

Forum on Education

American Physical Society

Summer 2012 Newsletter

Nic Rady, Editor

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Disclaimer–The articles and opinion pieces found in this issue of the APS Forum on Education Newsletter are not peer refereed and represent solely the views of the authors and not necessarily the views of the APS.

From the Chair

Renee Diehl

The Forum on Education (FEd) comprises about 10% of the membership of APS and it works hard to provide programming at the APS meetings that is timely and of interest to the entire membership. It also works with the APS Committee on Education to help to develop policies pertaining to the physics education of our citizens and beyond. And it liaises with the American Association of Physics Teachers (AAPT) to provide the best service to physics educators and students.

I would like to thank Chandralekha Singh for doing an excellent job as the FEd chair for the past year. She will continue on the executive committee for another year as the past chair, and will chair the Fellowship Committee. Please let this serve as a reminder that the FEd is always looking for qualified nominees for fellowship.

I would also like to extend our thanks to the outgoing members of the FEd executive committee—the past chair Larry Woolf, and the members-at-large Laird Kramer and Amber Stuver—and welcome the newly elected members—vice-chair Michael Fauerbach, and members-at-large Dan Crowe and Mel Sabella.

Paul Cottle, who is the FEd chair-elect, is also the chair of the FEd program committee for next year. The FEd organizes and coordinates invited and focus sessions at the March and April APS meetings, and the plenary session at the summer AAPT meeting. We are working to broaden our reach to the smaller divisional meetings, and this year we hope to also coordinate an education session at the conference of the Division of Nuclear Physics. If you have suggestions for possible sessions that could be sponsored or co-sponsored by the FEd for any of these meetings, please contact Paul Cottle (cottle@phy.fsu.edu).

Michael Fauerbach is the chair of the FEd nominating committee, which has the task of assembling the ballot for the FEd elections,

to be held in December or January. Three positions will be open – vice-chair and two member-at-large positions, one of which must be held by a member of AAPT. If you have suggestions for any of these positions, please contact Michael (mfauerba@fgcu.edu).

As you know if you are reading this, the FEd also produces newsletters, in summer, fall and spring of each year. The editors for this (summer) newsletter is Nic Rady, who also edited last summer's newsletter. The editors for the fall and spring newsletters will be Beth Lindsey and Paul Dolan, respectively. If you would like to write an article or have a news item or announcement for any of these newsletters, please contact one of the editors or me. The deadline for each newsletter appears on the FEd website.

The FEd website (<http://www.aps.org/units/fed/index.cfm>) also contains a list of the current executive committee members, and information on the Excellence in Physics Education Award. This award recognizes and honors a team or an individual who has exhibited a sustained commitment to excellence in physics education. As for all APS awards, it consists of \$5000 and an invited talk at an APS meeting. This award was established with support from several organizations and also individuals like you. Please consider making a tax-deductible contribution to this award at <http://www.aps.org/units/fed/awards/education.cfm>.

The FEd executive committee welcomes the active engagement of our members, so please feel free to contact any of us if you have suggestions or contributions to our missions.

Renee Diehl is Professor of Physics and Associate Department Head for Equity and Diversity in the Physics Department of Penn State University. She is Chair of the APS Forum on Education and carries out research in the area of surface physics, most recently with an emphasis on complex structures such as quasicrystals.

A Letter from the Editor

As the FED's summer newsletter editor, I am quite excited to present two articles in this to you concerning the establishment of a PER topical group in the APS. While attending the 2011 Winter AAPT meeting, another graduate student claimed that 'I was silly for being suckered into editing the FED's newsletter because no one reads it.' Later in that day, I was rewarded with a gentleman quoting from an article submitted to the newsletter a few years prior when the topic of a PER topical group in the APS arose during an open meeting. And now, a year later, I am certain the PER community will be reading about this new topical group that is forming.

As a PhD candidate studying physics education, I am quite excited that this new topical group is forming. While studying physics as an undergraduate, I went from an environment that used PER backed curriculum and methodologies; as a graduate student, I was forced to teach laboratories that were cookbook in style and there was no changing this. As an act of desperation for my own sanity, I decided that I wanted to understand better about how learning occurs and how this applies to physics education. So, once I finished

my masters degree in physics, I went to my school's department of curriculum and instruction and combined classes there with physics classes to create my PhD degree plan.

The sad fact about this story is that I had to go outside the physics department, with great resistance, to learn about physics education. I was met with comments about how it 'was not a real field,' or how 'there is no science in education.' The most disheartening thing about these types of comments was how it seemed that these professors were dismissing a whole group of their peers in one broad stroke. While looking at the other science departments on campus, there were science educators in their field hired to help make the department better prepare their students; not in physics. What I hope is that departments around the country that have a similar attitude towards PER will begin to see it as its own field. I am hopeful that this topical group may be a step towards that.

Nic Rady
University of Dallas

Toward establishing a Physics Education Research Topical Group within the American Physical Society

Eric Brewster, John Thompson, Noah Finkelstein

Physics Education Research (PER) is a growing and vibrant field of physics. The establishment and expansion of PER has been supported heavily by the American Association of Physics Teachers (AAPT), which hosts both the PER Topical Group (PER-TG) and the annual, national PER Conference since 1998.¹ Simultaneously, the American Physical Society (APS) has been instrumental in developing the field, especially with its 1999 Statement (99:2) “Research in Physics Education.” During the January 2011 PER-TG Town Hall meeting, the notion of formalizing PER as a research field within physics by creating an APS topical group was introduced. A small group investigated the rules, created and administered a survey for both AAPT and APS members, and met with AAPT leadership.

The survey results are clear: there is a strong interest in the creation of a Physics Education Research Topical Group within the APS (GPER). Responses to these two surveys (described in the parallel article) also reveal three principal questions that we hope to clarify here, namely: How is the APS GPER different from the Forum on Education (FEd)? What are the benefits of creating a topical group? Finally, how will the proposed PER topical group in APS relate to, support, and collaborate with the PER-TG in AAPT?

