NEW JERSEY CENTER
FOR TEACHING & LEARNING

The Time is Now

New Jersey Center for Teaching and Learning

January 2017

The mission of the New Jersey Center for Teaching and Learning (CTL) is to empower teachers to lead school improvement so that all children have access to a high quality education.

www.njctl.org

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Who We Are

The New Jersey Center for Teaching and Learning (CTL) is an independent nonprofit dedicated to ensuring that all students—regardless of gender, class or color—have equal opportunities to an education that prepares them for 21st century advanced study and careers in science, technology, engineering and mathematics (STEM).

CTL is providing a simple, scalable solution to address the critical shortage of K-12 science and mathematics teachers and the great social injustice that comes from depriving underserved students access to STEM education and the important opportunities that this learning provides.

Through two signature STEM programs—the Progressive Science Initiative® (PSI®) for teaching, K-12 science and the Progressive Mathematics Initiative® (PMI®) for teaching K-12 mathematics—CTL offers a modern, inclusive teaching approach.

Today, CTL is the No. 1 producer of physics teachers in the U.S. and a major creator of chemistry teachers. More than 1,500 certified mathematics and science teachers have been trained to teach PSI and PMI, and CTL programs are "on the ground" in 218 schools in the U.S., Argentina and West Africa. This new pool of STEM teachers is atypically racially and gender diverse and can serve in a role model capacity for students.

CTL has introduced a groundbreaking new pedagogy to empower teachers to lead the transformation of education. The goal is nothing less than to equip all students to actively contribute to a powerful future.

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An Innovative Approach
Built Upon Teachers' Insights, Experience & Research

Dr. Robert (Bob) Goodman never anticipated that his first quick spin around Bergen Tech to better equip his new classroom would be the first step toward challenging the entire status quo system of STEM education. But it was.

Bob had always loved science. After graduating from MIT, he headed into a career in audio electronics. There, he ended up serving as the president and CEO of several well-known brands, ultimately spearheading the turnaround of each of them. But after over 20 years in business, he took a dramatic step. He returned to his passion for physics, volunteering to teach his first classes at a nearby private school.

He quickly discovered: "Science is easy, Teaching is hard."

Several times during his first year in the classroom, he pulled over to the side of the road on his way home and literally cried with frustration. The combination of trying to motivate his students, control his classroom, create a reliable consistency in his teaching approach, evaluate his students in preparation for end-of-course exams, inspire the class leaders and help the stragglers, and on top of it all, invent a lesson plan from scratch every day, made his previous corporate life look like a cake walk. Productive teaching takes an extraordinary amount of effort; and the first year of teaching is almost universally formidable.

But as with all good teachers, Bob learned.

He learned that all kids respond well to a challenge -- and to the satisfaction of successfully completing a tough problem. He learned that students work well in small groups, figuring out solutions to increasingly complex problems among themselves after a short lesson from their teacher.

Bob was hooked. He got an MAT in teaching physics and took on his next challenge: a public school teaching job at Bergen County Technical High School in Teterboro, New Jersey.

His classroom was equipped only with individual computer stations, and this didn't reflect the collaborative learning environment he envisioned. So he pilfered round tables from the faculty room, chairs from the cafeteria, and a blackboard from a closet.

And the stage was set for change.

Create New Courses and Teaching Approaches

The 9th grade students at Bergen Tech were in a pre-engineering program and Bob realized they needed a stronger grasp of algebra in order to tackle physics. So he wrote a new course: Algebra-Based Physics, designed specifically to give students a way to understand the more abstract concepts of algebra in real-life physics situations.

By the end of the term, his students had improved not only in physics but also in algebra —and were developing a passion for mathematics and science, getting a personal sense of just how useful these subjects can be.

Encouraged by the success with students with this new first course, Bob spearheaded an effort with other educators to develop a new curriculum: The Progressive Science Initiative (PSI).

PSI courses were created with an exciting, visually evocative, yet reassuringly consistent format for students--as well as plenty of flexibility for each individual teacher's input. Course materials were—and are --created by highly experienced and talented educators and presented to the class using an interactive whiteboard. Teachers spend short periods of time in direct instruction, presenting concepts and then pose challenges and problems for the students to solve together in small groups. Rather than turning their backs to the class to write on a board, they focus on the real-time interactions of the students. Students take the lead in exploring concepts in their groups and then are asked to enter their individual answers using student response devices. The results of this "poll" are presented to the class and then

discussed together. If there are significant differences of opinion, students continue to debate, discuss and defend their thinking. Teachers facilitate a dynamic community of active, students in which all are learning.

