APS physics | Education & Diversity
PROMOTING PEOPLE IN PHYSICS

APS April Meeting

13 April 2019

Denver, CO

Effective Practices for Physics Programs (EP3): Townhall Discussion

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Townhall Outline

1. Introduction
2. Brief description of the Guide
3. Examples
4. Q&A
5. (Focus group)

External Evaluator: Stephanie Chasteen

- Get a sneak preview of the EP3 Guide and give your feedback
  - After this session
  - Or via videoconference later

Contact her at Stephanie@ChasteenConsulting.com

EP3: Effective Practices for Undergraduate Physics Programs

1. **Develop a guide for self-assessment of undergraduate physics programs founded on documented best practices linked to measurable outcomes**

   The guide should provide a physics-community-based resource to assist programs in developing a culture of continuous self-improvement, in keeping with their individual mission, context, and institutional type. The guide should include considerations of curricula, pedagogy, advising, mentoring, recruitment and retention, research and internship opportunities, diversity, scientific skill development, career/workforce preparation, staffing, resources, and faculty professional development.

2. **Recommend a plan for ongoing review and improvement of this guide under the oversight of the APS Committee on Education**

Passed by the APS Council, November 2015

Task Force Members

Co-Chair: David Craig, Oregon State University

Co-Chair: Michael Jackson, Millersville University of Pennsylvania

- Noah Finkelstein, University of Colorado Boulder
- Courtney Lannert, Smith College and UMass Amherst
- Ramon Lopez, University of Texas at Arlington
- Willie Rockward, Morgan State
- Gay Stewart, West Virginia University
- Gubbi Sudhakaran, University of Wisconsin-La Crosse
- Kathryn Svinarich, Kettering University
- Carl Wieman, Stanford University
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Editorial Director: Sam McKagan; **Staff Liaison:** Ted Hodapp;

External Evaluator: Stephanie Chasteen; **Researchers:** Chandra Turpen (MD), Joel Corbo (CO); **AAPT Liaison:** Bob Hilborn;

EP3Guide.org

Brief Timeline

STB*: Requests to APS to do what ACS does: Program Certification

2012: APS leadership asks Committee on Education (COE) to investigate

2013: Working group formed to investigate

2014: Survey of physics chairs, report written

2015: COE discusses, makes recommendation to APS Council
ABET announces intention to accredit all fields of natural science

2015: APS Council charges COE to form task force (BPUPP: "Best Practices for Undergraduate Physics Programs")

2016: COE begins process, drafts preliminary documents, recruits task force

2016: Task force begins meeting

2017: Applied for funding, beginning drafts & discussions on underlying issues, determination of content & structure of guide, development

2018: NSF funding received, guide development commences

2019: Guide development

2020: Initial Rollout, training of reviewers

2021+: Update guide, new sections, evaluate review process

*Since Time Began

Goals of the Guide

One stop shop for resources / Improve program health

- External program assessment and review
- Improve usefulness of assessment
- Bring together known literature of effective practices
- Collect practices recognized by the community as effective when there is insufficient evidence-based literature
- Encourage discussions in departments on continuous improvement of physics programs using evidence
- Collect information for departments to use in advocating for resources to improve their program
- Engage PER community on departmental needs
- **Key:** flexible, not prescriptive; mindful of local contexts

External Program Review

Current situation:

- The (unlucky) chair is tasked by the dean to prepare a set of materials for an external review
- External review is put on shelf (perhaps a few ideas are moved along), but it is a document unrelated to other department activities
- Assessments are done (e.g., Force Concept Inventory, ETS Major Field Exam), but no one is sure what to do with the results, what it means, or how it will impact teaching
- Instructors continue to teach as they have – as there is no incentive to change
- Difficult to decide which innovations or changes might be positive, and which negatively impact things.
- Courses taught as “independent” subjects, without coordination

External Program Review

What EP3 guide will do for program review:

- Transform assessment into useful tools that physicists can understand and use to creatively improve programs
- Provide a structure for assessment such that external reviews can be a compendium of annual assessments already demanded for regional accreditation – no new work required
- Reduce time needed to prepare for external review and accreditation materials
- Aligns department with university vision/mission, provides strategy for broader discussions of program components and their value
- Provides the chair with evidence from published and community sources that he/she can use in advocating for resources
- Trains, and recognizes external reviewers who embrace a similar philosophy of evidence-based program improvement

External Review

All departments and programs undergo periodic review

How many of you have served as program reviewers?

How many would like to have nationally-based arguments to increase resources for your department?

How many would like your program to undergo accreditation?

ABET offers to accredit ***all*** natural science disciplines (ANSAC: Applied and **Natural** Science Accreditation Comm.)

ABET ACCREDITATION FOR NATURAL SCIENCE PROGRAMS

JOIN THE CONVERSATION

ABET accreditation has long been the global standard for programs in applied science, computing, engineering, and engineering technology. And recently programs that fall outside of these four main areas have shown interest in becoming ABET-accredited.

During this half-day, three-part session you will explore the value of ABET accreditation, and specifically the value that it could bring to the natural sciences. Presenters from ABET as well as industry and programs in physics, geology, biology, and chemistry will share their perspectives and describe how

Tentative Structure of Guide

Chapters:

- **Introduction**: How to navigate and use the guide
- **Assessment**: Developing an efficient and effective culture of assessment
- **Effective practices** (~25 “sections”)
- **How to be an Effective Chair**
- **Departmental review**:
  - Guide to reviewers
  - Preparing for a review
- **Appendices**: Examples of student learning goals and program learning goals, assessment instruments, mentoring “contract”, additional resources

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Questions to Consider

- Can you imagine using this guide?
- What would you do with this information?
- Who might you give it to?