Distinguishing PER-TG from FEd

The Forum on Education is the second largest forum within the APS, with approximately 5,000 members. With the charge of “advancement and diffusion of knowledge regarding the inter-relationship of physics, physicists and education,” this forum represents a broad interest in education within the membership of the APS. Because physics education researchers are by definition interested in education, the FEd has been influenced by and supportive of PER efforts in addition to many other education-related efforts. However, topical groups are distinct from forums in that a topical group is a representational body of a *research field*, while a forum serves to inform the membership of and advocate in *broad areas of interest* like education. Not surprisingly, the group interested in education in general is much larger than those who have made education a research pursuit. Thus, the formation of GPER would provide many professional benefits to physics education researchers within APS. While the benefits of the topical group may primarily relate to researchers in PER, the insights, methods and results of the research would benefit APS membership broadly and specifically those members of the FEd.

Benefits of a PER-TG

There are several benefits of creating a PER topical group within the American Physical Society. As the APS is the professional organization of physicists, and physics education researchers identify with the community of physicists and thus representation of

PER within physics is important. The establishment of a GPER will formalize and further strengthen APS commitment to PER as a research field within the physics community and physics departments, and serve as a model for the rapid growth of educational research within disciplinary fields of all types. (See the recently released report on discipline-based education research (DBER) from the National Academies).³ Topical groups are also allowed to organize sessions at national APS meetings, which are prime opportunities to reach other physicists, who typically do not attend AAPT meetings and thus are not exposed to PER. These sessions should raise the awareness of PER and PER-based practices within the physics community, by allowing more interactions between physics education researchers and the rest of the physics research community. These interactions in turn have the promise to promote the uptake of PER-based practices by the broader physics community. The GPER would work closely in coordination with the FEd to ensure complementary and synergistic, rather than competing, efforts in education. Finally, APS has an active lobbying arm, which represents the members of APS on a variety of issues, including education. Formalizing the research field of PER within APS will allow the PER community to better have its interests represented by the lobbying efforts APS already undertakes. In addition to the benefits to the field of PER, a topical group formed within APS has the potential to bring members into APS and to formalize links between APS and AAPT.

Relationship of GPER with AAPT

One of the primary rationales for pursuing a topical group is that representing PER among physicists is valuable, just as representing PER to the physics education community is valuable. As mentioned earlier, a PER topical group already exists within the AAPT—the only topical group in that organization. The AAPT PER-TG has been very effective at supporting the growth of PER and building collaborations with physics educators: the PER-TG promotes the conduct of research and the exchange of ideas and information within the AAPT PER community as well as the adoption of teaching methods developed by PER researchers; practicing educators in AAPT ground and contribute to the practice of relevant PER.

The PER community represents a significant opportunity to bridge the APS and AAPT communities; we are trying to sort out how to leverage this opportunity during the formation of an APS topical group. Formal relationships such as shared leadership across the two topical groups and the leadership of the PER-TG in AAPT are actively being considered. Other, less formal opportunities, such as bridged meetings between APS and AAPT, are also being discussed.

Path toward a PER Topical Group

During the upcoming months, several steps are needed to create

the PER Topical Group with APS. First, a petition needs to circulate among APS members and receive a minimum of 200 'signatures.' The petition will be in the form of an electronic survey asking people to insert their name and email address and to state that they endorse the creation of a Physics Education Research Topical Group. While the petition is being sent to APS members, a set of bylaws will be generated, based on bylaws of other topical groups, which will also establish formal relationships between GPER, AAPT PER-TG and the leadership of the AAPT PER-TG and AAPT itself. The petition and bylaws, as well as documentation of the mission and impact drafts of the topical group, will then be submitted to APS Constitution & Bylaws Committee and the APS Council for approval. Once approved, the topical group will

have 18 months during which 200 members need to be recruited and to be sustained, 300 members need to be recruited by year 3. This process is anticipated to take between 6 and 12 months, for approval and then the recruitment of members will begin. Those members of the Forum on Education who are interested in collaborating on these efforts are encouraged to contact Eric Brewe at eric.brewe@fiu.edu.

1. <http://www.compadre.org/per/pertg/>
2. http://www.aps.org/policy/statements/99_2.cfm
3. <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=13362>

Methods of Surveying Members of FEd and PER-TG on the Creation of an APS PER Topical Group

Eric Brewé, Noah Finkelstein, John Thompson

Determining the interest in creating a Physical Education Research Topical Group in APS

During the January 2011 American Association of Physics Teachers Physics Education Research Topical Group (AAPT PER-TG) Town Hall meeting, the notion of formalizing Physics Education Research as a research field within physics by creating an APS topical group was introduced. A companion article (cite) identifies the goals, benefits and expectations for a Topical Group with APS (GPER), as well as describing the relations with other bodies (AAPT PER-TG and the Forum on Education.) Following on that recommendation, a small group began to pursue the formation of a topical group. At least two criteria are required to form a topical group: 1) a petition with 'signatures' of 200 APS members, and 2) a statement of interest that includes justification of how the topical group will benefit the APS. These items are to be submitted to the APS Constitution & Bylaws Committee and the APS Council. In order to identify community interest and potential signatories in forming a Topical Group within APS, we developed two surveys. The results from these two surveys, one issued to Forum on Education members and another to the AAPT PER-TG members are clear: it is time to pursue a Physics Education Research Topical Group within APS.

Surveying FEd Members

The first survey consisted of six questions and was distributed to the approximately 5,000 members of the Forum on Education in May 2012. The design of the survey was straightforward, members were asked if they supported the creation of a topical group, then were asked if they would provide contact information to be contacted to sign a petition, finally all respondents were offered the opportunity to provide comments on the notion of the topical group. Overall, 358 members of the FEd responded to the survey, two were identified as also having taken the AAPT PER-TG survey and so were counted in that survey. Of the 356 respondents, 309 or 86.8% supported the creation of a topical group. Of these, 270 provided their names and email addresses to be contacted regarding the petition, which far exceeds the number of signatories to a petition to satisfy the requirements for a topical group. In addition, 253 respondents to the survey administered through the FEd indicated that they are interested in joining the topical group. Based on the results of the FEd survey, indications are strong that the topical group will meet the membership requirements within 18 months of

formation. We also received 62 comments on the efforts to create a PER topical group, 39 were positive such as, "I think it is important to create this topical group, as it will legitimize PER as a valid area of research for physicists to consider." Another 10 responses encouraged the formation of the topical group to further clarify or maintain good relationships with FEd, "Essential to maintain good collaboration with FEd." Two responses were negative, and two more indicated that there are too many groups within APS already. The sentiment expressed in this survey was strongly positive.

