Designing Tracks and Certification Pathways

Panelists: Kathy Koenig, Robert Culbertson, Laird Kramer, Gay Stewart, Stamatis Vokos
Task Force on Teacher Education in Physics

Recommendations include:

“Physics departments should recognize that they have a responsibility for the professional preparation of pre-service teachers.”

“Schools of education should recognize that programs to prepare physics teachers must include pedagogical components specific to the preparation of physics teachers; broader science education courses are not sufficient for this purpose.”
Evolution of Physics Teacher Education at Arizona State University

Undergraduate Programs

Robert Culbertson

Department of Physics
Pathway: BA in Education (BAE) (with Concentration in Content Area)

Example: BAE Education with Concentration in Physics

<table>
<thead>
<tr>
<th>Courses Subject</th>
<th>BAE Secondary Education (Physics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>12</td>
</tr>
<tr>
<td>Physics</td>
<td>30</td>
</tr>
<tr>
<td>Science Education</td>
<td>6</td>
</tr>
<tr>
<td>Education</td>
<td>46</td>
</tr>
<tr>
<td>Other</td>
<td>26</td>
</tr>
</tbody>
</table>

Total: **120** credits

**Arizona Minimum:** 30 education credits, including 8 student teaching
New (2013): BS in Physics (with Concentration in Education)

<table>
<thead>
<tr>
<th>Subject</th>
<th>BS Physics (Secondary Education)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>12</td>
</tr>
<tr>
<td>Physics</td>
<td>42</td>
</tr>
<tr>
<td>Science Education</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>30</td>
</tr>
<tr>
<td>Other</td>
<td>32</td>
</tr>
</tbody>
</table>

Total: 120 credits
New Approach: BS(BA) in Content Area With Certificate in Education

Example: BS Biophysics with Certificate in Education

<table>
<thead>
<tr>
<th>Subject</th>
<th>BS Biophysics (Cert. in SED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>12</td>
</tr>
<tr>
<td>Physics</td>
<td>14</td>
</tr>
<tr>
<td>Biophysics</td>
<td>9</td>
</tr>
<tr>
<td>Biology</td>
<td>9</td>
</tr>
<tr>
<td>Chemistry</td>
<td>14</td>
</tr>
<tr>
<td>Science Education</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>30</td>
</tr>
<tr>
<td>Other</td>
<td>30</td>
</tr>
</tbody>
</table>

Total: **120-4** credits
## Compare Credit Hours By Subject

<table>
<thead>
<tr>
<th>Subject</th>
<th>BAE Secondary Education (Physics)</th>
<th>BS Physics (Secondary Education)</th>
<th>BS Biophysics +SED Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Physics</td>
<td>30</td>
<td>42</td>
<td>14</td>
</tr>
<tr>
<td>Biophysics</td>
<td>-</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Biology</td>
<td>-</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Chemistry</td>
<td>-</td>
<td>-</td>
<td>14</td>
</tr>
<tr>
<td>Science Education</td>
<td>6</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>46</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Other</td>
<td>26</td>
<td>32</td>
<td>28</td>
</tr>
</tbody>
</table>

Science Credits: 46
Credits Distributions

BAE Secondary Education (Conc. In Physics)

BS Physics (Conc. In Secondary Education)

BS Biophysics With Certificate in Secondary Education

- Math
- Physics
- Biophysics
- Biology
- Chemistry
- Science Education
- Education
- Other
## Pros and Cons

<table>
<thead>
<tr>
<th>Features</th>
<th>BAE Secondary Education (Physics)</th>
<th>BS Physics (Secondary Education)</th>
<th>BS Biophysics With Certificate in SED</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥Physics Minor (≥24 Credits)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
</tr>
<tr>
<td>Sufficient Physics for Grad. School</td>
<td>No</td>
<td>Yes</td>
<td>No (Biophysics: Yes)</td>
</tr>
<tr>
<td>Possibility for Multiple Subjects</td>
<td>No</td>
<td>No</td>
<td>Maybe</td>
</tr>
<tr>
<td>Minimized Ed. Credits</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Must Meet 120 Credit Limit</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
FIU’s Physics Teacher Preparation System