Tentative Section List: 25 "Executive Summaries"

Students

- Recruiting
- Retention
- Mentoring / advising
- Internships
- Undergraduate research
- Career preparation

Curriculum

- Implementing research-based instructional practices in your program (overarching)
- Introductory courses for physical science and engineering majors
- Introductory courses for life sciences majors
- Upper-level physics courses
- Non-STEM major courses
- Communications skills
- Laboratory / experimental skills
- Computational skills
- Culminating integrative experiences (Capstone experiences)
- Online education

Programs

- Individuated degree tracks: engineering / applied physics
- Institutional partnerships: dual-degree physics / engineering programs
- High school physics teacher preparation
- Learning Assistant preparation
- Community engagement / outreach

Departmental

- Physical environment: encouraging collaboration and learning
- Departmental climate
- Equity, diversity, and inclusion
- Ethics

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Effective Practices: Computational Skills

Themes:

1. *Establish goals and a plan* for providing students with computational skills
2. *Integrate opportunities* to develop computational skills into the curriculum
3. *Provide early and continuing opportunities* for students to learn and apply computational skills
4. *Communicate the value* of computation in physics and for a broad range of careers

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Effective Practices (Theme 2):

a. Embed computational learning opportunities across the curriculum
b. Provide opportunities for students to learn the relationship between analytical and computational models
c. Provide opportunities for students to learn the broader computational practices necessary for doing computational physics
d. Develop and/or collaborate with other departments to offer computational curricular opportunities

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Implementation Strategies (Effective Practice b):

- Teach students about analytical models for which there are computational analogs and extensions.
- Have students reflect on the similarities and differences of modeling a physical system using analytics versus computation.
- Have students explore the affordances and constraints of analytical and computational modeling.
- Have students explore the connection between posing problems and solutions as continuous ones (analytic) as compared to discrete ones (computational).

Effective Practices: Computational Skills

Also included (in each Section):

a. Benefits to the program
b. Programmatic assessments
c. Evidence and resources
   a. Key readings/resources
d. Examples (in some cases)
e. Case studies (planned: community input)

Effective Practices: Teacher Preparation Programs

High School Physics Teacher Preparation

Description

Physics programs are encouraged to implement, document, publicize, and support pathways to recruit and educate future high school teachers. This includes creating an environment within the program that promotes high school teaching as a valid and desirable career option for students.

Benefits to the Program

Effective Practices

1. *Implement a teacher preparation pathway*
    a. Establish a degree track for high school teacher education within the major
    a. Understand alternate pathways to teacher certification
    b. Support recent graduates during their transition into the classroom
2. *Provide students opportunities to learn physics in ways teachers are expected to teach*
    a. Incorporate evidence-based, active-engagement pedagogies into courses
    b. Provide opportunities for future (pre-service) teachers to participate in existing courses or workshops for practicing (in-service) teachers
3. *Provide early teaching experiences for students interested in teaching as a career*
    a. Provide departmental and university opportunities for students to experience and practice teaching
    b. Provide physics degree credit for students to take “introduction to teaching” courses
4. *Understand and communicate paths to and requirements for teacher licensure*

Effective Practices: Teacher Preparation Programs

Effective Practices

1. *Implement a teacher preparation pathway*
    a. Establish a degree track for high school teacher education within the major
        i. In programs with one track, modify the existing degree to allow certification requirements
        ii. In programs with multiple tracks, design a teaching track to allow students to smoothly transition among degree options (should be perceived as on par with other career options)
        iii. Collaborate with School of Education or its equivalent to accurately communicate required components for licensure (curriculum, field experiences, testing, etc.) to students
        iv. Design the program (individually or with other science departments) in collaboration with the College of Education to meet licensure requirements
        v. Learn from existing models, e.g., PhysTEC and UTeach employ practices and strategies for recruiting, preparing, and supporting teachers that begin within the physics program
        vi. Be mindful not to add extra expense or time to graduation

What the Guide Is

- Collection of community knowledge and evidence-based practices
- Authored, reviewed, approved by physics community
- *Living* document (not static), with stewardship by APS COE
- Primarily online
- Ethics and diversity included throughout
- Effort to implement evidence-based pedagogy
- Transform mandatory assessment into useful exercise
- Suggestions on how to improve all aspects of a program
- Opportunity to extend reach of education research

What the Guide Isn't

The guide is **NOT**

- Accreditation
- Program certification
- Mandate to conform
- 'To-do' list departments are required to complete
- **Finished (yet)**

Questions to Consider

- Can you imagine using this guide?
- What would you do with this information?
- Who might you give it to?

References

SPIN-UP 2002 (enrollment):

aps.org/programs/education/undergrad/faculty/spinup/

T-TEP 2012 (teacher education):

phystec.org/webdocs/TaskForce.cfm

Phys21 2016 (careers):

compadre.org/phys21/

Vision and Change 2011 (biology):

visionandchange.org

Active learning:

Scott Freeman, et al., “Active learning increases student performance in science, engineering, and mathematics,” PNAS **111** (23), 8410-8415 (2014).

PTEPA (assessment):

Physics Teacher Education Program Analysis: phystec.org/thriving

Come give us feedback!
External Evaluator: Stephanie Chasteen

- If you are a…
  - Department chair
  - Undergraduate studies director at a university
  - New chair
- Get a sneak preview of the EP3 Guide and give your feedback about the guide structure and content.
- Meet in the front

Contact her at Stephanie@ChasteenConsulting.com if you'd like to participate at a later date

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