APS physics

Forum on Education
American Physical Society

Spring 2022 Newsletter

Jennifer Docktor, Editor

Letter from the Chair

Eric Brewe, *Drexel University*

Welcome to a new year of the Forum on Education. For the FEd, this new year brings a reenvisioning of how the FEd does business, and ultimately how we serve the membership of APS. There is a great deal to be excited about - mini-grants, a renewed focus for FEd, and a return to in-person meetings. None of these would be possible without the behind the scenes efforts of Catherine Crouch (Past-Chair of FEd) and Laura Ríos (Secretary-Treasurer), the Program Committee, and the Awards committee of the FEd. So a sincere thank you to all who participated.

APS Meetings

One of the fundamental tasks of the FEd is to orchestrate sessions at the March and April meetings. And this year the meetings will offer both an in-person or virtual experience. This year FEd will be sponsoring or co-sponsoring nine invited or invited/contributed sessions. Sessions at the March Meeting will include the Reichert Award Session (which will be an invited contributed session), a session on Professional Society Efforts in Education, and a session on Science Communication. At the April Meeting sessions will include the Excellence in Education Award (this year granted to the TEAM-UP project), the AAPT organized session "Programmatic efforts changing physics education", "Transforming intro physics with computation", "Teaching to build physics identity", "Outreach in formal settings", and "Active learning in upper division physics."

In addition to sponsoring sessions, at the April the FEd will honor departments awarded the Award for Improving Undergraduate Physics Education (Colgate, Howard, Michigan State, and Rowan University - Congratulations to all) and the newly elected APS Fellows (Beth Cunningham, Valerie Otero, and Katherine Perkins). As a reminder, it is never too early to consider nominating a department, group, or member for one of the FEd honors.

Re-envisioning FEd

The pandemic has necessitated everyone to rethink nearly everything, and the operations and roles of the FEd is one of the things that we have been working on during the last year, under the guidance of Catherine Crouch. It is both challenging and exciting to continue this process. First, because we have been forced to Zoom and realized that Zoom meetings are fairly effective, the FEd will make all of the executive committee meetings by Zoom. This means that the budget, which previously supported travel, is now available for different purposes. One of the purposes that became evident during the pandemic was to support mini-grants. These mini-grants have focused on supporting small projects or personal grants to FEd members during the pandemic. The FEd executive committee is committed to continuing these mini-grants in some form as we plan for next phases of the pandemic. These mini-grants represent a new role for FEd in supporting physics education.

Other goals of the re-envisioning process are to help clarify the purposes and roles of the Forum on Education from other groups, particularly the Topical Group on Physics Education Research, to better address the needs of the members, considering how to best utilize the Engage platform, and to more effectively promote physics teaching within the broader APS membership.

All of these efforts are toward the betterment of the organization and simultaneously are challenging. Finally, if you are interested in helping FEd to meet these challenges, please consider nominating yourself for the executive committee.

Nominate Colleagues for Fellowship and Awards!

Catherine Crouch, *Swarthmore College, Past Chair of FEd*

As Past Chair of FEd, my main responsibility is to oversee the honors that FEd can nominate people for: APS Fellowship and our two awards, the Excellence in Physics Education Award and the Reichert Award for Excellence in Advanced Laboratory Instruction (more about these below). I want to encourage you to nominate candidates for both of these!

Fellowship is the way the APS recognizes a broad set of its members for outstanding contributions to the field of physics. The Forum on Education puts forward nominations of members who have made significant contributions to physics education, which do not have to involve research in physics education. Any member of the APS can nominate any other member of the APS for this honor; the FEd Fellowship Committee then reviews all nominations that are directed to us and can select a small number to advance to APS for evaluation. (The exact number is subject to change with APS and unit membership; in the past FEd has been able to put forward up to four candidates for consideration.)

