

APEX Physics Teacher Institute Introduction

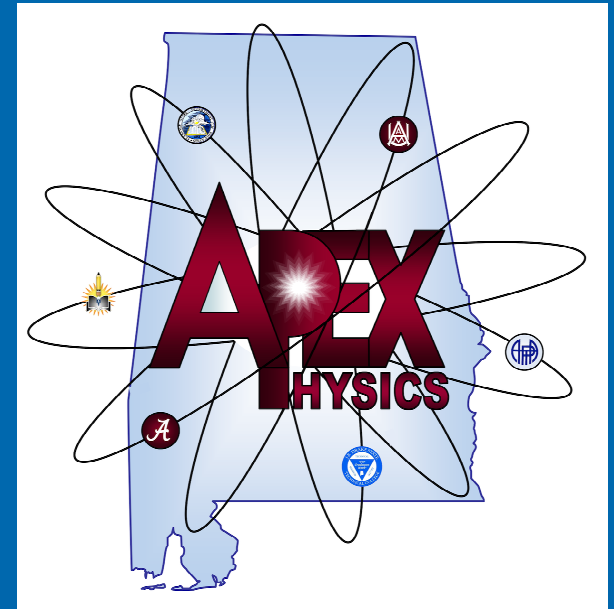
Sunday June 2, 2013

7:00 - 8:00 PM



Alabama Professional Development Project

Alliance for Physics Excellence (APEX) Project



National Science Foundation DUE-1238192

APEX 5 Key Features

- Partnership Driven;
- Teacher Quality, Quantity & Diversity;
- Challenging Courses & Curriculum;
- Evidence Based Outcomes; and
- Institutional Changes

The APEX Project is a partnership project funded by the National Science Foundation DUE-1238192. Partnership among:

- IHE - Alabama Agricultural and Mechanical University (AAMU) Physics & Secondary Education Departments,
- IHE - University of Alabama at Tuscaloosa (UA) Physics & Secondary Education Departments,
- IHE - Drake State Technical College (DSTC),
- American Association of Physics Teachers/Physics Teaching Resource Agents (AAPT/PTRA) Program
 - Alabama State Department of Education,
- Alabama Mathematics, Science & Technology Initiative (AMSTI) & 11 Regional In-service Centers,
 - LEA - Huntsville City School System (HCS),
 - LEA - Madison County Schools, and
 - LEA - Scottsboro City Schools.

APEX Vision Statement: The vision of the Alliance for Physics EXcellence (APEX) is to transform secondary physics education in Alabama. By recruiting more physics majors. By recruiting more physics majors to become physics teachers. By enabling physics teachers to acquire a deeper knowledge of physics content and effective pedagogical strategies based on physics educational research, thus enabling their students to achieve higher gains.

Philosophy: APEX subscribes to national philosophy that every student is entitled to the same quality educational experience regardless of where they attend school, this assumes the teachers of all students are highly qualified. Thus APEX is designed not only to raise the quantity and quality of physics teachers, but also to provide teachers with instructional strategies leading to higher student achievement in physics.

Need Statement: More students of all racial groups are studying physics than ever before (According to AIP, 33% of high school students or over 1,000,000 students nationwide presently study physics in high school). Physics topics are becoming ubiquitous as educators realize that physics is the fundamental science upon which the other sciences and engineering are built. However, over the past decade the percentage of highly-qualified physics teachers has not significantly changed in either quantitatively or qualitatively.

Overarching Goal: The APEX project aims to transform secondary physics education in the State of Alabama by enabling physics teachers to acquire a deeper knowledge of physics content and employ more effective pedagogical strategies based on physics education research, thus enabling their students to achieve higher gains.