Surveying AAPT PER-TG Members

In addition to surveying FEd members, we developed a survey that was distributed through the AAPT PER-TG listserv. The 153 respondents to this survey were approximately evenly distributed between APS members (74) and non-APS members (77). Seventy-four APS members responded to the AAPT PER-TG survey, prior to analysis people who responded to both surveys were removed. Of the 74 APS members who responded, 72 indicated that they would sign up for the topical group, 71 indicated that they would sign the petition, and 68 provided their name and email address. Between the two surveys, that means 338 members of APS have indicated that they would sign a petition and have provided contact information. In addition to APS members, 77 non-members responded. Of these, 58 indicated that the creation of a PER topical group would make them more likely to join the APS, and 71 of the 77 non-members indicated that an option for joint membership, which is currently not an option, would make them more likely to join.

Summary

Both surveys have indicated strong support for the creation of a PER topical group within APS. Further, there is evidence that the APS will benefit from additional membership as a result of the creation of a topical group. The feedback offered through these surveys shows both the areas of strength but also that clarifying the differences between the proposed topical group and the Forum on Education and the relationship with American Association of Physics Teachers are important in the formation of the topical group. A companion article in this newsletter clarifies the distinctions between GPER and the Forum on Education as well as to describes the relationship between the GPER and the AAPT PER-TG and outlines the process for moving forward with the GPER.



Section on Teacher Preparation

Teacher Preparation Section

John Stewart, University of Arkansas

In this issue, we begin with a description of the teacher preparation program at SUNY- Geneseo, one of the newly funded PhysTEC sites. This site mixes traditional PhysTEC components, the teacher in residence, with an innovative program that builds demonstration equipment for local schools. The PhysTEC program is built on an undergraduate program with an impressive graduation rate.

The second article describes the annual PhysTEC conference held this February in Ontario, California. This exceptional event brings together experts in physics teacher preparation for an intimate meeting each year. I cannot recommend this event strongly enough. Next year's meeting will be held in conjunction with the APS March meeting in Baltimore, Maryland.

The last article features an online resource that I have found particularly useful over the past few years, MSPnet.org. This resource

features articles by participants in the National Science Foundation's Math and Science Partnership Program (MSP). The site also contains a library of related articles. While the site contains articles about the teaching of many sciences, there is strong physics content. The site contains many general articles and reports useful to grant writers on diversity, high-needs teaching, and professional development. For example, at the time of the writing of this article the new featured items in the library include the "Next Generation Science Standards (First Public Draft)", "The NSTA Reader's guide to A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas", and "The Nation's Report Card: Science 2011- National Assessment of Educational Progress at Grade 8". A description of a math and science partnership centered on the relation of physics and mathematics in the readiness to attend college can be found in the [summer 2009 newsletter](#).

SUNY- Geneseo – A PhysTEC Targeted Site

Kurt Fletcher – State University of New York at Geneseo

A team of college faculty, high school science teachers and enthusiastic physics majors are completing the first year of funding as a Targeted Site supported by the Physics Teacher Education Coalition (PhysTEC). The Geneseo PhysTEC Site is reinvigorating a long-established physics teacher education program through special attention to early teaching experiences, an enhanced recruitment program, and the efforts of a well-qualified part-time Teacher-In-Residence (TIR). Through these efforts we expect to double the number of graduates certified to teach physics from our current average of three per year.

Geneseo's PhysTEC team includes Kurt Fletcher and James McLean from the Department of Physics and Astronomy and Dennis Showers from the Ella Cline Shear School of Education. Our part-time TIR, Mr. Rob Sells, is a physics teacher at Mt. Morris Central School. Mr. Sells has a wide variety of teaching experiences: he has taught physics to students in the Choate Rosemary Hall in Connecticut, inmates at the Groveland Correctional Facility, undergraduates at Alfred State University, and now public school students in a nearby high school in Mt. Morris, NY. This diverse experience is particularly useful as he mentors pre-service teachers in the Geneseo program.

To address the PhysTEC goals of demonstrating “successful models for increasing the number of highly qualified high school physics teachers” and transforming “physics departments to engage in preparing physics teachers”, the Geneseo site is adopting key components of the PhysTEC program to integrate into the physics department culture. The Department of Physics and Astronomy at SUNY Geneseo has been quite successful in attracting physics majors and preparing them for graduate school in physics and engineering. There are eight full time physics faculty and over 200 physics majors at Geneseo, a campus with 5100 undergraduate students located about 30 miles south of Rochester, New York. In 2011, 33 students earned bachelors' degrees in physics from Geneseo. About one-third of physics graduates go directly into graduate programs in physics and one-third enter graduate engineering programs. Geneseo physics graduates are working as professors at colleges and universities, scientists at national laboratories, researchers at small start-up companies, engineers, medical professionals, attorneys, financial analysts, educational technology consultants, computer programmers, and in many other fields.

Undergraduate research is strongly encouraged at SUNY Geneseo and in the Physics and Astronomy Department. Geneseo physics majors work on projects in applied nuclear physics, inertial confinement fusion, optics, general relativity, engineering, condensed matter physics, biophysics, and astronomy. The Department supports a 1.7 MeV tandem Pelletron particle accelerator which is used for materials analysis using PIXE and RBS techniques and

for the development and characterization of particle detection systems such as Thompson Parabolic Spectrometers. Other major equipment, such as a 20-inch Ritchey-Chretien telescope, an optical laboratory for cavity-enhanced spectroscopy, a 30-keV duoplasmatron ion source, etc. are used for undergraduate research on a regular basis.

In this physics-rich environment students who want to pursue graduate studies in physics or engineering find opportunities related to their interests, working with physics faculty. However, students who want to teach physics in high school have not always found a similar community within our Department. Although individual physics faculty have provided outreach to K-12 students (visiting classrooms, hosting tours of high school students, etc.), little of that activity has included physics majors or had a direct impact on physics teacher candidates. While the faculty have been supportive of physics teacher candidates, there was a perceived bias among some students that preparation of physics teachers was not as important as preparation of potential physics graduate students. This is not surprising given there is less support for endeavors that support future teachers compared to other research projects. Some of the projects undertaken in physics could be used as teaching platforms in high school. For example small projects that investigate model rocket engines, human gait analysis, musical instrument experiments and laser light properties are all inexpensive and effective learning tools that have benefited Geneseo physics teacher candidates in the past.

