Overarching Question

How do we effectively prepare our graduate students for successful career in physics education research (PER)?

Prepare our students to...

- lead teams of researchers, teachers and students to conduct high quality, independent research,
- facilitate the integration of research and educational endeavors,
- collaborate with a broad range of students, teachers, administrators, researchers and faculty in the sciences and in education,
- seek and obtain external funding to support a vibrant research program,
- provide effective mentoring and professional development to others over a range of levels, and
- engage in lifelong professional growth to continually broaden their intellectual horizons from a diverse multidisciplinary perspective.

Challenges

Incoming grad. students typically have...

- strong physics background, but seldom adequate preparation in pedagogy.
- diverse non-U.S. educational backgrounds.
- diverse career paths: Ph.D. in Physics with emphasis in education.
- Science Education with emphasis in physics.

Need flexible professional development

Current Efforts

- "Teaching University Physics" course
  - Broad survey of PER.
- Several Education courses
  - Methods, Statistics, Educational Design, etc.
- Weekly PER Seminar each semester
  - Present and critique each others' research.
  - Discuss other relevant research.

Need: Students face difficulties in applying the principles learned in the courses to their own research

New Program at KSU

- Administrative Framework
  - Communicating with teachers & students.
  - Integrating research & education.
  - Scalability for larger projects.
- Research Framework
  - Multiple methodologies.
  - Segmented phases.

1Lesh & Kelly, (2000)
Administrative Framework

- Evolving Modeling Cycles
  - Data Stream
  - Informs

Grounded Theory Backbone

RESEARCHER LEVEL

TEACHER LEVEL

STUDENT LEVEL

3Lesh & Kelly, (2000)

Research Framework

PRIMARY STREAM

STAGE 1: FACT FINDING
- Broad Research Scope
- Develop Teaching Interview Protocol
- Identify Assessment Activities

STAGE 2: TEACHING INTERVIEWS
- Investigate Conceptual Understanding
- Design Assessment Tasks
- Develop Learning Experiences

STAGE 3: FIELD TESTING
- Final Materials & Integrated Assessment

SECONDARY STREAM

Develop Theory of Instructional Design & Development

Integration Phase: Assimilate findings into Theoretical & Analytical Frameworks
Disseminate Theoretical Results & Instructional Materials in Broader Literature

First Implementation

- Fall 2004 / Spring 2005 – PER Seminar
  - Overview of methodologies.
  - Discussion of interview techniques.

- Positives
  - Helpful in connecting with previously taken courses.
  - Learned questioning and interview coding.

- Negatives
  - Recipe-like implementation of methodologies.
  - Focus exclusively on physics content in interviews.

Next Implementation

- Project: Everyday Electrical Devices
  - All students participated as researchers.

  1st Week: Generating themes, topics & questions
  - Worked individually.
  - Avoided exclusive focus on physics.

  2nd Week: Narrowing focus
  - Shared ideas in large group.
  - Collapsed themes, topics and questions.

Next Implementation (2 of 2)

- 3rd – 5th Week: Designing & Conducting Interviews
  - Worked in pairs.
  - Allocated roles: interviewer & observer.
  - Critiqued partner in front of larger group.

- 4th – 6th Week: Transcript Preparation & Analysis
  - Transcribed individual interviews.
  - Generated personal log, analytical log and codes.

- 7th Week Onwards: Research Project Critique
  - Presented and critiqued each others’ ongoing research.

Feedback from Grad. Students

- One page reflection on experiences.

- Students liked:
  - Focus on methodologies.
  - Application of knowledge to own research.
  - Sharing ideas presented by others.

- Some students would have preferred...
  - “...some kind of a sample set of steps, a template...
  - … we also had to choose more physics-related
  - subjects to discuss so we could really use our
  - expertise”
Our Reflections

- Continue with focus on...
  - Methodologies
  - Applications to students’ own research.

- Use program to provide framework for facilitating mentorship of new graduate students by advanced graduate students.