APEX Individual Goals

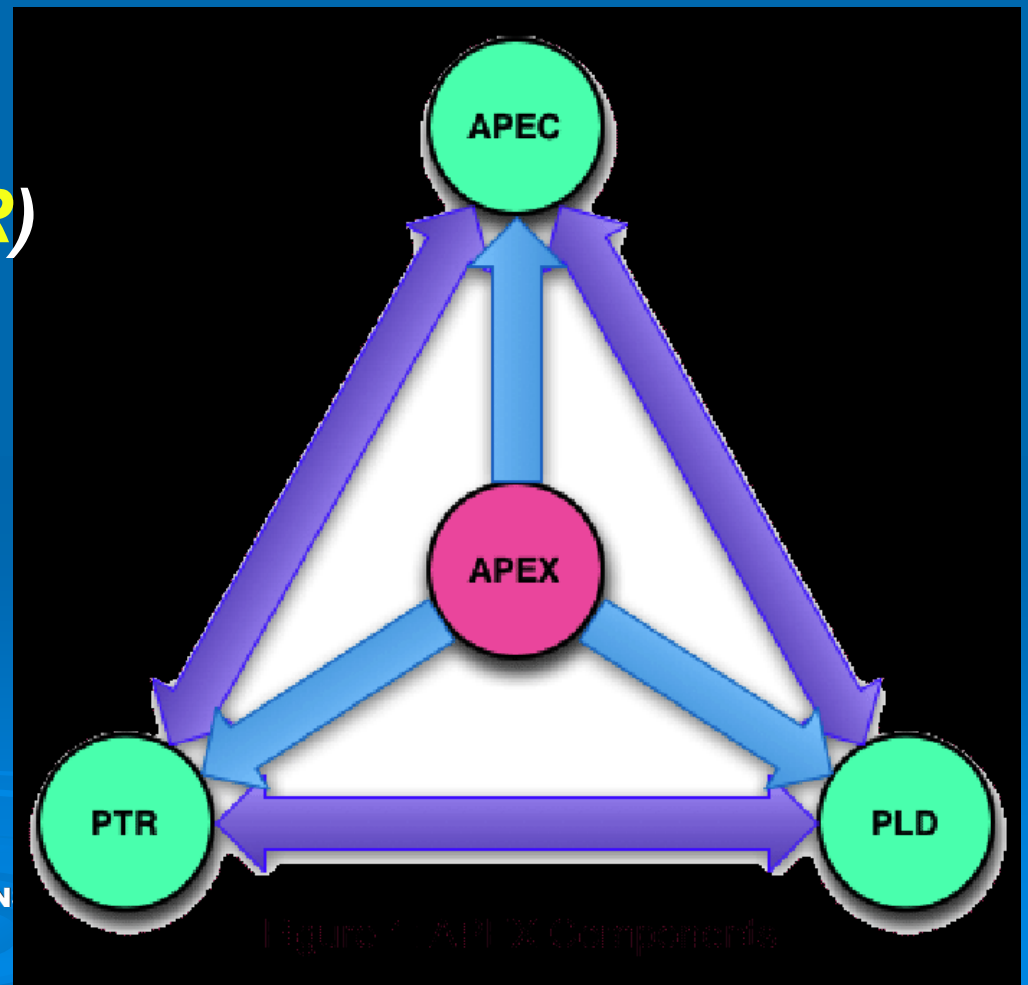
- Increase the quantity of highly qualified in-service and under-represented minority pre-service physics teachers.
- Enhancement the quality of Alabama secondary Physics Education.
- Establish an environment in which Alabama high school leadership promotes research – based physics education in Alabama secondary school systems.
- Institutionalize professional development opportunities for physical science and physics teachers that result in increased student interest in physics and deeper knowledge of physics and STEM subject matter.
- *Identify* and *document* successful pedagogical models and methods for teacher preparation and for in-service development of physics teachers.
- Evaluate the impact of implementation of the APEX Project on higher education faculty in professional development and on teachers and students in their classrooms.

The APEX Project is comprised of 3 **interrelated** components (A, B, &C).

A. The Alabama Physics Education Center (APEC)

B. Physics Teaching Research Program (PTR)

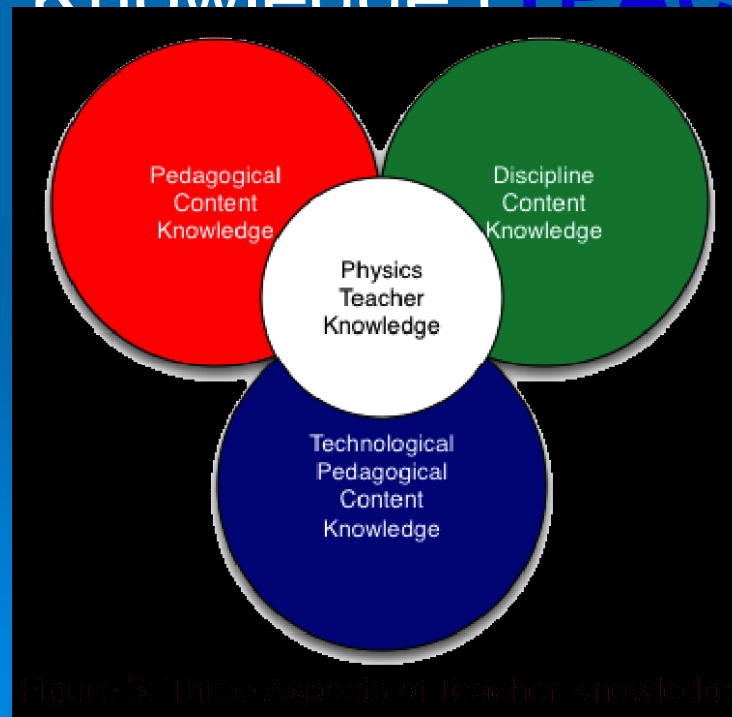
C. Physics Leadership Development (PLD)



APEC is comprised of 2 components.

