

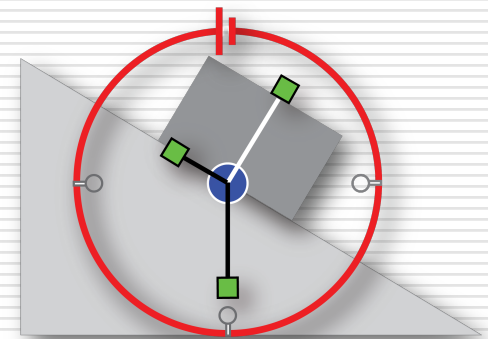
YEAR 1 IMPLEMENTATION OF A TIME FOR FRESHMAN PHYSICS

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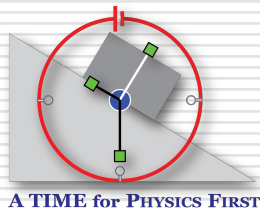
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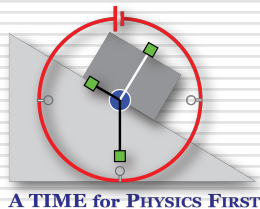
A TIME for PHYSICS FIRST





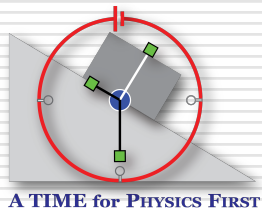
Physics First - Quick History

- ❑ Physics First has been gaining steam since 1995, spearheaded by Physics Nobel Laureate Leon Lederman.
- ❑ Framework by Project ARISE advocates the inversion of the standard biology-chemistry-physics teaching order. The logic is that the “foundational” science, physics, underlies all chemistry content, and together they support the biological sciences.
- ❑ Nationwide a small number of schools teach Freshman Physics (FP), but the sequence in later grades varies.



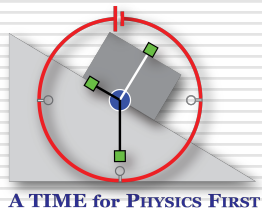
Freshman Physics (FP) - Impact

- ❑ AAPT reports that FP promotes growth in enrollment in advanced courses, including 4th year and AP electives.
- ❑ Following FP, minorities and female students feel encouraged to take more sciences in higher grades.
- ❑ With FP, 9th and 10th graders' performance compares well with seniors on the New York Regents exam.
- ❑ Math educators support FP, which allows immediate opportunities for students to practice newly acquired algebra skills. In contrast, physics in 12th grade produces a 3-year delay between 9th grade algebra and physics.



Making Freshman Physics Work

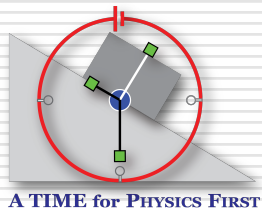
- Effective teaching suitable to the 9th grade level is needed - knowledge of subject matter and pedagogy.
- Successes of our previous project (Dept of Ed funded MSP, 2005-08) include
 - Increased motivation in Missouri to offer 9th grade physics
 - Strong retention (80.5%) over the 3-year project
 - Development of a successful PD curriculum for teachers that utilizes inquiry and modeling-based instruction
 - Excellent gains in content knowledge of teachers (gain = 26 to 32%, n = 58) and students (gain = 39 to 50%, average n = 911) using project-constructed unit tests.



A TIME FOR FRESHMAN PHYSICS: STRUCTURE

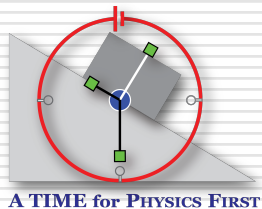
In the current NSF project:

- ☐ 80 teachers recruited for two cohorts.
- ☐ Summer and academic year engagement with teachers.
- ☐ Recruitment for all participants occurs before first summer academy.
- ☐ Cohort 1 begins series in 2010, Cohort 2 in 2011.
- ☐ Research and evaluation are based on this delayed entry design.



Curriculum Support

- ☐ Continue to use inquiry and modeling based pedagogy.
- ☐ Revise the curriculum to be more student centered.
- ☐ Develop digital resources such as podcasts
- ☐ Include teacher resources based on the Educative Curriculum Material (ECM) model.
- ☐ Reference content to both the National Science Education Standards and the Missouri Course Level Expectations.
- ☐ Support teachers with in-person visits by coaches or online support by mentors as curriculum is implemented in classrooms.



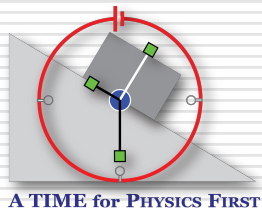
A TIME for PHYSICS FIRST

ACTIVITIES, Summer

Three-year Summer Academy series:

- ☐ Four weeks long in Years 1 and 2; two weeks long in Year 3
- ☐ Builds Physics content knowledge integrated with
 - Inquiry
 - Modeling
 - Technology
 - Intellectual leadership
- ☐ Support for Praxis and National Board certification

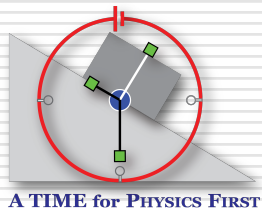




ACTIVITIES, Academic Year

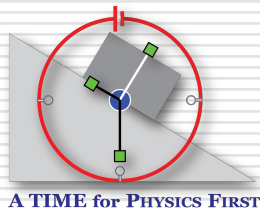
Academic Year:

