

ABOUT THE NEW JERSEY CENTER FOR TEACHING AND LEARNING

PURPOSE

Investing in teachers to improve student outcomes

The New Jersey Center for Teaching and Learning® (CTL) is an independent, non-profit organization grounded in this mission:

CTL empowers teachers to lead change so that all children have access to a high quality education.

Central to that mission is working with teachers to spread and improve successful programs so that all students benefit.

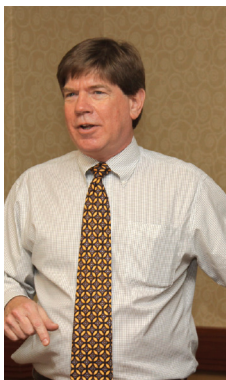
Making teaching easier and more effective

CTL believes the best way to improve education is to invest in teachers by creating changes that make their work less isolated, simpler, more effective, and less stressful. This belief has propelled CTL to an unparalleled track record in rapidly increasing the supply of science, technology, engineering, and mathematics (STEM) teachers and advancing student STEM attainment.

HISTORY

Built by teachers for teachers

CTL grew out of the heads, hands, and hearts of teachers. The New Jersey Education Association created the organization in 2006; their support and participation continues today.



In 2009, Dr. Robert Goodman was released from his high school teaching position to join CTL full-time, becoming its executive director in 2011. CTL's major programs, the Progressive Science Initiative® (PSI®) and the Progressive Mathematics Initiative® (PMI®) are deeply rooted in Dr. Goodman's doctoral work and teaching experience. Today, the core approach Dr. Goodman developed has been enhanced and expanded by the work of hundreds of teachers from around the world. Hallmarks of CTL's approach include physics - chemistry - biology high school science sequencing, technology-supported instruction, and pedagogy that combines direct instruction and social constructivism.

*Rapidly
expanding
nationally and
internationally*

The success of PSI and PMI is driving a rapid expansion. Originally piloted by Dr. Goodman in a single New Jersey high school in 1999, it had extended to over 100 New Jersey schools by 2013. In the last three years, PSI-PMI has grown to more than 157 schools in New Jersey, Colorado, Rhode Island, Vermont, The Gambia and Argentina. More than 1,100 certified math and science teachers have been trained in CTL methods; 137 teachers have completed physics or chemistry endorsement through CTL's program. In the last year, 120,000 unique visitors to CTL's website experienced more than 2,000,000 page views, double the previous year's totals. Over 4500 teachers have registered to use online student assessment materials, strongly suggesting they are implementing the PSI-PMI approach independently. In 2013, the National Education Association became a financial partner, contributing funds to help offset implementation costs in new US locales, speeding the spread of PSI-PMI.

*Effectiveness
attracts wide
ranging support*

PSI and PMI bring supporters together. Expansion has been driven by partnering teachers associations, nations, states, districts, foundations, and corporations. PSI and PMI have demonstrated the effectiveness of making smart investments in good teachers in order to produce better student learning outcomes.

CURRENT PROGRAMS

*Engineering
opportunity
competitiveness*

CTL believes that providing an effective, universal opportunity to learn science and mathematics is critical to advancing social justice, by giving all students access to ideas and careers that drive the modern world, and to international competitiveness, by allowing societies to prosper through realizing the capacity of all their people. Further, CTL believes critical thinking, a key outcome of science and math competency, benefits all citizens, regardless of their particular field of adult endeavor.

Special role of physics

CTL's programs grew out of an understanding of profound inequities in the delivery of science education in the US, exacerbated by antiquated sequencing of high school science courses. In particular, physics instruction was being offered infrequently, too late in the science sequence, and absent mathematical rigor. CTL understands that in order to have a fair shot at the careers and critical thinking skills a sound science education offers, all high school students should study one year of mathematically rigorous physics and have the option of taking Advanced Placement Physics.

Inequity in access to physics

Today, many US schools don't offer physics at all. In fact, less than 30% of US students study any physics and it's often not mathematically rigorous. Less than 3% of US students study Advanced Placement Physics. Schools with high poverty and marginalized minorities are the least likely to offer physics.

Gaps in the teaching supply

At present, there are far too few physics teachers to teach all US high school students physics. Serving those students would require a three-fold increase in the US alone. Other nations face similar shortages. Clearly, CTL's rapid and efficient system of training new physics teachers is a foundational part of fueling equitable access to physics courses.