1. Physics Teacher Institute (**PTI**)
2. Physics Teaching Resource Enhancement Program (**PREP**)
Resources developed and shared by participants.

The **PTI** is a three-year experience that offers participants a coherent program of study to deepen their physics Discipline Content Knowledge (**DCK**), Pedagogical Content Knowledge (**PCK**), and Technological Pedagogical Content Knowledge (**TPACK**)



Each year the Physics Teacher Institute (PTI) will consist of a two-week summer institute and three two-day follow-up sessions.

Table 1 Physics Teacher Institute for Professional Development Program using AAPT/PTRA Professional Development Model

	FirstYear
DCK	Kinematics
	Newton's Laws of Motion
	Work, Energy, & Power
	Impulse & Momentum
	Circular Motion & Rotation
	Gravitation
	Static Fluid Mechanics
PCK	Misconceptions & Ideas
	Effective Teaching Strategies
	Learning Environments
TPACK	Class Presentation Tools
	Audio Podcasting
	Video Podcasting

Table 1 Physics Teacher Institute for Professional Development Program using AAPT/PTRA Professional Development Model

		Second Year	
DCK		Thermodynamics	
		Temperature & Heat	
		Electric Circuits	
		Conductors	
		Capacitors	
		Electrostatics	
		Magnets/Magnetic Fields	
PCK		Misconceptions & Ideas	
		Metacognition	
		Collaborative Learning	
TPACK		Social Media	
		Groupware	
		Computer Modeling	

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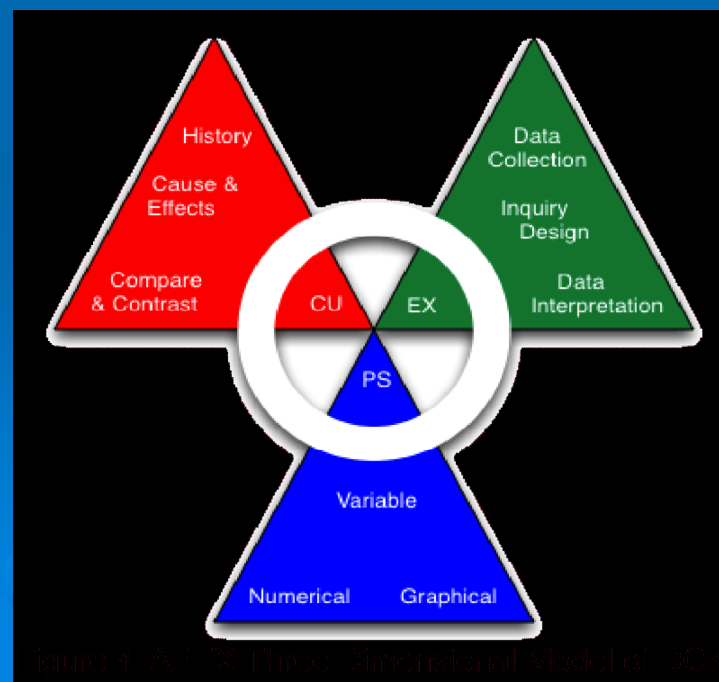
		Third Year
DCK		Waves (1 & 2 dim.)
		Geometrical Optics
		Sound
		Physical Optics
		Electromagnetism
		Atomic Physics
		Nuclear Physics
PCK		Misconceptions & Ideas
		Assessment Methods
		Constructivist Epistemology
TPACK		Blackboard
		Content Mgmt. Systems
	Visualization Tools	

Table 1 Physics Teacher Institute for Professional Development Program using AAPT/PTRA Professional Development Model

	First Year	Second Year	Third Year
DCK	Kinematics	Thermodynamics	Waves (1 & 2 dim.)
	Newton's Laws of Motion	Temperature & Heat	Geometrical Optics
	Work, Energy, & Power	Electric Circuits	Sound
	Impulse & Momentum	Conductors	Physical Optics
	Circular Motion & Rotation	Capacitors	Electromagnetism
	Gravitation	Electrostatics	Atomic Physics
	Static Fluid Mechanics	Magnets/Magnetic Fields	Nuclear Physics
PCK	Misconceptions & Ideas	Misconceptions & Ideas	Misconceptions & Ideas
	Effective Teaching Strategies	Metacognition	Assessment Methods
	Learning Environments	Collaborative Learning	Constructivist Epistemology
TPACK	Class Presentation Tools	Social Media	Blackboard
	Audio Podcasting	Groupware	Content Mgmt. Systems
	Video Podcasting	Computer Modeling	Visualization Tools

Teachers and pre-service participants will experience teaching methodologies that emphasize an integrated, 3-dimensional approach consisting of

- **conceptual understanding (CU)**,
- **problem-solving methods (PS)**, and
- **hands-on exploration (EX)**.