One year after receiving funding as a PhysTEC Targeted Site, we are forming a community of physics teacher candidates—from first-year students to seniors—who enjoy the opportunity to get together and support one another while working on PhysTEC activities. This has become an important (and unexpected) outcome of the project for our students. Olivia, a sophomore physics major reports:

“PhysTEC truly became something special. Not only did it bring students pursuing similar career paths together, but it created a group of friends that push each other to achieve greatness in all aspects of teaching. The collaborative meetings are filled with laughter, ideas, praise and progress. Each student brings their own innovative teaching style to the table, making for better future educators.”

The PhysTEC group has convened several times a semester to work on shared projects, spend some time with our teacher-in-residence and PhysTEC faculty, and discuss issues pertinent to physics teaching. We have been able to do this in several ways.

Our Build-it, Leave-it, Teach-it (or BLT) program is a distinctive component of PhysTEC at Geneseo. PhysTEC identifies Early

Teaching Experiences as one of the key components of the program. Geneseo's BLT program is an opportunity for our physics majors to spend time in local high school classrooms presenting to high school students. Through the BLT program students and Geneseo professors select, design, and build equipment for a particular physics demonstration, discuss ways to present the physics content of the demonstration to the students, and practice the presentations. Geneseo physics teacher candidates travel in pairs to participating high school physics classrooms and give their presentations. The teacher candidates get valuable feedback by talking with the participating physics teacher about their presentation. The physics demonstration equipment is then donated to that school's classroom.

The first BLT demonstration was "The Race" where two 0.75-inch diameter ball bearings are released at the top of inclined tracks of identical lengths. After rolling down a 45 degree section for 20 cm and traversing a short level section, one ball rolls uphill and then downhill while the other rolls down and then back uphill. Both balls end up on a level section at the same height. Students predict which ball will win the race or whether they will tie. Eight of "The Race" units were constructed and physics majors have given presentations at four local schools. The high school students have peppered Geneseo candidates with questions about the physics but also topics such as what college life is like.

The next BLT demo illustrates Lenz's Law for induced currents and has been presented by one team at a local school. Information on the materials and methods used to produce these demonstrations are posted online at the Geneseo PhysTEC site (<http://www.geneseo.edu/phystec>). We will produce two new demos each year and present them in local classrooms.

One of our physics majors summarizes the impact of these BLT visits: "Nothing you'd learn from a textbook can match the experience of going up in front of a class of high-school students and actually teaching them something, and PhysTEC granted me that opportunity through the BLT program."

In addition to the BLT program our relationship with our part time Teacher-In-Residence, who teaches fulltime at a local school, has created some unexpected opportunities for early teaching experiences. It is difficult for schools in our area to find substitute teachers who have a background in physics. Mr. Sells has had several of our PhysTEC students work with him to prepare lessons that they present to his students when he is away and a (non-physics) substitute teacher is in charge of his high school physics class. This is a program that benefits everyone. The substitute teacher provides classroom management, the Geneseo physics teacher candidates get to teach a substantial lesson to real high school students, and Mr. Sells can take planned absences knowing that his students are benefiting from instruction that he personally vetted. Since the same pair of Geneseo students have worked with Mr. Sells' class several times this year, they are familiar to the high school students in the class.

A second way in which we have supported the community of physics teacher candidates is through participation in national physics education meetings. This exposes our students to some of the various forms of instruction supported by physics education research. Last January two of our PhysTEC students attended the winter meeting of the AAPT in Ontario, CA, with physics faculty member James McLean. These students participated in workshops on "nTIPERs: Research-Based Reasoning Tasks for Intro Mech" and "Learner-Centered Environment for Algebra-Based Physics"²². After returning to campus they shared their insights and comments with the rest of the Geneseo PhysTEC community at an evening meeting. During the summer of 2012 a larger group of Geneseo students will attend the national AAPT meeting in Philadelphia. We expect these shared professional development activities to strengthen our teacher candidate community.

To meet our goal of increasing our production of highly qualified high school physics candidates ready to succeed in classrooms we need to stress recruitment in a wide variety of ways. Because we have a good number of physics majors already, at Geneseo we focus on recruiting existing physics majors into teaching. This effort is somewhat complicated by the number of education courses that students need to complete to be recommended for certification by the College and the way these courses dovetail into the physics curriculum. Given these realities, students are better served if they identify their interest in teaching within their first or second year of college. The Geneseo PhysTEC recruitment strategy has focused on the first-year students. Physics faculty and the Teacher-In-Residence have visited introductory calculus-based physics classes each semester to invite students to be involved in the local PhysTEC program. We created a Geneseo PhysTEC website (<http://www.geneseo.edu/phystec>) that is linked to the Physics Department webpage and features information about our activities. We designed and printed "Teach People Physics" posters featuring photos of recent alumni teaching in area school districts. We invited these alumni to speak at Department Colloquia and at alumni career panels. We hosted an academic advisement night where Dennis Showers from the School of Education reviewed the requirements for students seeking certification and answered questions for students planning their course schedules. We highlighted the PhysTEC program in our recruitment PowerPoint presentation that physics faculty give to groups of prospective students over eight times each year.

While all these recruitment efforts may encourage students who are thinking about entering the teaching profession, we realize that—when it comes to career advice—most students find one-on-one conversations to be more meaningful than websites or posters. Our Teacher-In-Residence, Rob Sells, has embraced this component of the recruitment strategy. During the first several weeks of the fall semester he scheduled individual meetings with each of the PhysTEC students to talk with them about how they are doing in the program, to learn why teaching interests them, and to answer questions they may have about the teaching profession. In the course of these conversations he has developed a relationship with many of our PhysTEC students.

Our TIR also holds office hours on Monday and Tuesday evenings, when first-year physics majors are crowding into the nearby Physics Learning Center to work on homework assignments that are due mid-week but regular faculty are not available. He offers problem-solving advice and tutoring for first-year students, regardless of whether or not they are physics teacher candidates. This also provides him with informal opportunities to talk to first-year physics majors about the teaching profession.