Key components align

CTL does its work through two programs, the Progressive Science Initiative (PSI) and the Progressive Mathematics Initiative (PMI). PSI and PMI are created by teachers, for teachers. They are technology-enabled, transformational approaches to educating teachers and students in parallel through the integration of professional development, pedagogy, curriculum, and assessment. As a result, the trained, written, taught, and assessed curriculum is squarely aligned.

Student-teacher collaboration

The pedagogical methods used interweave direct instruction and social constructivism guided by the use of frequent, real-time formative assessment. When students can signal their understanding immediately, teaching becomes more precise.

Free, open-source courseware

All PSI-PMI curriculum materials are open-source and available at www.njctl.org. Any teacher, school or district is free to use any of these materials, whether through a formal partnership with CTL or independently.

Rigorous evaluation

PSI and PMI have been evaluated both by Dr. Goodman (in the course of his dissertation on the subject) and by independent evaluators as the programs have grown. The Initiatives continue to be the subject of both formative and summative evaluation.

*Documented
success*

Generally speaking, PSI has demonstrated the ability to increase the number of advanced placement science enrollees. PMI has increased both student test scores on standardized measures and the number of middle school students taking algebra at the eighth grade level.

PSI has given schools serving high percentages of low-income students and students of color the ability to outperform less diverse, wealthier schools. In 2012, six of the top twelve New Jersey schools for Advanced Placement Physics B participation were schools that use PSI. The PSI schools served dramatically more students of color (83%) than the non-PSI schools (19%). The same is true of economic status, where PSI schools serve more low-income students (58%) than the non-PSI schools (4%).

*Ongoing
quality
improvement*

Formative assessment, which includes real-time classroom student feedback; teacher participation in professional development courses and learning communities; and continuous curriculum refinement, root the Initiatives in ongoing quality improvement.



*Widely
recognized*

PSI and PMI have received highly regarded awards. The 2011 national report Leaning Forward: Teacher Professional Learning in the United States, said

“The New Jersey Center for Teaching and Learning (NJCTL) has been doing groundbreaking professional development work in math and science instruction as well...using the innovative curriculum of 2006 New Jersey Teacher of the Year Robert Goodman...to create the Progressive Science Initiative....”

That same year, PSI and PMI won a prestigious Gold Learning Impact Award in conjunction with a key technology partner, SMART Technologies. The award calls the Initiatives

“...an effective new approach to student learning and teacher training.”



A DEEPER LOOK AT PSI AND PMI

PSI-PMI COURSEWARE

43 *Coherent courses*

PSI and PMI both use the same core pedagogies, assessment strategies, and technology, but each has its own set of free, online courseware to support the teaching of 43 courses including PSI courseware for grades 6-12, and PMI courseware for grades K-12. Courseware includes presentations, homework, labs, and student assessments for every course. PSI K-5 will be available starting in the fall of 2014.

*Spanish
language
courseware*

Through a partnership with teachers implementing PSI-PMI in San Luis, Argentina, courseware is being translated into Spanish. Some materials are available now.

MATH COURSES

Pre-K
Kindergarten
Grade 1
Grade 2
Grade 3
Grade 4
Grade 5
Grade 6
Grade 7
Grade 7 - Accelerated
Grade 8
8 Domain Level Courses
Grade 8 - Algebra
Algebra I
Geometry
Algebra II
Pre-Calculus
Integrated Mathematics I
Integrated Mathematics II
Integrated Mathematics III
AP Calculus A/B
AP Calculus B/C

SCIENCE COURSES

Kindergarten [ready fall 2014]
Grade 1 [ready fall 2014]
Grade 2 [ready fall 2014]
Grade 3 [ready fall 2014]
Grade 4 [ready fall 2014]
Grade 5 [ready fall 2014]
Grade 6
Grade 7
Grade 8
Algebra-Based Physics
AP Physics B (Trigonometry-based)
AP Physics C (Mechanics; Electricity, Magnetism)
AP Physics I
Chemistry
AP Chemistry
Biology
AP Biology

Electronic courseware eliminates textbooks

Courseware is available via the Internet. Where classrooms have Internet access, it is delivered directly. In the alternative, it can be delivered to a laptop or desktop computer and transferred to a flash drive for later classroom use. Courseware is presented to students via an interactive white board or projector and, where in use, to teachers' and students' personal devices. PSI-PMI are being used successfully in developing nations with intermittent power and connectivity. Materials can be printed as necessary. Textbooks are eliminated. Risky investments in textbooks, which become outdated as standards change, are eliminated. PSI-PMI materials are updated continually at no cost to the user.

