Mitchell Institute Physics Enhancement Program (MIPEP)

Alexey Belyanin, Bhaskar Dutta, and Tatiana Erukhimova
A vicious cycle

Few high schoolers take physics with qualified teachers

Limited supply of qualified physics teachers

Fail or can’t take physics in college

Can’t pursue STEM careers
How to make an impact on K-12 education with limited resources?

Train the Trainer

- Reach out to all Texas high school teachers
- Provide rigorous physics training
- Concentrate on problematic areas for incoming freshmen
Select physics teachers from all over Texas with very little or no physics classes in the college. A unique program!
Two full weeks
8 am – 8 pm

Lectures, labs, hands-on demos, discussion, tours
Objectives

• Physics concepts and problem-solving skills
• *Boost teachers confidence*
• Show how to explain concepts to students and engage them effectively
• Labs and hands-on learning experiences
• Tools, ideas, and kits for physics demonstrations on a small budget
• Facilitate collaboration of physics educators in Texas
Who is involved in teaching?

- 9 physics faculty members from Texas A&M
  - Award-winning teachers, experts in introductory physics education
  - High evaluations from previous MIPEP

- 2 Master Teachers
  - Live with the participants during the school, provide instructions
Instructors

Tatiana Erukhimova
- Presidential Professor for Teaching Excellence
- APS Fellow, 4 AFS awards
- Fish Camp Namesake 2019
- Teaches half of the curriculum, all labs and demos

Lewis Ford
- Expert in teaching physics to non-science majors
- AFS award for teaching

Dave Toback
- Teaching awards
- Author of the popular course “Big Bang, Black Holes, No Math”

Jonathan Perry
- Won a teaching award as a graduate student
- Did physics education research with Tatiana
- Now an instructional professor at UT-Austin
Master teachers

Paula Hiltibidal
• MS in Education
• Education Specialist, High School Science

Kris Tesh
• PhD in Chemistry

Janie Head
• PhD in Education
A day of MIPEP

- Introduction of necessary material
- Problem solving
- Hands-on experiments
- Extensive discussion at the end of every school day
- Two days of laboratory-based work
- A field trip or meeting with a top researcher or astronaut
Feedback from teachers

“I was trained in Biology, so my first year teaching physics was overwhelming. After attending MIPEP, my second year teaching physics was a dramatically different experience for both myself and my students. The content knowledge, the demonstrations, and the teaching strategies that I learned at MIPEP were all extremely helpful. The most important thing that I gained from MIPEP was the confidence that yes I can teach physics and do it well. I am very grateful for your willingness to help high school educators and their students.”
Feedback from teachers

“I am from an extremely rural area of the Texas Panhandle. … I have now attended well over 400 hours of continuing education in my 7 years of teaching, and this has been far-and-away the most beneficial professional development experience I have ever had. … The MIPEP program is a diamond among continued education. It is rigorous, intense, it is time-intensive… This unique program is the perfect balance to maximize learning for secondary educators.”
“Enhancement is exactly the right word for this program. I have read about cyclotrons, nuclear reactors, observatories, superconductors, and Foucault pendulums. I had never seen any of these things in person. The Physics Show and classroom demonstrations also included many firsts.”
Evaluation

Education Research Center at TAMU
led by Dr. Jackie Stillisano

- Pre- and post-tests of physics knowledge
- Pre- and post-perceptual surveys
- Post-session topic surveys
- Structured observations of classrooms and labs
Evaluation

• "Effectiveness of MIPEP for teacher development": ongoing research project led by Tatiana Erukhimova

• Testing and survey of all past MIPEP participants

• Results reported at the national annual conference of the American Association of Physics Teachers
Key findings: it worked!

Participants’ knowledge increased for all physics concepts taught at MIPEP

Participants found most sessions useful and applicable to their teaching

Enhanced their instructional practices

Hands-on activities and problem-solving discussions were particularly effective

*Confidence in understanding and teaching has increased*
Outlook

• Currently we select 28 teachers and fully cover their dorm room and board
• We can expand and serve more teachers!
• Live broadcast, recording of all lectures and activities, free access through MIPEP website
• Ideas and toolkits for low-budget physics demonstrations
• RealPhysicsLive.com!
• Keep in touch after MIPEP
  – Invite teachers with students to Physics Shows and Physics Festivals, campus tours
  – Post-MIPEP evaluations
  – Site visits
Physics and Engineering Festival
Next: April 4, 2020
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