



Online physics courses for teachers provide path to endorsement

By Robert Goodman, executive director, New Jersey Center for Teaching and Learning

At the NJEA Convention, the New Jersey Center for Teaching and Learning (CTL) announced five online courses for teachers. These courses can be taken anytime, anywhere. They will allow teachers everywhere in New Jersey, across the United States and around the world to benefit from CTL's core programs: the Progressive Science Initiative® (PSI®) and the Progressive Mathematics Initiative® (PMI®).

In addition, NJEA members will be provided a 20 percent discount on the standard rate of \$275 per credit for these courses as thanks to NJEA for founding CTL and continuing to be its strongest supporter. This lowers the tuition for NJEA members to \$220 per credit.

CTL has partnered with Colorado State University-Global Campus (CSU-Global), a public, regionally accredited, 100 percent online institution, to provide graduate credits as well as a pathway to a Master of Science degree in Teaching and Learning at an additional cost for those who meet admission requirements.

Teaching Methods course

Teaching Methods (MET-6101) is a two-credit course that instructs teachers in how to take full advantage of CTL's free editable course materials in order to create highly engaging student-centered classrooms.

CTL is one of the world's largest producers of free editable K-12 science and mathematics course materials. Those materials, which consist of more than 100,000 slides and 3,500 Word documents, are posted at www.njctl.org and were used last year by teachers in all 50 states and more than 180 countries. In the last 12 months, that has included 275,000 users and 1.7 million file downloads.

Those materials are designed to help teachers create welcoming, student-centered classrooms by using technology to seamlessly integrate pedagogy, curricula and assessment. However, experience has shown that it's important for teachers to learn how to use those materials in order to realize their full potential.

In the past, that meant driving to a central location in New Jersey or having someone from CTL visit a school for professional development sessions that are often too limited in time to do more than scratch the surface. This course is equivalent to 30 hours of instruction, so it has the time to go deeply into the theory and practice of PSI and PMI for people located anywhere, on their own schedule.

Physics for All

The other four online courses instruct teachers in physics and how to teach it. These courses are based on CTL's PSI Physics Endorsement program. The courses allow teachers everywhere to take part in what has made CTL the No. 1 producer of physics teachers in the United States. It also allows teachers who teach at any grade level, or who are just interested in how the world works, to learn this most fundamental of the sciences.

The PSI Physics Endorsement program emerged from a shortage of new physics teachers so that all students would have access to a physics class taught by an effective teacher. Physics for All is critically important because physics is the most fundamental of the sciences and is required by virtually every STEM major in a college or university. Also, physics represents the best use of mathematics that students will experience in school, or in their young lives, so it is key to motivating them to succeed in mathematics.

However, despite its importance, physics is the science

that is taught to the fewest number of students. Physics for All is critical to any state or country being competitive in science and mathematics. Until now, there has been a self-perpetuating shortage of the teachers needed to enable all students to study physics. This limits which students have a fair chance to obtain the STEM-related jobs that are open now and the increasing number of such jobs in the future.

The development of PSI Physics

PSI was developed, beginning in 1999, by my colleagues and me while we were teaching at Bergen County Vocational Technical High School in Teterboro. The approach and its outcomes were documented in my 2006 doctoral dissertation for Rutgers University and an article in *The Physics Teacher*, the peer-reviewed journal of the American Association of Physics Teachers. PSI showed that all students could be successful in science and mathematics, regardless of their prior experience or success in those subjects.

NJEA formed CTL as a nonprofit charitable organization in 2007 in order to provide support to its members in their efforts to improve student outcomes. CTL's mission is to empower teachers to lead school improvement, and its focus to date has been on science and mathematics, areas of great need. I was honored to be named one of CTL's five founding board members. Efforts to replicate the success seen with PSI at Bergen Tech became an early effort of CTL's.

A key obstacle was the shortage of physics teachers. The answer lies in using the same solution that was making physics accessible to all students at Bergen Tech, to train physics teachers.

The reason for this is clear from the numbers. The United States needs 36,000 more physics teachers if all students are to study physics. However, there are only about 7,000 physics majors in the country, and only about 300 choose to become physics teachers each year. The need for physics teachers would not be met by the traditional approach of having physics majors become physics teachers.

However, there are about 3.5 million teachers. If only 1 percent of teachers were to learn physics and how to teach it, we would have the needed 36,000 physics teachers so that all American students would have an effective physics teacher.

Since CTL began offering the PSI Physics Endorsement in 2009, 196 New Jersey teachers have completed the program.

Online physics for teachers

While this effort has been highly successful, it has faced the limitations of time and space. The program requires teachers to study algebra-based physics in a classroom setting for about 112 hours before beginning to teach that same course to students in the fall, often requiring those teachers to spend 19 summer days in a classroom. Then, while teaching algebra-based physics to students, they needed to study another 188 hours of physics by meeting one night a week and every third Saturday during the school year. That represents 300 hours of classroom instruction plus 150 hours of field experience. Teachers would then be prepared to pass the Physics Praxis Exam to earn an endorsement to teach physics.