Easy links to open educational resources

PSI-PMI courseware provides context and links to other open educational resources (OER), such as Khan Academy's library of videos; the University of Colorado's PhET Interactive Science Simulations; and National Library of Virtual Manipulatives, opening the door to rich, coherent learning experiences. PSI-PMI also allows teachers to create their own links to exciting OER instructional materials with ease.

Common core compliant, coherent Pre K-12 math curriculum

PMI provides math teachers and schools with a fully articulated, complete, Common Core compliant, Pre K-12 instructional sequence. In addition to being organized by grade level, instructional materials can be accessed by domain (for example, fractions), to provide interventions for students who struggle with learning or instructional deficits. This feature not only helps support individual students; it also helps schools, teachers, and students transition from historically employed content sequences to the Common Core mandated sequence.

Standards-based, coherent science curriculum

PSI is a College Board Advanced Placement Exam compliant high school science curriculum currently including the sequence Algebra-Based Physics, Advanced Placement (AP) Physics B, AP Physics C, Chemistry, AP Chemistry, Biology, and AP Biology. This "Physics First" approach to science is central to the PSI-PMI philosophy, driving achievement gains among a more diverse community of learners. Next Generation Science Standards compliant courseware for grades K-8 will be available in the fall of 2014.

Math and science reinforce one another

The PSI-PMI sequence is mutually reinforcing. That is, the sequence of science learning supports, rather than confounds, the sequence of mathematics learning, and vice versa. Students have immediate opportunities to apply math learning in science.

*Teacher-driven
continuous
improvement*

All courseware is developed by Teacher Curriculum Writers under contract to CTL. A program of continuous improvement keeps courseware effective and current. PSI-PMI teachers anywhere can and do provide feedback, which is rapidly evaluated and incorporated.

*Supplemental
resources
support
implementation*

CTL has created a supplemental body of online resources to support PSI-PMI. These include documents addressing teaching methods, technology, classroom furniture and laboratory equipment, scheduling, policies and practices, and implementation recommendations.

PSI-PMI PEDAGOGY

*Clear instruction
and active
learners*

PSI-PMI pedagogy relies on a combination of social constructivism and direct instruction. Class periods are divided between brief periods of instruction based on courseware-provided presentations and longer periods of active student discussion and shared problem solving. Seated at round tables, small groups of students work together on a common problem. Classrooms are lively, as students debate the merits of their own ideas and compare solutions.



Real time student feedback guides instruction

Real-time student feedback guides instruction. Using handheld electronic responders (“clickers”), students respond to periodic inquiries concerning their answers to assigned problems. Their anonymous answers appear on the classroom whiteboard, in the form of a pie chart, which reveals how many students have gotten the correct answer, and how many hold other opinions. Individual privacy is protected, but all can see whether or not the class has grasped a concept. Since teachers and students together see how well the class is doing, they share a sense of when and why more instruction is necessary. As a result less time is spent in review, but time spent is more focused in areas of true need. Overall, PSI-PMI classrooms tend to move through curriculum more swiftly.

Heterogeneous classmates

Classes are populated as heterogeneously as practicable, minimizing tracking. After-school tutorial sessions are established to enable heterogeneous classes to be successful learning environments for struggling students and to allow for test retakes.

Student commitment to mastery

Individual student assessment is based on testing and lab performance. PSI-PMI classrooms hold the door to success wide open: students are invited to test and retest until each achieves the level of proficiency in which he or she is willing to invest. Subjective factors such as class participation and conduct are removed from the equation; only mastery matters. PSI-PMI has demonstrated that when students are judged on mastery, they commit to mastery.