Typical Lesson(s) with place emphasis on integrations of:

- ❖ **Alabama & Next Generation Standards**
- ❖ **Advanced Placement B Topics & Concepts**
- ❖ **Engineering Concepts & Design**
- ❖ **Inquiry & Learning Styles**
- ❖ **Instructional use of Technology**
- ❖ **Mathematics Concepts (NCTM)**
- ❖ **Misconceptions & addressing with students**
- ❖ **PRAXIS Topics**

Participants will be able to choose between completing a master's degree in physics education or passing the Praxis II examination, which will give them a new certificate as a Highly Qualified Teacher.

Physics Resource Enhancement Program (PREP), consisting of a Cyber-Infrastructure Resource Repository (CIRR) to serve as a central clearinghouse for dissemination of best teaching practices for APEX participants to share and discuss their teaching practices.

Physics Teaching Research Program (PTR) goals are to establish, foster, enhance and sustain project outcomes in teaching and learning through development of a research priority using a community of researchers focusing on physics education.

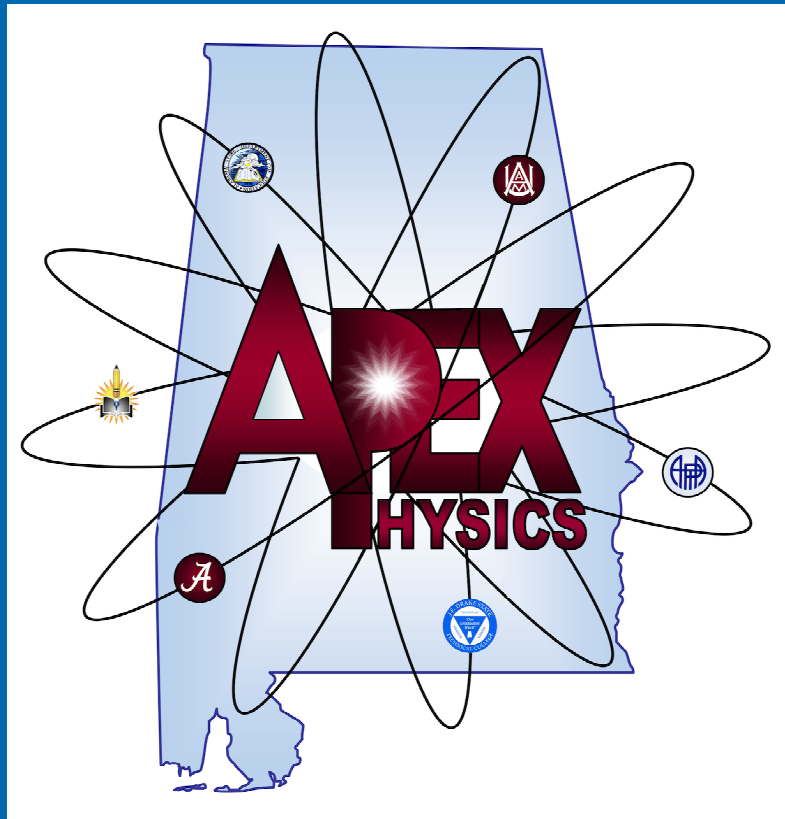
Focus of PTR will be on effect(s) of PTI on physics teacher knowledge and abilities; Discipline Content Knowledge (DCK), Pedagogical Content Knowledge (PCK), and Technology Pedagogical Content Knowledge (TPACK). Among the elements of PTI, action research allows teachers to understand best practices studied during PTI and as reported in research literature.

UA and AAMU will oversee and conduct ongoing action research within the secondary schools involved in the project.

AAMU (a HBCU) and Drake will focus on minority students and participants. Students will be undergraduate and graduate and participants will be both pre-service and in-service teachers.

Physics Leadership Development (PLD)

Drake State will coordinate two half-day leadership workshops per cohort each year, one in the fall and one in the spring, in conjunction with the APEC follow-up workshops. Drake State will also assist the K-12 core partners in the development and promotion of physics education policies.



The End