educators have indicated an interest in serving on the first year planning team and on the institute faculty:

Dr. Dewey Dykstra Boise State University	Dr. Ingrid Novodvorsky University of Arizona
Dr. Daniel MacIsaac SUNY College at Buffalo	Dr. Carl J. Wenning Illinois State University
Dr. Eugenia Etkina Rutgers University	Dr. Stanley Sobolewski Indiana University of Pennsylvania
Dr. Ronald Henderson Middle Tennessee University	Dr. Esther Zirbel Tufts University
Dr. Joel Bryant Ball State University	Dr. Patsy Ann Johnson Slippery Rock University of PA

When: If funded, it is expected that the first NIPTE summer institute will occur during 2011, after the first planning year and during year two of the grant.

Where: Illinois State University is fully committed to serving as the base of operations for this grant. It will host planning activities to take place during the first year of the grant, and host the first NIPTE summer NIPTE Pre-proposal (2/04/2009)

program. In subsequent years, the Institute will be moved to other national centers with successful physics teacher education programs. Funding will flow from ISU to other institutions through subcontracts as appropriate.

How:

Step 1: Planning Year – Prior to the first summer institute, highly qualified faculty and staff from universities, community colleges, and high schools will be recruited nationwide for curricular and instructional development of the Institute. Those selected for this work will meet for five days at Illinois State University during the planning phase of the grant. The meeting’s focus will be the detailed development of the institute content including objectives, activities, program and teacher candidate assessments, and *A PTE Program Administrator’s Handbook*.

Step 2: Summer Institutes – During the summer institutes participants will be introduced to a wide variety of experiences, information, resources, and teacher preparation models taken from the best and most successful PTE programs in the nation. This will allow participants to develop programs best adapted to the needs of their students, institutions, and states. The goal is NOT to mandate a particular model of instruction; rather, it is to provide a variety of strategies and allow institutions to develop their own programs using successful models as a guide. Nonetheless, specific minimum criteria will be set institution-by-institution for implementing improved PTE programs.

Step 3: Follow-up Support – Ongoing support to physics teacher educators will be provided by NIPTE faculty through a variety of means such as e-mail, listserv, meetings at national events such as AAPT, and online resources such as ComPADRE.

Dissemination to the Broader Community: Efforts will be made to benefit pre-college members of the AAPT, and to spread the benefits of the grant across the whole country. For instance, according to former AAPT President Jim Nelson, “...the AAPT/PTRA Program has been developed and is ready to provide professional development for pre-college teachers. In fact we are providing such professional development in several states support by state MSP funds” (personal communication). There is a possibility that NIPTE could work within the existing PTRA infrastructure (leaders, curriculum, and assessment) in this effort.

And as Dewey Dykstra noted, “As we train up some people and they become competent, we can have them run local/regional versions of the national summer institute. It would help also to create an email network that enables ongoing interaction across the country, as well as, local maintenance of regular contact between times of gathering at any level. Because, at least at the beginning, programs will not have very large numbers of students, there is the possibility of coordinated collaborations between programs that are not geographically too separated. These local/regional versions of the national institute do not have to be aimed at training physics teacher educators, but could be aimed at beefing up the skills of local teachers challenging them to look deeper at students’ understanding, how, why and under what conditions these understandings change. Such offerings can be of the sort to share what transfers from physics teaching to other areas, so they would not be limited to physics/physical science teachers” (personal communication).

Measurable Outcomes: A number of measurable outcomes will be affiliated with this grant:

Physics Teacher Educators

- significantly increase the competence of 96 PTE coordinators to administer and teach within their PTE programs,

- to build both quality and quantity of their PTE courses in comparison to specified indicators,
- to increase enrollment in those programs by a minimum of 200% - all within the lifetime of the grant.

Physics Teacher Candidates

- Improved pedagogical and pedagogical content knowledge of teacher candidates as measured with the use of standard and performance-based assessment instruments (CFE, 2001)

PTE programs and resources

- preparation of a comprehensive *Teaching High School Physics* textbook
- create of Web site with resources for physics teacher education

NIPTE Curriculum: The NIPTE curriculum will include two foci: (1) PTE program administration, and (2) PTE program content. Representative topics of each focus are provided below in no particular order.