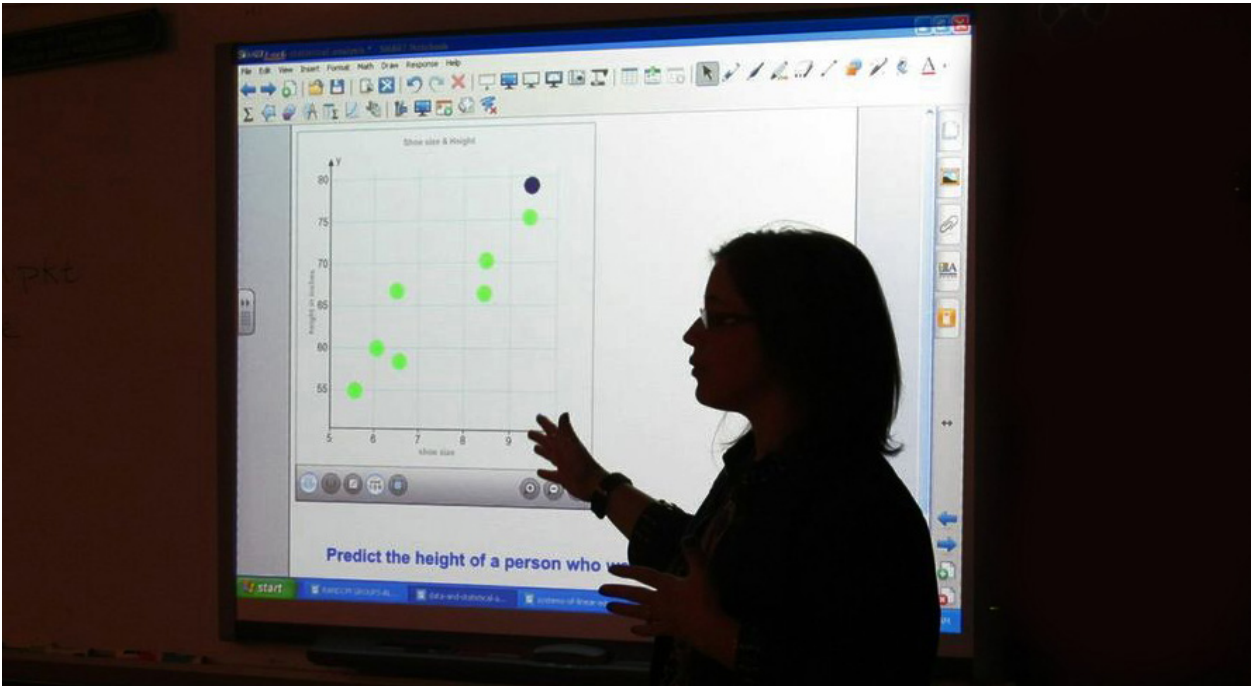
Ongoing professional development

Creating Professional Learning Communities during one class period per week supports teacher collaboration and leadership. Embedded professional development helps teachers improve their grasp of content, methods, and creation of an open-classroom environment.

PSI-PMI TECHNOLOGY, FURNISHINGS, & LABORATORY EQUIPMENT

Technology that simplifies teaching and learning

PSI and PMI are a technology enabled, transformational educational paradigm. The Initiatives utilize technology to fully integrate professional development, pedagogy, curriculum, and assessment. As a result, the written, taught, and assessed curricula converge. Technology is employed to absorb the complexity teachers face when creating lesson plans in isolation and to create a real-time feedback loop between students and teachers.



Classroom requirements

PSI-PMI classrooms require either direct Internet access (which is advantageous) or access to teacher-downloaded courseware; an interactive, electronic white board or projector; a classroom set of responders; and access to a printer. Teachers require a classroom computer in order to access courseware for preparation and/or downloading courseware.

Textbooks eliminated; technology costs reduced

In considering the costs of this technology, it is important to remember that the cost of textbooks is permanently eliminated. Additionally, CTL has a partnership arrangement with SMART Technologies that can reduce costs associated with acquiring interactive white boards or projectors and responders.

Furnishings that support social learning

CTL recommends that classrooms be furnished with five-foot, round student tables and chairs to facilitate social constructivist interaction. In addition to the electronic whiteboard specified above, placing a large, conventional white board in the room provides a space for student problem solving and posting of ancillary material.

Lab equipment lists provided

PSI provides equipment lists for each science domain (physics, chemistry, and biology). Each set is sufficient for sharing among five teachers.



PSI-PMI PROFESSIONAL DEVELOPMENT

Any good teacher can be a good STEM teacher

As an organization founded by teachers, CTL is deeply engaged in professional development for teachers. CTL has demonstrated that **any** good teacher can become a good science or math teacher. In the context of the national shortage of STEM teachers, CTL has developed highly effective, affordable approaches to increasing that supply.