- ☐ Implement yearlong 9th grade Physics course
- ☐ Participate in Professional Learning Communities
- ☐ Attend three day-long follow-up meetings
- ☐ Receive support from Coaches or Mentors
- ☐ Participate in online peer collaboration
- ☐ Take online *Leadership in Science Education* course
- ☐ Access to classroom kit-lending program
- ☐ Access to content experts
- ☐ Participate fully in evaluation activities



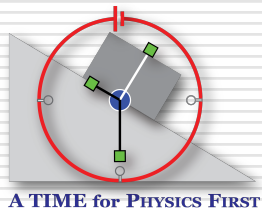
Leadership

- ❑ Teacher leadership development will include:
 - Assess and understand their own teaching and learning styles.
 - Interact with learners and peers with different learning styles.
 - Develop strategies for assuming leadership within a group.
 - Understand school structures, political systems and hierarchy.
 - Understand curriculum design, alignment of curriculum to standards and assessments.
 - Develop presentation skills to peers and other adult groups.
 - Develop a personal leadership action plan with specific goals and strategies and a timeline for implementation.



Research Design

- ❑ **Research Question 1:** In a teacher PD project, can enhancement of pedagogical practice, student content acquisition and teacher leadership growth through participation in an online learning community achieve results comparable to sustained classroom coaching support?
This question will test whether the inherent challenges in training and maintaining qualified coaches, addressing teacher needs outside a particular coach's range of skills, and managing logistics of travel and the associated burden of costs in the coaching model can be offset by a well-implemented, active and engaging online alternative.
- ❑ **Hypothesis:** We expect that the online learning community will achieve comparable results to the in-person coaching cohort

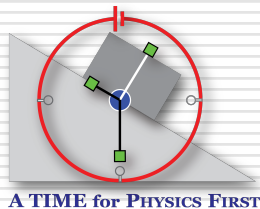


Research Questions, continued

- ☐ **Research Question 2:** Does implementation of Freshman Physics through the project curriculum yield positive results aligning to National Science Foundation goals for improved student math and science achievement, compared to more traditional educational sequencing of science?

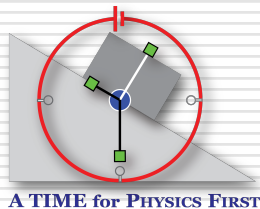
This question will be tested by obtaining student achievement scores and from course taking plans and data for students who do and do not take Freshman Physics

- ☐ **Hypothesis:** The implementation of the Freshman Physics curriculum will exceed in student achievement.



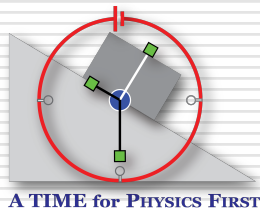
Evaluation Questions

- ☐ **Q 1:** Through what processes do teachers become leaders in freshman physics?
- ☐ **Q 2:** What are critical district support mechanisms that assist the leadership development in teachers?
- ☐ **Q 3:** What characteristics are present in the learning environments (specifically schools) of students who attain higher levels of content?
- ☐ **Q 4:** What are the constraints to institutional change in core partners?
- ☐ **Q 5:** How is successful institutional change evidenced in core partners?
- ☐ **Q 6:** What are the critical factors in students' continuation of science course-taking in high school?



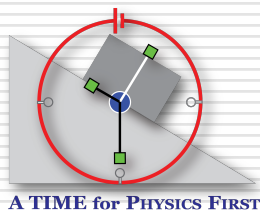
Evaluation Methods

- ☐ Teacher leadership goals: analysis of leadership plans, teacher surveys, online discussions, leadership plans and implementation reports, teacher and administrator surveys.
- ☐ Teacher and student content gains: pre/post content tests (MOSART 9-12 Physics, FCI and TUG-K).
- ☐ Pedagogy and teacher confidence goals: analysis of annual confidence tests, coach reports, online discussions and curriculum coverage reports.
- ☐ Institutional change: surveys, interviews, examination of course syllabi and Praxis data.
- ☐ Student course taking: results of research question 2.



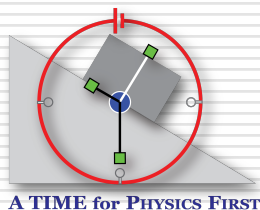
Dialogue Questions

- To pro-actively address issues that might affect implementation and lay ground-work for long-term leadership implementation and sustainability:
 - What methods help sustain enthusiasm among participants?
 - What methods assist with providing teachers confidence about new subject matter?
 - What methods help buy-in within buildings and districts among administrators whose support is necessary, but who may not be involved in the nitty-gritty of the project?
 - What methods can help with fidelity in the implementation of curriculum and the methodology?



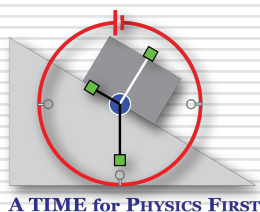
A TIME for Physics First Team

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- ☐ Dorina Mitrea, Prof of Math, MU
- ☐ Deborah Hanuscin, Asst Prof of Science Education, MU
- ☐ Sarah Hill, Project Director, Physics Dept, MU,
- ☐ Sunder Balasubramanian, Physics, Lincoln U
- ☐ Dennis Nickelson, Jeff City HS and William Woods U
- ☐ Paul Miceli, Angela Speck, Karen King, Physics Dept, MU
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- ☐ Doug Steinhoff, CPS
- ☐ Brian Foster, Mehlville HS
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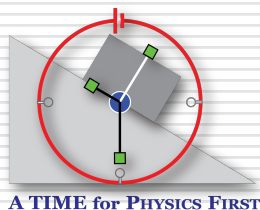
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