We expect that these recruitment strategies are having a positive effect and we are tracking our students to evaluate the impact. Attendance at PhysTEC evening meetings fluctuates as the demands of the semester ebb and flow, but we have had as many as sixteen students in attendance. (Pizza helps.)

After less than a year as a PhysTEC Targeted Site, we are still experimenting with how to integrate PhysTEC activities into the Geneseo culture. We have several new ideas we are exploring.

One is linking with the strong commitment Geneseo has to undergraduate research. Since PhysTEC students are already preparing and presenting BLT demonstrations at local school districts, our PhysTEC students could design and conduct physics education research projects using something like the Interactive Lecture Demonstration³ model. This is a way to investigate high school students' preconceived notions about the physical world. This could turn into a nice research project for a team of PhysTEC undergraduate researchers and could result in a research poster at our campus-wide research symposium or at another local meeting. Linking the PhysTEC teaching activities with undergraduate research would raise the status of our BLT program from an optional outreach program to a scholarly pursuit on par with other undergraduate research projects. In addition, treating the BLT activity in a more scholarly way demonstrates to our PhysTEC students that we value teaching that is reflective and informed by pedagogical research.

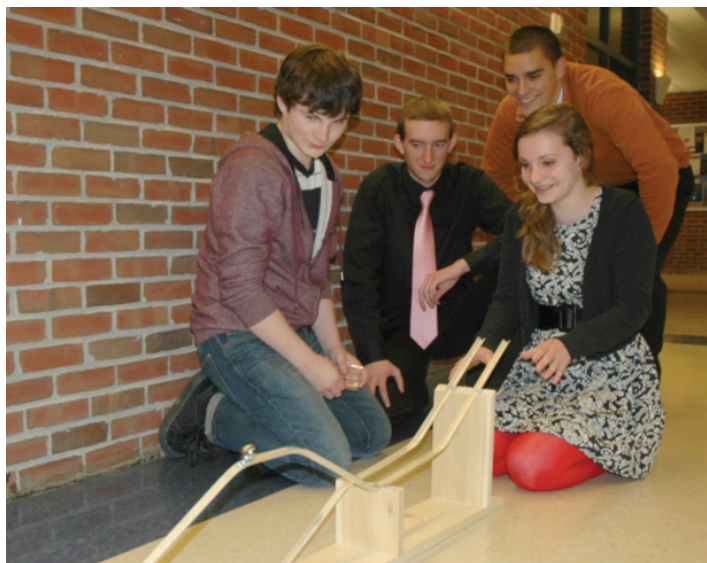
A second goal for the future of PhysTEC at SUNY Geneseo involves integrating the PhysTEC Teacher Advisory Group (TAG) which we formed to guide our efforts and our PhysTEC students. In early fall we held the first meeting of the TAG, which included six area physics teachers, several of whom are Geneseo alumni. At this meeting we introduced them to the plans and goals for the program, and sought their support and feedback. At all future meetings we will set aside a time for our PhysTEC undergraduates to meet and mingle with the TAG teachers so that our students will have a larger pool of mentors available to ask questions and to discuss career options. Our undergraduates will be able to capitalize on the experiences and enthusiasm of these seasoned high

school teachers, and our TAG members will enjoy supporting and enriching the college experiences for our students. It may be hard to build those kinds of relationships based on biannual meetings, but there are great resources available to us that we would like to tap for the benefit of our PhysTEC undergraduates.

By developing new early teaching experience opportunities, enhancing recruitment efforts, and paying particular attention to the needs of physics majors who want to share their enthusiasm for physics with high school students, we are strengthening the preparation of physics teachers at SUNY Geneseo and working on our goal of increasing the number of exceptional future high school physics teachers. Over the next two years we will focus on building sustainable programs that will work well for us and adapting the principles that have been articulated as part of the national Physics Teacher Education Coalition to our local context.

Kurt Fletcher is a Distinguished Teaching Professor of Physics at the State University of New York at Geneseo, where he has taught since 1993. Fletcher's research interests include physics education, experimental nuclear physics, and inertial confinement fusion.

1. <http://www.phystec.org/about/index.php>
2. <http://www.aapt.org/Conferences/wm2012/workshops.cfm>
3. David R. Sokoloff and Ronald K. Thornton, "Interactive Lecture Demonstrations, Active Learning in Introductory Physics," Wiley (2004).



High school students Kyle and Rebecca (front) observe the results of the BLT Demo "The Race", as taught to them by Geneseo PhysTEC students Mike and Tony.

PhysTEC 2012 Annual Conference

By Jacob Clark Blickenstaff and Bushraa Khatib, American Physical Society

The 2012 PhysTEC Conference was held in Ontario, California on February 3-4, 2012 with the theme of New Paradigms for Physics Teacher Education. The date and location were chosen to coordinate with the Winter 2012 AAPT meeting that immediately followed. The 124 participants were pleased with the quality of conference sessions, with several commenting that this was the best PhysTEC conference yet. Plenaries by Fred Goldberg, Phil DiStefano, and Mary Kirchhoff were well received. Dr. Kirchhoff's plenary was one part of the significant presence of the American Chemical Society, which is launching the Chemistry Teacher Education Coalition (CTEC) to address the national shortage of high school chemistry teachers.

This year's PhysTEC conference was preceded by a day-long regional conference involving 80 representatives of two math and science teacher preparation efforts in California that had never before met together. The Math and Science Teacher Initiative (MSTI) of the California State University system and CalTeach at the University of California came together for the first time to discuss physics and chemistry teacher preparation efforts.

Collaboration between the two distinct groups with similar aims generated healthy discussion as leaders from both organizations offered their insights on issues such as student recruitment and retention, course transformation, student-centered teaching, and how to streamline teacher licensure. Stephen and Phoebe Roeder from the physics department at San Diego State University found discussions on increasing enrollment and finding new sources for funding highly relevant to their university.

At the PhysTEC meeting, a panel discussion on cultural perspectives on teacher education moderated by Peter Muhoro of the APS, addressed underrepresentation of minorities in the population of U.S. physics teachers. The session featured faculty from minority-serving institutions and high school physics teachers from schools with significant minority populations. Panelists and participants candidly discussed cultural issues that rarely make it to the forefront of physics education.