This approach not only creates collaborative classrooms in which critical thinking is emphasized—but empowers teachers to put their energy into the art of teaching rather than into writing curriculum

The success at Bergen Tech has been replicated again and again. Teachers and students both find that this type of teaching and learning not only increases their accomplishments but influences their confidence and interest in learning more..

Hallmarks of CTL's Innovative Approach

- Uniquely designed, teacher-developed K-12 science and mathematics courses that align to standards and are delivered as free open educational resources. Everything needed is included -- presentation slides, labs, homework, assessments, video—that can be edited and adapted as teachers desire.
- Accessible teacher training in innovative teaching methods that empower teachers to help students to think carefully, critically and creatively and leads to dynamic and collaborative classrooms.
- A new sequence for teaching STEM subjects that is based on what is needed for learning 21st century science. This sequence builds coherent relationships between science and mathematics and helps students master and apply their learning.
- Use of classroom technology to actively engage students and provide real-time assessment information to guide instruction for optimal learning.
- Cost savings to districts. CTL materials are provided free of charge, eliminating the need for expensive, quickly outdated textbooks. District investments in training and technology are rapidly repaid.

Learn more about CTL programs at www.njctl.org

Make Science Make Sense: Reverse the Science Sequence

From the outset, Bob understood that science can be an application of mathematics that helps students to develop proficiencies in both areas. And that it made sense to essentially reverse the sequence for science instruction to adapt for teaching 21st century science.

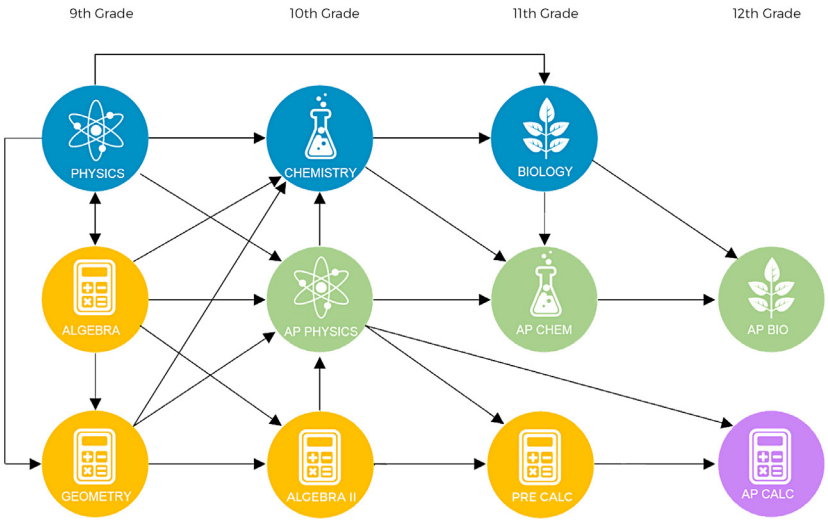
While the traditional sequence for secondary school science—namely, biology-chemistry-physics—made sense when it was introduced, in 1892, today to understand

modern biology students need to understand chemistry, and to understand chemistry, they must understand physics. In addition, mathematics aligns better with physics at the beginning of the sequence.

Algebra-Based Physics became the first step in this sequence. By using physics as a primary building block for mathematics and science education, rather than positioning it as a rarely studied area of science at the uppermost reaches of high school education, students had a concrete way of imparting meaning to abstract mathematics. The modernized sequence builds student proficiency and maximizes the number of Advanced Placement (AP) science courses students are able to take.

Within a few years, all students at Bergen Tech were taking physics in the 9th grade, and many were heading on to AP courses—making the school No.1 in the state for AP Physics.

A Modernized Sequence for STEM Learning



In 2006, Bob was named New Jersey Teacher of the Year for this work, which was the topic of his disseration that year.

By early 2007, the New Jersey Education Association (NJEA) asked him to be a founding board member of the New Jersey Center for Teaching and Learning (CTL). CTL was created by NJEA's president, Joyce Powell, to empower educators to spearhead education reform and position teachers to better prepare their students for the new testing standards. In 2009, Bob became CTL's first full time Executive Director and built a dedicated team working to continuously improve and grow the initiative

CTL applied knowledge gained from its high school science programs, and expanded its reach to include all K-12 science (PSI) and K-12 mathematics, through the Progressive Mathematics Initiative (PMI).

Both New Jersey policy makers and New Jersey teachers supported introducing PSI (and PMI) to more schools. This meant developing course materials that could be

broadly shared in additional subjects, equipping classrooms with whiteboards, software, and associated student polling devices, and creating many more physics teachers. Support from NJEA, the National Education Association and private philanthropy enabled CTL to blend the new curriculum, teaching methods and real-time assessment into a seamless whole.

Programs to train teachers were next.