Good teachers, aligned professional development, and flexible training

CTL's approach to teacher training is grounded in three basic principles. First, CTL believes it makes sense to invest in teachers who are already at work in the classroom, building their strength in math or science. Second, CTL trains teachers by using exactly the same online materials, pedagogy, and technology they will use in their own classrooms, so that they experience the same learning journey their students will ultimately travel. Third, CTL believes flexible course structures can make professional training more accessible, affordable, and successful. Currently, CTL is deploying blended learning model professional development courses that give teacher-learners options for crafting their own combination of online and face-to-face instruction.

Courses for continuing education hours or graduate credit

CTL offers professional development courses directly to teachers. It is a frequent provider of professional development qualifying as continuing education hours. Graduate credit for some CTL courses can be arranged through some universities. Courses include CTL Teaching Methods, and Algebra-Based Physics and Chemistry for teachers for wishing to improve their knowledge of those content areas.

New Jersey endorsement course

A special agreement in the state of New Jersey allows any licensed teacher completing a CTL program of professional development to secure their physics or chemistry teaching endorsement. While full endorsement takes about 18 months, teachers begin teaching their subject after a one-month, intensive training program. Continuing professional development supports their efforts and increases skills to complete full endorsement. In most cases, teachers complete intensive training during the summer months and begin instructing the next fall. In other states, this arrangement may vary. At present, CTL is creating endorsed physics teachers at a significantly greater rate than all other New Jersey colleges and universities combined.

Courses for teachers in training

CTL's Alternate Route Program serves individuals seeking their initial teaching certification in New Jersey in either physics or chemistry. This program includes six courses focused on PSI pedagogy, technology, and content in either physics or chemistry. This program includes a Professional Learning Community that supports participants in their first year of teaching.

Residencies for non-teachers

CTL's Residency Program allows a person with a BA or BS to become a certified physics teacher in New Jersey. In this program, participants follow the same general course of study offered to certified teachers seeking endorsement, but also requires an internship working in the classroom with a certified PSI teacher.

Courses for groups

CTL also offers professional development courses for groups. Schools, districts, or states can arrange for groups of up to 20 teachers to be trained at the location of the sponsor's choosing. This option reduces the per enrolled teacher-learner cost. Often, when a district or state enters into an implementation partnership with CTL, group professional development courses are arranged.

Learning communities

Sites implementing PSI-PMI also embed ongoing professional development via Professional Learning Communities and consultative guidance from experienced PSI-PMI teachers.

ENDORSEMENTS AND SPONSORS

Supported by many sectors

PSI and PMI have spread rapidly because of an enthusiastic community of partners and sponsors. CTL's partners include the community of teachers building and implementing its courseware; school curriculum leaders, administrators, and elected officials who have launched implementation programs; and foundations, teacher's professional associations, and corporations who fund the work.

Teacher support

Gulderen Ozbek, a New Jersey PSI endorsement graduate, put it this way: **"The curriculum is there. The tests are there. The lessons, the quizzes, everything is there. So it takes a lot of the stress off the teachers."**

International funder support

Nathalie Lahire, Task Team Leader for The Gambia Education Portfolio at the World Bank explained her organization's funding of the CTL/Gambian PSI-PMI implementation partnership by calling the program **"a cutting edge, yet simplified approach based on evidence of success in low income and disadvantaged settings."**

Principal support

Dr. Nicholas DelTufo, principal at East Orange STEM Academy is a CTL supporter because the approach works for his students. **"We've made real progress since opening our doors in September 2011. We have 37 students in AP physics out of about 270 students enrolled here. We're among the top 10 schools in the state for students completing AP physics by the time they graduate. We are a shining star in urban education."**

Professional Association support

Naming CTL as a national example of teacher-led education reform, NEA President Dennis Van Roekel explained his enthusiasm. **"We need millions of educators to be given the opportunity to use their incredible talents and creativity to define solutions that work for students."**