Panelist Geraldine Cochran, a doctoral student at Florida International University, expressed her belief that minority students do not necessarily need to have role models that look like themselves in order to be inspired to pursue physics or teaching themselves. "This can be accomplished by good teaching, regardless of the student or teacher's personal background," Cochran said.

Vivian Incera, chair of the University of Texas at El Paso physics



Jack Hehn of AIP and Stephanie Chasteen, CU Boulder, in conversation at the PhysTEC poster session.

department, and Victor Gonzalez, AP physics teacher at Pioneer High School in southern California, cited examples of how sharing cultural backgrounds with their students gave them more insight into their students' experiences. "In the Latino culture, students have a hard time explaining physics as a career choice to their parents. I tell them to tell their parents that they're going into engineering instead," Gonzalez said.

Abstracts from the meeting are available in the APS Bulletin. Presentations are available for download on the PhysTEC conference website.

The 2013 PhysTEC annual conference will be held March 16 and 17 in conjunction with the APS March meeting Baltimore, MD.

Jacob Clark Blickenstaff taught high school physics in California for five years before returning to graduate school at UC Davis. He earned a PhD in science education in 2004, and has held faculty positions at Western Washington University and the University of Southern Mississippi. He is Teacher Education Programs Manager for APS.

Bushraa Khatib is a recent graduate of the University of Maryland, Baltimore County with a double major in Biochemistry and English Literature. She joined APS in October 2011 as Programs Coordinator for the APS Bridge Program.

MSPnet: The Math Science Partnership Network

Debra Bernstein and Joni Falk, TERC

MSPnet.org is an online community resource for math and science educators, researchers, and administrators. The site is created and administered by TERC, a non-profit research and development institution in Cambridge, MA. MSPnet has two primary purposes. One is to support the National Science Foundation's Math Science Partnership (MSP) program by providing an online professional learning community for K-12 practitioners and Higher Education STEM faculty engaged in innovative partnerships forged through the MSP program. The second is to share research and resources related to effective mathematics and science education reform with the general public.

The MSP Program

The National Science Foundation's MSP program is a major research and development effort, aimed at improving mathematics, science, and engineering education. K-12 school districts partner with STEM and Education faculty at institutions of higher education (IHEs). These innovative partnerships develop and test new approaches to science and math education and teacher professional development, enriching both K-12 and the university experience as well.

The program focuses on the following three interrelated goals: "Ensure that all students have access to, are prepared for and are encouraged to participate and succeed in challenging and advanced STEM courses; Enhance the quality, quantity and diversity of the K-12 STEM teacher workforce; and Develop evidence-based outcomes that contribute to our understanding of how students effectively learn" STEM content¹.

MSPnet.org

MSPnet, which serves as an online resource for all stakeholders interested in improving STEM teaching and learning, also serves a practical function for the MSP projects. Each funded project has its own interactive space on MSPnet, allowing the projects to share their abstracts, articles, and resources with the broader STEM education community. The MSPnet hub (mspnet.org) aggregates contributions from all of the NSF MSPs. The home page is updated each week to highlight new research and resources.

Over 160 MSP projects have been funded since the inception of the program in 2002. Individual projects vary in their focus—some focus on the elementary school level, some on middle school and some on high school. Projects also vary in their subject focus—some target science instruction, some target math instruction, some engineering or computer science, and others purposefully combine STEM topics. A subset of projects focus on physics or related science content (i.e., energy and light in the early grades). Five sample projects are described below (see Figure 1). To learn more about the projects funded through the MSP program, visit

http://hub.mspnet.org/index.cfm/find_projects

MSPnet Resources for Physics Education

Subscribe to MSPnet News. We invite you to visit frequently. To keep up to date, subscribe to our weekly newsletter the MSPnet News. A link to sign up for the newsletter can be found on the MSPnet home page (see box in the right upper corner).

MSPnet Library. The MSPnet library contains over 1,500 full text, freely available articles related to Educational Change and Policy, Teaching and Learning, Professional Development, Higher Education, the MSP 5 key features (partnership-driven; teacher quality, quantity, diversity; challenging courses and curricula; evidence-based design and outcomes; institutional change and sustainability), and papers written by or about MSP projects (see Figure 2). New items are added weekly.

Within the library, you will find a number of articles related to physics teaching and learning (See http://hub.mspnet.org/index.cfm/library_physics) We offer a sample below (with quotes from paper abstracts):

Depth versus breadth: How content coverage in high school science courses relates to later success in college science coursework. By Marc Schwartz, Philip Sadler, Gerhard Sonnert, and Robert Tai. "This study relates the performance of college students in introductory science courses [biology, chemistry, or physics] to the amount of content covered in their high school science courses." The article is available at: <http://hub.mspnet.org/index.cfm/17658>

Learning about gravity I. Free fall: A guide for teachers and curriculum developers. By Claudine Kavanagh and Cary Sneider. "This article is the first of a two-part review of research on children's and adults understanding of gravity and on how best to teach gravity concepts to students and teachers." The article is available at: <http://hub.mspnet.org/index.cfm/14306>

Exploring ninth-grade science teachers' path of leadership for implementing educational reform efforts: A case study. By Carina Rebello, Ya-Wen Cheng, Somnath Sinha, and Deborah Hanuscin. This paper presents case studies of three 9th grade science teacher leaders as they take part in a 'Physics First' curriculum reform effort in their school district and examines the impact of a professional development program that focuses on developing teacher leadership. The article is available at: <http://hub.mspnet.org/index.cfm/24414>

Voices from the Field. Beyond providing resources to the community, MSPnet facilitates interactive events such as the sharing of project work through webinars and interactive poster sessions.