Provide Access: Expand the Pool of STEM Teachers

The limiting factor for many high school students is the lack of physics teachers. Students need to master physics to prepare for 90% of STEM fields, making the physics teacher one of the most important educators in the high school. Within the massive shortage of STEM teachers, in general, this is a particular shortage of physics teachers.

There are, literally, millions of students in classrooms now who need these teachers. Bob realized that if we rely only on the traditional pathways for producing physics teachers—looking to the very small subset of physics and science majors in college who wish to teach—it will be years, or decades, to make any substantive headway to address the shortage.

Bob recognized that the foundation of the PSI teaching approach —a combination of direct instruction and collaborative learning—could be applied to train teachers from a variety of backgrounds and subject area expertise to successfully teach science. (This pedagogical approach is very much in line with the award-winning work of Carl Wieman and Eric Mazur to improve the teaching of science at higher education institutions.)

Today, CTL has become the No.1 producer of physics teachers in the U.S., as well as a leading producer of chemistry teachers.

CTL not only now trains more teachers in physics than any other university, but trains a more gender and ethnically diverse pool of educators, expanding opportunities and providing role models for students of every class and color. Most importantly, CTL provided teachers with much-needed support – just the kind of support that would have been so helpful for Bob, especially in that difficult first year.

Close The Achievement Gap Using PSI and PMI

The boost in student gains at Bergen Tech were not an anomaly.

In the years since Bob introduced his first class of students to Algebra-Based Physics and saw them head onto AP courses, CTL has seen similar results in other communities. Some examples:

- In 2014, PSI was used in eight of the 20 top NJ schools for student participation in AP Physics B—a key measure of student progress toward college preparedness in STEM. The PSI schools were dramatically more than 70% Black or Hispanic students, and low

income (60% of students recieved free or reduced lunch); the non-PSI schools were less than 10%.

- Along with improving student achievement in science, 9th grade students in Newark, NJ who took Algebra-Based Physics also realized a 14% improvement on a national Algebra I exam.

- In Westminster High School, Colorado, 11th grade students in a 2014-15 pilot of Algebra-Based Physics produced such significant gains that teachers lobbied the district to reverse the science sequence and offer the course to the entire 2015-16 class of 600+ 9th graders and a similar number of juniors.

- In The Gambia, West Africa, there were such significant gains from CTL's three-year pilot of PSI training high school science and math teachers that it is being extended to all students in the country in 7th through 12th grade. In 2015, CTL was awarded a $1.3 million contract from the Ministry of Basic and Secondary Education of The Gambia, funded by the World Bank, for a three-year project to develop a program in English Language Arts (ELA) using the CTL pedagogy and approach.

CTL Recognized as "Best in Class"

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CTL was selected as one of 236 "best in class" members of the prestigious national multi-sector network responding to the imperative to train and retain 100,000 excellent science, technology, engineering, and math (STEM) teachers by 2021.

2011 IMS Learning Impact Gold Medal

CTL received a 2011 IMS Global Learning Impact Gold Medal, presented by this consortium of over 150 education technology companies to recognize the most impactful use of technology worldwide in support of learning.

WORLD BANK GROUP

CTL programs in The Gambia, West Africa have been so successful that a new $1.3 million, 3-year contract was awarded to The Ministry of Basic and Secondary Education of The Gambia to work with CTL to develop English Language Arts programs.

njea

New Jersey Education Association

Proud Founder and Major Supporter of CTL

The Results of CTL's Work Speak for Themselves

- In 2015, Bergen County Technical High School, the birthplace of PSI and PMI, was ranked as one of the top 3 schools in New Jersey and No. 31 out of over 14,000 high schools nationwide (U.S. News and World Report). Newsweek awarded CTL the distinction of "Overcoming the Odds" due to its share of underrepresented minorities and students in poverty. Niche ranked it as number 12 out of 14,000 public schools in the nation, indicating "the school is an exceptional academic institution with a diverse set of high-achieving students who rate their experience very highly."

- CTL remains the No. 1 creator of physics teachers in the US today.

- More than 1,500 certified mathematics and science teachers have been trained to teach PSI and PMI, and this pedagogy is on the ground in 218 schools in the U.S., Argentina and West Africa This new pool of STEM teachers is atypically racially and gender diverse and they can serve in a role model capacity for their students.

- There have been over 1.8 million downloads of CTL curricula files in the last 12 months alone. As a result, approximately 2.5 million students in the United States and abroad learned from CTL content in the past year, many from economically disadvantaged backgrounds

- CTL is now a leading global provider of free, open source K-12 science and mathematics curricular materials that give teachers and students access to a coherent, consistent and comprehensive resource for understanding and mastering science and mathematics.

  These achievements are just the beginning.

A comprehensive overview of research on CTL programs is available here.

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