Corporate support

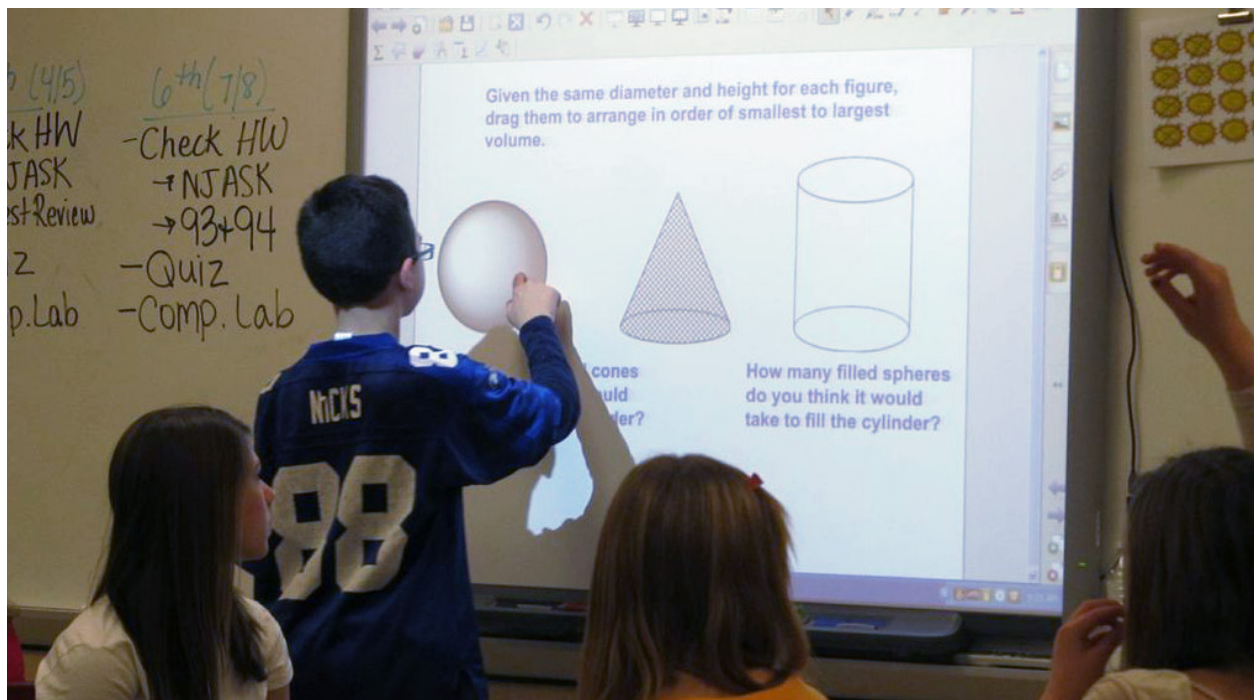
Greg Estell, President, Education for SMART Technologies explained his company's partnership with the NEA and CTL, which reduces the costs to schools for necessary technology, by saying **"For more than 22 years, SMART has supported educators and students by providing innovative products, resources and services. This partnership with the Center for Teaching and Learning and the National Education Association is a natural fit and helps us advance our mission of bringing inspired collaboration into education settings around the world."**

Foundation support

Carrie Morgridge, Vice President, Morgridge Family Foundation, explained her foundation's support for Colorado's PSI-PMI implementation and her subsequent joining of the CTL Board of Trustees this way: **"I've seen firsthand the Center for Teaching and Learning's considerable achievements, and supporting them is an important part of the Foundation's work to promote innovation in the classroom."**

Current funders

CTL is funded by the Morgridge Family Foundation, the New Jersey Education Association, the National Education Association, the NEA Foundation, Bayer HealthCare, Xcel Energy, Verizon, SMART, the Overdeck Family Foundation, the World Bank, Universidad de la Punta, and einstruction.



THE IMPLEMENTATION PROCESS



IMPLEMENTATION OPTIONS

Individual teachers as implementers

Since courseware is open-source, free, and available for download to anyone, individual teachers can and do implement independently in their own classrooms. Over 4500 teachers have registered on CTI's website in order to secure access to assessment materials, so it is likely that this kind of implementation is common.

*Schools, districts,
and states as
implementers*

Other times schools, districts, or states create formal partnership agreements with CTL to drive PSI-PMI implementation on a broader scale. In those cases, adoption of the PSI-PMI approach is formalized and systematically undertaken. While partnerships vary, they generally involve CTL's designation of a staff Program Manager to lead efforts in conjunction with leadership from the site. CTL provides teacher training; administrative support; assistance in securing technology, furnishings and equipment; ongoing professional development; partial financial support, support for local fundraising efforts; public appearances; and evaluation. In many cases, implementation agreements are financially supported by a combination of grant money available through CTL itself, and from interested corporations and foundations as well as public revenue.