MSP Projects focusing on Physics

A number of funded MSP projects include or focus exclusively on teaching and learning in physics. For example:

A TIME for Physics First in Missouri (PI: Dr. Meera Chandrasekhar, University of Missouri): The Academy for Teachers using Inquiry and Modeling Experiences (TIME) for Freshman Physics is a partnership between the University of Missouri-Columbia and seven school districts. “This Partnership creates eighty Teacher Leaders from participating Missouri school districts. These Teacher Leaders deliver a yearlong physics course to ninth grade students.” To learn more about this project, visit <http://time.mspnet.org/>

College Ready (PI: Dr. Gay Stewart, University of Arkansas): The College Ready in Mathematics and Physics project is a partnership between the University of Arkansas, 33 school districts, and a number of other partners. “College Ready intends to build vertical and horizontal learning communities among school and college faculty in order to improve major articulation issues that impact the successful transition of students from high school to college.” To learn more about this project, visit <http://collegeready.mspnet.org/>

Science and Math Applied Real-problem Teaching (SMART) (PI: Dr. Sean Bentley, Adelphi University): The SMART project is a partnership between Adelphi University, Informal Learning Institutions, and local high schools. “The goal of the project is to enhance the quality of high school science and mathematics education in high-needs schools in Long Island, New York... This project is jointly designing a grade 9 integrated physics/math course grounded in local interactive museum contexts, and build[ing] a collaborative network amongst teachers, museum educators and university faculty.” To learn more about this project visit <http://smart.mspnet.org/>

The Power of Physical Sciences (POPS) (PI: Dr. Kurtis Fletcher, SUNY Geneseo): POPS is a partnership between the State University of New York (SUNY) at Geneseo and five rural school districts. POPS encourages “middle and high school girls to study physics and geological science... [by] focusing on a hands-on, middle school enrichment curriculum that emphasizes the role that physics and geology play in solving societal problems, specifically in addressing future energy needs in an environmentally responsible way.” To learn more about this project, visit <http://pops.mspnet.org>

Big Sky Science Partnership (PI: Dr. Tim Olson, Salish Kootenai College): The Big Sky Science Partnership is a collaboration between Salish Kootenai College, K-12 school districts, and additional Higher Education partners. “The overarching goal of the Big Sky Science Partnership (BSSP) is to increase science achievement of American Indian students in grades 3-8 of partner schools. A cross-disciplinary team of the partner IHEs’ Geoscience, Physics, Astronomy and Education faculty, along with professional developers from the SKC Indigenous Math and Science Institute, and the Center for Learning and Teaching in the West, K-8 teachers, and administrators will collaboratively design and facilitate year-round project activities.” To learn more about this project, visit <http://bigsky.mspnet.org/>

Figure 1. MSP projects with an emphasis on physics.

This year was the inaugural year for the MSPnet Academy, a web-based speaker series featuring leaders in the fields of STEM Education and Policy (see Figure 3). Guests are welcome to join future webinars, or to view past webinars, all of which are archived on MSPnet.org. Some MSPnet Academy presenters addressed particular issues in math and science education. For example Dr. David Hammer (Tufts University) offered a webinar on “Responsive Teaching and the Complexity of Learning Science”, which examined third-grade students’ inquiry about motion. Dr. Ruth Parker (CEO, Mathematics Education Collaborative) offered an engaging, interactive presentation entitled “Breaking the Cycle of Failure: From Numerical to Algebraic and Geometric Reasoning”. Other MSPnet Academy speakers addressed topics of broad interest to the STEM community. A webinar given by Dr. Heidi Sch-

weingruber (National Research Council) and Dr. Philip Bell (University of Washington) addressed “The NRC Framework for K-12 Science Education”, and Dr. Stephen Pruitt (Achieve) addressed the Next Generation Science Standards. Dr. Deborah Lowenberg Ball (University of Michigan) provided a very engaging webinar, “Learning to Teach the Common Core”. All of these webinars, as well as others, can be found at http://hub.mspnet.org/index.cfm/mspnet_academy

Videos of Conference Presentations. Physics educators may also be interested in the following presentations (video of speaker with slides) all archived on MSPnet.

Dr. Philip Sadler (Harvard-Smithsonian Center for Astrophysics)

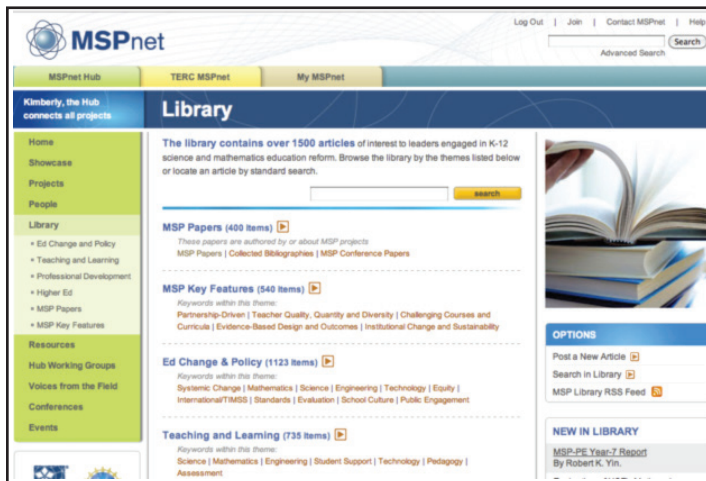


Figure 2. The MSPnet Library. <http://hub.mspnet.org/index.cfm/library>

examines science education at the K-12 level. Dr. Sadler’s talk explores student misconceptions in science, and the relationship between teacher knowledge and student outcomes at the middle school and high school levels. This talk, which emphasizes the importance of teachers’ ability to predict student performance, is entitled “The Interaction Between the Science Content Knowledge



Figure 3. The MSPnet Academy http://hub.mspnet.org/index.cfm/mspnet_academy

of Teachers and Their Students.” This talk was originally given at an MSP Conference in Washington, DC, and is available at: <http://hub.mspnet.org/index.cfm/12701>

Dr. Lillian McDermott (Physics Education Group, Department of Physics, University of Washington) examines issues in physics education at the university level. Dr. McDermott’s engaging presentation, “Improving the teaching of science through discipline-based education research: An example from physics,” describes her investigations into the depth of understanding obtained by undergraduate students and pre-service teachers in introductory physics courses, and the development of curricula to help students move towards a functional understanding of the content. In her talk, Dr. McDermott also describes how she situates her work within the academic culture of a physics department, and the benefits that accrue to the department as a whole, as well as to the Physics Education Group. This presentation, originally given at an MSP Conference in Washington, DC, can be viewed by going to: <http://hub.mspnet.org/index.cfm/17581>

Contribute

We invite you to contribute your own resources, related to K-12 STEM education that may be of broad interest to the MSP community. The weekly newsletter goes out to over 9,000 educators, so contributions are widely disseminated. Please feel free to share articles and other resources with us at contact@mspnet.org

Debra Bernstein is a Senior Researcher at TERC. Her research focuses on electronic learning communities and informal STEM learning environments. She is a researcher on MSPnet.org.

