PICUP capstone conference: Integrating Computational Skills with EP3

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Outline

- History and mission of EP3
- Section development
- Quick tour of EP3guide.org
- Computational Skills in EP3
- Integrating Computational Skills into your program
- Quick Discussion
- Questions/Feedback
EP3 history and mission

- ACS: certification of degrees
- ABET: accreditation of programs
- APS: ...
EP3 history and mission

- ACS: certification of degrees ➔ prescriptive
- ABET: accreditation of programs ➔ onerous
- APS: ...
EP3 history and mission

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  + leverage, consistency, standards
  - lack of flexibility, innovation

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- APS: Effective Practices for Physics Programs = EP3
EP3 history and mission

The EP3 charge (2015):

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**
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EP3 history and mission

The EP3 task force (2016-2021):

Co-Chairs: **David Craig, Oregon State University**
            **Michael Jackson, New Mexico Institute of Mining and Technology**

• Noah Finkelstein, University of Colorado Boulder
• Courtney Lannert, Smith College and UMass Amherst
• Ramon Lopez, University of Texas at Arlington
• Willie Rockward, Morehouse College
• Gay Stewart, West Virginia University
• Gubbi Sudhakaran, University of Wisconsin-La Crosse
• Kathryn Svinarich, Kettering University
• Carl Wieman, Stanford University
• Lawrence Woolf, General Atomics Aeronautical Systems, Inc.

**Editorial Director:** Sam McKagan

**APS:** Ted Hodapp, Kathryne Sparks Woodle, Sean Costello; **AAPT:** Bob Hilborn
EP3 history and mission

- Improve program assessment and external review
- 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, but specific and actionable
EP3 section development

For each section, 3-5 experts contribute content.

3 task force members and editorial director synthesize into draft section.

Draft section is reviewed by contributors, plus 3-5 additional reviewers.

Editorial director incorporates feedback and reviews.

Task force approves section for publication to website.
Quick Poll

Thinking about your experience integrating (or plans to integrate) Computational Skills into your undergraduate physics curriculum,

what is/was/will be the biggest barrier:

1. cost and/or resistance from your administration
2. lack of local knowledge base and/or infrastructure
3. resistance and/or lack of interest from physics faculty
4. resistance and/or lack of interest from students
5. something else
6. nothing, it was/is going to be easy
EP3’s Computational Skills Section

Computational Skills | Effective Practices for Physics Programs
EP3’s Computational Skills Section

- Description
- Benefits
- Programmatic Assessments
- Evidence/Resources
Description:
Computational skills encompass computational physics skills (e.g., translating models into code, choosing scales and units, choosing appropriate algorithms and tools, extracting physical insight, understanding the limitations of computers and computer models), the use of a variety of computational tools (e.g., spreadsheets, structured programming languages, computer-based symbolic manipulations, modeling packages), and technical computing skills (e.g., analysis, visualization, and presentation of data). Computational skills can be introduced at numerous points throughout the curriculum through individual and group activities, and can become more sophisticated as students progress through their education.

Benefits

Programmatic Assessments

Evidence/Resources
EP3’s Computational Skills Section

• **Description**

• **Benefits:**

  Computational tools and techniques are used ubiquitously in physics, are integral to how physics is currently practiced, and provide excellent preparation for careers. Knowledge and skills in programming, simulations, and modeling are needed by physics graduates in a variety of careers. Adding these skills to the curriculum addresses a common weakness that many physics graduates report in their undergraduate programs, improves and accelerates students’ ability to engage in research and solve research-like problems, and may assist in the recruiting of students. Computational skills allow students to answer questions not solvable through analytic techniques, including practical and applied problems, and are transferable across disciplines. The use of computational tools can deepen students’ understanding of fundamental concepts and principles.

• **Programmatic Assessments**

• **Evidence/Resources**
EP3’s Computational Skills Section

• Description
• Benefits
• Programmatic Assessments:
  1. What are the mechanisms through which your degree program includes computational skills? What are the additional mechanisms through which it could do so?
  2. Are all of your students, including those from marginalized groups, participating in, aware of, and valuing computational learning opportunities?
  3. What expertise and perceptions do your faculty have with respect to computational skills? What expertise do they need?
  4. How successful is your program at preparing students to use computational skills? How has its success changed over time?

• Evidence/Resources
EP3’s Computational Skills Section

- Description
- Benefits
- Programmatic Assessments
- Evidence/Resources: https://ep3guide.org/guide-overview/computational-skills
EP3’s Computational Skills Section

• Contributors:
  Ernest Behringer, Eastern Michigan University
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• Synthesis Committee
• Reviewers
• Final Review Committee
EP3’s Computational Skills Section

• **Contributors**

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• **Reviewers**

• **Final Review Committee**
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• Final Review Committee
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  Lawrence Woolf, General Atomics Aeronautical Systems Inc.
• Effective Practices: https://ep3guide.org/guide-overview/computational-skills
Quick Discussion

In breakout rooms, for 10 minutes, please discuss:

What would you like to see included in the EP3 Computational Skills section?

○ What type(s) of advice would be particularly helpful?
○ What practices were particularly effective for you?

Someone keep track of your main takeaways, for report out!

When we rejoin, please type your takeaways into the chat
Welcome back!

please put the takeaways from your discussion into the chat
Thank you!

Any questions/comments/suggestions?