Program Administration

- National Science Education Standards
- NSTA Teacher Preparation Standards
- AETS Professional Knowledge Standards for Science Teacher Educators
- NCATE/NSTA program accreditation
- State board of education program accreditation
- Clinical experiences
- Administrative networks
- Administrative resources
- Supervision of student teachers
- Reviews of successful PTE programs
- Recommendations for *Basic*, *Intermediate*, and *Advanced* PTE programs
- Placement of clinical student and student teachers
- Professional development for in-service teachers
- Support for novice teachers
- PTE major recruitment and retention
- Program design and development
- Advising PTE majors
- Building a presence among in-service high school physics teachers
- Philosophies of physics teacher preparation
- Performance-based assessment
- A canon of PTE literature
- Instructional modeling

Program Content (see the six physics teaching methods courses at <http://www.phy.ilstu.edu/pte/> for detailed examples of such course content)

- The aim of physics teaching
- Inquiry-oriented instruction
- Culturally responsive teaching
- Alternative conceptions
- Physics curricula
- Instructional strategies
- Class management
- Cooperative learning

- Metacognition and self-regulation
- Cognition and instruction
- Subject matter integration
- Lesson study
- Lab activities with technology
- Discourse management
- Whiteboarding and Socratic dialogues
- Problem-based learning/cooperative/collaborative learning
- Assessment
- Student difficulties

Suggested Reading List:

Prior to and during the institute, participants will be expected to read extensively. Readings will be selected from among the following and similar resources:

- *A PTE Program Administrator's Handbook*
- *National Science Education Standards*
- *Inquiry and the NSES*
- *Project 2061: Science for All Americans*
- *Benchmarks for Science Literacy*
- *How People Learn: Brain, Mind, Experience, and School*
- *NSTA Teacher Preparation Standards*
- Selected readings from resources such as the following:
 - *A Literary Canon in Physics Education Research* by John Thompson & Bradley Ambrose
 - *American Journal of Physics*
 - *Physics Education*
 - *Journal of Physics Teacher Education Online*

Methodology: Program administration will be addressed through readings of *A PTE Program Administrator's Handbook* and follow-up discussions. Program content, however, will be addressed quite differently. As with most other forms of education, teaching by telling is not the most effective way to get students to learn. It is our belief that participants will best learn how to prepare the next generation of high school physics teachers by participating student-centered activities that model appropriate teaching and learning strategies. Taking advantage of the findings of science education research in general and physics education research in particular, NIPTE will use an “immersion” approach where participants will not only hear about the best physics teacher preparation practices, but will participate in them as both teacher and student. Participants will be expected to complete many of the various exercises that PTE majors complete so as to more fully understand the process and value of their education. They will also practice leadership activities by co-teaching.

Participant Recruitment: Efforts will be undertaken to recruit current and potential physics teacher educators from emerging or existing PTE programs on a national level. The resources of AAPT, the AAPT's Teacher Preparation and High School Committees, and participating teacher education projects will be used to identify and recruit these individuals.

Participant Commitment: The NIPTE philosophy of preparation requires that participants demonstrate and/or articulate appropriate knowledge and skills as they relate to excellence in high school physics teacher preparation. To this end authentic performance-based assessments will be employed to ensure adequate preparation of physics teacher educators. Participants will be expected to be personally committed to attending and fully participating in all preparatory, participatory, and follow-up activities of the Institute.

Institutional Commitment and Support: Institutions whose faculty member(s) is/are selected to participate in NIPTE must show potential for program growth, must commit to program change, must meet goals on an established timeline, must provide data for project assessment, etc. NIPTE will follow successful examples of other projects in establishing and clearly enunciating these expectations.

Graduate Credit/CPDU: Six (6) semester hours of optional tuition-free graduate credit will be available by way of NIPTE through Illinois State University and possibly affiliated centers. Alternatively, continuing professional education units will be available for those who request them.

Certification: Participants who successfully complete the summer institute will be NIPTE certified physics teacher educators. They will receive a certificate from NIPTE in recognition of their efforts. In addition, one or a combination of the participating groups might eventually certify participating PTE programs that meet NIPTE standards.

Request for Organizational Commitments: The originators of this proposal are seeking support from the Executive Board of AAPT, the AAPT's Teacher Preparation and High School Committees, and other similar projects in the form of letters of support/commitment for the NIPTE proposal process and its implementation if funded.

The AAPT has set for itself the over-arching aim of enhancing the understanding and appreciation of physics through teaching. To this end, the AAPT has identified four goals to guide their activities:

1. Increase AAPT's outreach to and impact on physics teachers
2. Increase the diversity and numbers of physics teachers and students
3. Improve the pedagogical skills and physics knowledge of teachers at all levels
4. Increase our understanding of physics learning and of ways to improve teaching effectiveness

The goals of the AAPT would be furthered through their association with NIPTE. The endorsement and participation of AAPT, its Teacher Preparation and High School committees, and similar projects to the NIPTE effort would be of great benefit to the work of all organizations. Through its association with NIPTE, participating PTE program educators, future physics teachers, and their students would benefit greatly as well.

Requested Commitment: It is hoped that the Executive Board of AAPT, its Teacher Preparation and High School committees, and other similar teacher education projects will support this proposal. At this time, the NIPTE planning team (a loose coalition of physics teacher educators) is seeking informal support. As the grant proposal process moves forward, details will be provided for a formal letter of support.

Please feel free to address any questions and/or concerns to:

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References:

Center for Education [CFE]. (2001). *Testing Teacher Candidates: The Role of Licensure Tests in Improving Teacher Quality*. Washington, DC: National Academies Press.