Joni Falk co-directs the Center for School Reform at TERC, a non-profit research and development institution aimed at improving mathematics and science teaching and learning. She is currently the Principal Investigator of MSPnet.org, the electronic learning community that supports NSF’s Math and Science Partnership Program, and of IGERT.org the collegial network created for NSF’s flagship IGERT program (Integrative Graduate Education and Research Traineeship program).

References

1. Hamos, J. (January, 2012). *Math and Science Partnership (MSP): A research and development effort in K-16 teaching and learning.* Paper presented at the MSP LNC Conference, Washington, DC.

Browsing the Journals

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- Giovanni Organtini's model of a transistor as a flush toilet on page 221 of the April 2012 issue of *The Physics Teacher* (<http://scitation.aip.org/tpt/>) is cute. The May 2012 issue of the *American Journal of Physics* (<http://scitation.aip.org/ajp/>) has a theme on astronomy with many helpful articles for non-astrophysicists like myself: An explanation on page 376 of why the expansion of the universe does not result in the expansion of the size of atoms and other bound systems; a discussion on page 539 of a better way to explain star colors than using Wien's law; and a short but provocative calculation on page 417 that uses the uncertainty principle to estimate the time it takes for a pencil balanced on point to fall over.
- On page 197 of the March 2012 issue of *Physics Education*, a nice explanation is provided of why modeling radioactivity by throwing 1000 dice and removing the ones that shows a 6 leads to a half-life that is systematically low compared to theory. The problem is that radioactive nuclei decay continuously while the dice "decay" in discrete steps as they are thrown. Other nice papers in the same issue is the discussion on page 152 of inverting a partly filled cup of water covered with a card and observing that the water does not all spill out, and a quantitative analysis on page 169 of a hanging rope slipping around a frictionless peg in terms of an Atwood machine with variable masses. The journal can be accessed at <http://iopscience.iop.org/journals>.
- The same webpage also gives a link to the *European Journal of Physics*. On page 439 of the March 2012 issue, the melting ice-cube puzzle is discussed: When an ice cube floating in a glass of water melts, what happens to the water level in the glass? A previous publication shows the answer is it rises if we include the loss of buoyant force on the part of the ice that was above the water line. But this new paper shows the answer is it drops if we also include the thermal contraction due to the heat required to melt the ice. On page 467 of the May 2012 issue, a nice discussion appears about how to avoid artificial infinities when calculating the electrostatic potential of an infinite line charge.
- There is a vigorous debate in the letters in the April 2012 issue of the *Journal of Chemical Education* (<http://pubs.acs.org/toc/jceda8/89/5>) about whether it's time to retire the model of hybrid atomic orbitals.
- I appreciated Chunfei Li's model for how the bowling down a track down which a cart is rolling will lead to an apparent violation of conservation of mechanical energy in the March 2012 issue of the *Latin-American Journal of Physics Education* (<http://www.lajpe.org/>).
- One of the reasons I love reading educational physics articles is that they often force me to rethink familiar physics explanations for phenomena. An excellent example is the article by Héctor Riveros on page 52 of 2012 Issue 2 of the relatively new *European Journal of Physics Education* (<http://ejpe.erciyes.edu.tr/index.php/EJPE>). He challenges explanations for three common demonstrations: that when the end of a ruler protruding from under a sheet of newspaper at the edge of a table is given a sharp blow it breaks because of air pressure on the sheet; that water rises into an inverted jar covering a burning candle in a tray of water because the candle consumes the available oxygen; and that a stream of water is attracted to an electrically charged balloon because water is polar.



Web Watch

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Three more webpages devoted to STEM (Science, Technology, Engineering, and Mathematics) education to add to the lists in my previous two columns:

- Pathways to Science at <http://www.pathwaystoscience.org/>
- Georgetown's STEM page at <http://cew.georgetown.edu/stem/>
- Connecting Humanities to STEM at <http://www.artstem.org/>
- Puzzles are fun in physics. But mathematicians like to get in on the fun too. A lengthy list of mathematical articles related to physics puzzles is online at the following verbose link: http://cadalyst.digibooks.cn/Tutorials/Poser-Tutorials/Most-recreations-in-probability-are-connected-with-some-paradoxical-feature-A-good-exposition-of-most-these-appears-following_1/.
- If you haven't seen the "Scale of the Universe" animation created by two teenagers, check it out at <http://abcnews.go.com/Technology/page/scale-universe-cary-michael-huang-california-high-school-15573968>.
- The Institute of Physics has a new webpage with content tailored for teachers online at <http://www.iop.org/tailored/teachers/>.
- I have not yet tried using it, but there is a free tool to convert PDF documents into HTML pages at <http://www.pdfhtml.net/>.
- My children found <http://www.sciencebuddies.org/> to be helpful in finding ideas for Science Fair projects.
- Wolfram has hundreds of interactive physics demonstration animations on the web at <http://demonstrations.wolfram.com/topic.html?topic=College+Physics>.
- What young person could resist videos about the physics of race car driving at http://www.nsf.gov/news/special_reports/sos/
- Three substantial American RadioWorks presentations in a series entitled "Don't Lecture Me" can be accessed at <http://americanradioworks.publicradio.org/features/tomorrows-college/lectures/>.
- If you teach intermediate-level physics with substantial calculus content, you'll likely find something useful at <http://mathdl.maa.org/mathDL/20/?pa=content&sa=viewDocument&nodeId=3852>. Examples include a short derivation of the sum of the reciprocal integers squared, various kinds of average distances from the earth to the sun, and a bug problem.
- There's an interesting website from a German PER group devoted to visualizing special and general relativity at <http://www.spacetime travel.org/>.
- Westfall's biography of Newton has been strongly recommended to me. Put it on your summer reading list at <http://www.amazon.com/Never-Rest-Biography-Cambridge-Paperback/dp/0521274354>.



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