- Teacher Preparation begins in physics classes
  - What if students have profound experiences in physics...
  - What if students learn physics as physicists...
  - Modeling Instruction & ISLE introductory courses (80/section)

- Teacher Preparation in Science and Mathematics
  - Bachelor’s degree in major plus teaching certification in 120 credits
  - Collaborative across Colleges of Arts & Sciences and Education
  - LA program, early field experiences, develop PCK throughout

- New programs / state certification in Oct 2010
  - Result of Administration closing Secondary Education programs in CoE in 2009 due to budget cuts
FIU’s Physics Teacher Preparation System

• Critical Partner: Administration
  – LA Funding / political cover / staff hires

• Unique Partnership
  – ACCESS: Miami-Dade Schools / FIU Partnership
  – Top administrators of both institutions / quarterly meetings
  – Links to M-DCPS schools: 4th largest district / 350k students
  – Are ready for implementing Modeling across sciences

• The Future
  – FIUteach launched in January 2014
  – Programs continue evolution to UTeach model
  – Question: Physics BA or BS plus certification?
SPU Physics Teacher Preparation System

• Teacher Preparation begins in physics classes
  – All intro courses at SPU have been reformed
    • Use of several PER-validated and PER-guided curricula
  – All intro courses are LA-facilitated
    • To be a LA, you must take LA pedagogy course, even repeatedly

• Teacher Certification Pathways in Physics
  – BA/BS in physics plus teaching certification (almost no students)
  – Post-bac, one-year internship program (primary pathway)
  – Master’s in Teaching Math and Science (not SPU grads, typically)
  – Collaboration across Colleges of Arts & Sciences and Education

• SPU faculty part of specification of state endorsement competencies for physics teachers
  – 2007 & 2014
SPU Physics Teacher Preparation System

• Critical Element 1: Synergy with PER
  – PER external grants

• Critical Element 2: Collaboration
  – Within institution
  – With teachers and school districts
  – With other TP programs in state
UC Physics Teacher Preparation System

“Physics departments should recognize they have a responsibility for the professional preparation of pre-service teachers.”

- BS or BA Physics or BS Engineering with licensure option; students with BS in Education do a physics minor
- Promoting best teaching practices in intro lecture and recitation sections (PER grants help place value on this)
- Intro physics labs revised (focus on experimental design, evidence-based reasoning, communicating results) (NGSS)
- Use of Learning Assistants (LAs), undergrads may teach labs
- Monthly department Learning & Assessment lunches
- Two faculty joint appts - teach intro methods and LA course so can embed common experiences above in reflections, etc
“Schools of education should recognize that programs to prepare physics teachers must include pedagogical components specific to the preparation of physics teachers; broader *science education* courses are not sufficient for this purpose.”

- Students may do a BS or Masters in Education (major/minor in physics *required* part of program for physics licensure)
- Physics courses selected based on NSTA/CAEP standards
- Moved to 3 methods in teaching courses
  - Licensure choices include single subject physics, biology, chemistry or integrated science
  - Intro (physics), intermed (earth/chem), adv (bio)
Having done this all at UA, how did we start the licensure process at WVU, and why?

Gay Stewart
Formerly, University of Arkansas
Now, West Virginia University
Some advice to myself, and I will answer anyone else's questions, too...

• From the beginning our charge as part of PhysTEC was to "seek to dramatically improve the physical science preparation of teachers by enlisting physics departments in collaboration with education colleagues to rethink and revise their programs of undergraduate science education for future teachers."

• Unless certification happens in the college that physics lives in, physics cannot do it alone.

• Someone in physics has to learn about requirements for certification, and alternative routes.

• Find out what your graduates will most likely be doing, and prepare them for it.
• Who should be at the table when existing tracks are redesigned or new tracks are designed?
• What should these tracks look like? What essential elements must they include?
• Should prospective teachers be encouraged to seek more than one certification area and if so, how might that be done?
• In which programmatic ways do we incorporate explicit immersion in science and engineering practices and in crosscutting concepts of NGSS?
• How can school systems become part of the teacher preparation program beyond student teaching?