*A solution
that unites all
stakeholders*

By stepping away from partisan recriminations that have stymied national progress and providing a solution that works quickly and affordably, CTL has garnered the support of students, educators, businesses, foundations, and elected officials in a growing number of states.

*Special support
dramatically
reduces
implementation
costs*

At present, CTL has support from the National Education Association to help underwrite the spread of PSI-PMI in new U.S. jurisdictions. These funds can be used to attract local or regional dollars. Additionally, SMART Technologies, which manufactures necessary classroom technology, joins this partnership to reduce those costs in new implementation sites. While available funds vary over time, interested schools, districts, and states often collaborate with CTL in designing a funding plan.

Local partners

Local partners support PSI-PMI implementation by making leaders and spaces available for consultation. They:

- ✓ Support pedagogy by making student assignments in a manner that promotes heterogeneous classrooms, and making teacher assignments that promote vertical and horizontal curriculum articulation;
- ✓ Assist in shaping professional development course schedules;
- ✓ Cultivate teacher leaders by supporting ongoing Professional Learning Communities;
- ✓ Equip and furnish classrooms in a manner consistent with PSI-PMI recommendations;

- ✓ Provide feedback and data that allows CTL to engage in continuous improvement;
- ✓ Help spread PSI-PMI to kindred schools, districts, and states by welcoming visitors; and
- ✓ Expand course offerings as physics joins the curriculum and demand for advanced placement science courses grows.

WORKING WITH CTL

CTL meets partners where they are, literally and figuratively. Operating as a virtual organization, CTL has Program Managers, Curriculum Writers, and Trainers in several locations around the US. Additionally, staff travels willingly to national and international program sites, or sites considering PSI-PMI implementation. Staffed by teachers and former teachers, CTL has a very real understanding of the scheduling and budgetary constraints schools face. CTL works with clients to craft solutions that work.

Dr. Robert Goodman, CTL's Executive Director, is a frequent speaker at public events in jurisdictions considering new approaches to STEM education, at professional associations, and in public forums. His appearances are scheduled at the discretion of CTL; speaker's fees are negotiable; in select circumstances, presentations are arranged without charge. Travel expenses for these appearances are subject to negotiation

Costs

Fixed costs associated with adopting PSI-PMI include tuition for teacher training programs and imbedded support. Costs for classroom technology vary from school to school, based on the percentage of classrooms already equipped with whiteboards and responders. Some districts choose to schedule training outside of school hours, requiring teacher stipends conforming to applicable collective bargaining agreements. Below, per teacher costs are shown assuming the need for new classroom technology. Additional embedded support can be provided upon request at a charge of \$1800 per day per school.

PMI teachers are prepared by taking the Teaching Methods course. CTL does not offer mathematics content or endorsement training. The PMI methods course costs \$540 and embedded support is available.

In New Jersey, teachers are required to pass the specific Praxis exams as a part of their endorsement program. Those costs are established by the Educational Testing Service and can change at any time.

**PER TEACHER ESTIMATED COSTS: TRAINING AND EQUIPPING PSI-PMI TEACHERS
AS OF OCTOBER 31, 2013**

Physics Endorsement		
Algebra-Based Physics for Teachers Training Tuition and Embedded Support		7260
Praxis Exams*	General Science and Physics	508
Total Physics Endorsement		\$7768

Chemistry Endorsement		
	Requires Physics Endorsement	
Chemistry Training Tuition & Embedded Support		8820
Praxis Exams*	General Science and Chemistry	508
Total Chemistry Endorsement		\$9328

Professional Development		
Teaching Methods		\$540

Classroom Technology if not already available		
1 Whiteboard**	CTL Discounted Price	2559
32 Responders**	CTL Discounted Price	962
Total Classroom Technology		\$3521

* Administered by the Educational Testing Service, which determines fees. These costs are subject to change.

** Based on fixed discount of current retail price. These prices are subject to change.

CONTACT CTL

It's easy to get in touch with CTL, and staff invites ideas and inquiries from individuals, school systems, organizations, foundations, and corporations.

INFORMATION

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WEBSITE

www.njctl.org

INSTRUCTIONAL VIDEOS

www.youtube.com/user/TheNJCTL



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