It's a tribute to New Jersey teachers that they put in this effort on behalf of improving themselves and being able to help their schools and their students address this important need.

However, not all teachers who want to take part in this



CTL's mission is to empower teachers to lead school improvement. These new online courses allow us to overcome the limitations of time and geography to bring these benefits to all students and teachers.



It's a tribute to New Jersey teachers that they put in this effort on behalf of improving themselves and being able to help their schools and their students address this important need.

The courses allow teachers everywhere to take part in what has made CTL the No. 1 producer of physics teachers in the United States.

important mission are equally able to do so. While CTL has offered its courses in several locations, not all interested teachers can find one nearby. Also, some teachers have other jobs in the summer or after school or have children at home, which makes them being at a school during those 300 hours impractical.

That inspired CTL to work with Colorado State University-Global Campus (CSU-Global), using a grant from the Morgridge Family Foundation, to develop online courses that would allow any teacher in New Jersey, across the country, or around the world, to study physics and how to teach it. The courses for teachers are roughly parallel to student courses:

- PHYS-6601 – Learning and Teaching PSI Algebra-Based Physics
- PHYS-6603 – Learning and Teaching PSI AP Physics 1
- PHYS-6605 – Learning and Teaching PSI AP Physics 2
- PHYS-6607 – Learning and Teaching PSI AP Physics 2 and Physics Praxis Review

Online physics endorsement for teachers

In moving online, CTL recognized that a great advantage of the face-to-face classes was that teachers would learn physics in the same way that their students would: the teaching methods were modeled for them each day. Some of that instruction in methods was explicit, but it was also implicit in the teaching-and-learning process.

While the online courses would retain the advantage of using the identical materials to teach the teachers as they would use to teach their students, key elements would be different. For instance, the use of social constructivism would not be used to teach the online course, but is fundamental to the student course. Social Constructivism is the notion that people construct knowledge through group interaction. In the classroom this translates to groups of students working together toward a common goal. While individual students are ultimately responsible for demonstrating mastery, the group interaction speeds up learning. That is what initially led to the development of MET-6101, the Teaching Methods course, to explicitly address teaching methods.

The teaching methods course plus the four physics courses provide 24 graduate credits of instruction: 16 credits in physics and eight credits in education.

The six credits of field experience for teaching algebra-based physics remains unchanged, as do the frequent coaching visits by CTL staff to visit each teacher in his or her classroom to provide feedback. The field experience takes place during the normal teaching schedule of the teacher, which should not be an obstacle for the teacher in a supportive district.

Teachers of any mathematics or science... or just curious

Physics is vitally important to science and mathematics and to having an understanding of our

world. Many Americans, including many teachers, have not studied physics at all, or have not studied it recently. These online courses provide the opportunity for them to understand this subject and use it to imbue additional depth and understanding to their courses, or to their general understanding.

For instance, just taking the first physics course, PHYS-6601, will provide a solid overview of physics as well as all the understanding needed to teach physics at a middle school or first-year high school level. Many teachers would benefit from taking that first course even if they are not seeking an endorsement to teach physics.

Advanced Placement physics teachers

The three physics courses subsequent to PHYS6601—PHYS-6603, PHYS-6605, and PHYS-6607—teach the content and teaching methods of AP Physics 1 and 2 as well as prepare the endorsement candidate for the Physics Praxis exam. The College Board has approved teacher syllabi for the student versions of these courses without the need to purchase a college textbook: the student course materials are deemed of such high quality that they suffice.

Current physics teachers who would plan to teach AP Physics 1 or AP Physics 2 can take one or more of these courses to become prepared to use CTL's free editable materials to teach AP Physics to students.

Graduate credits and a master's degree

CTL partnered with CSU-Global to bring its PSI Physics for Teachers face-to-face courses online. CSU-Global Campus offers innovative higher learning opportunities for nontraditional students and working adults. The evaluation of the CTL's new online courses by an outside expert and a CSU-Global faculty review confirm that altogether they are equivalent to the 24 graduate credits discussed earlier in this article. Those who successfully complete each online course can register with CSU-Global and, for a cost of \$85 per credit, receive a transcript from CSU-Global reflecting those credits.

In addition, CSU-Global will count up to 18 of these credits toward a 36-credit master's degree. The additional 18 credits of coursework can be completed online. While the normal cost for those credits would be \$500 per credit, those enrolled in this program would pay \$450 per credit for those additional credits.

CTL's mission is to empower teachers to lead school improvement. These new online courses allow us to overcome the limitations of time and geography to bring these benefits to all students and teachers. 📍

Dr. Robert Goodman is the executive director of the New Jersey Center for Teaching and Learning (CTL). His role in the development of the Progressive Science Initiative (PSI) at Bergen County Vocational Technical High School in Teterboro led to his being named the 2006 New Jersey State Teacher of the Year. PSI and its counterpart, the Progressive Math Initiative, have been adopted by CTL. Goodman can be reached at bob@njctl.org.