Please consider a diverse set of possible candidates, including women, members of historically marginalized groups, and people at smaller institutions. You can look through this listing of all Fellows put forward by the Forum for ideas. You may be surprised to see that some persons whom you would expect to see on this list are not there—although they may have become Fellows through another unit, it's possible that no one has yet taken the time to nominate them!

Nomination instructions can be found at the APS Honors website: https://www.aps.org/programs/honors/index.cfm. The deadline for Fellowship nominations is 1 June 2022. If you have ideas for colleagues to nominate, but have questions about how to assemble a strong nomination, or would like to be connected with a possible co-nominator, please get in touch with me. It does take some time to assemble a nomination and requires another APS member to provide a supporting letter. However, nominees are inevitably very grateful to know that their work is valued by their colleagues. Self-nomination is permitted.

In addition to APS Fellowship, I also want to encourage you to submit nominations for the APS education-related awards that FEd oversees. The **Excellence in Physics Education Award** honors either a team or a single individual for sustained commitment to excellence in physics education. You can find more information at https://www.aps.org/programs/honors/prizes/education.cfm.

The **Jonathan F. Reichert and Barbara Wolff-Reichert Award for Excellence in Advanced Laboratory Instruction** honors outstanding achievement in teaching, sustaining, and enhancing an advanced undergraduate laboratory course or courses. Its nomination procedure and past winners can be found at https://www.aps.org/programs/honors/prizes/education.cfm.

For both awards the nomination deadline is 1 June 2022, the same as the Fellowship deadline.

The final education award I want to make you aware of is the **Committee on Education Award for Improving Undergraduate Physics Education**. This award recognizes a few physics departments (not individuals) or programs each year for improvement of their undergraduate physics education programs through implementation of best practices. It offers the opportunity for a department or program to receive national recognition for its undergraduate education efforts, which can be valuable both internally and externally. More information can be found at https://www.aps.org/programs/education/undergrad/faculty/award.cfm and the deadline is 15 June 2022.

Surely you know of individuals whose efforts on behalf of physics education deserve recognition. Please nominate them — it is worth the effort!

From the Editor: Special EP3-Themed Issue

Jennifer Docktor, *University of Wisconsin – La Crosse*

I am excited to introduce a special themed-issue of the APS Forum on Education Newsletter highlighting the Effective Practices for Physics Programs (EP3) Project. The project is led by the American Physical Society (APS) in collaboration with the American Association of Physics Teachers (AAPT) with the goal of developing a guide to support physics departments in a range of areas. More information is at: https://ep3guide.org/.

I would like to personally thank everyone who contributed to this themed issue.

If you have ideas for future newsletter themes, recurring columns, or an article you would like to contribute, please e-mail me at jdocktor@uwlax.edu. The deadline for the summer 2022 newsletter is June 1.

A Note from the EP3 Chairs

David Craig, *Oregon State University*

Michael Jackson, *New Mexico Institute of Mining and Technology*

The Effective Practices for Physics Programs (aka EP3) initiative aims, in the words of the project tagline, to "[support] physics programs with collections of knowledge, experience, and proven good practice for responding to challenges and engaging in systematic improvement" via the EP3 Guide, available online at ep3guide.org. It's been a busy time for the project as a large and dedicated team works diligently to complete the initial release of the Guide.

The first sections of the Guide were made available in January of 2021, and we are steaming toward the finish line for version one, with release of the remaining sections planned later in 2022. Also look for workshops and other initiatives to support the use of the EP3 Guide coming soon. As co-chairs of the EP3 initiative, we would like to recognize the incredibly hard work of the many, many people involved in the creation of the Guide. Since the EP3 Task Force was initially charged by the APS Council in November 2015 (then called BPUPP, Best Practices for Undergraduate Physics Programs; see Ted Hodapp's piece in this newsletter), the Task Force has committed a simply astonishing amount of its time and creative energy to developing the Guide and pushing it forward to completion. You can read all about the EP3 team (which includes the Task Force, key APS staff, our AAPT liaison, the research team, external evaluation of the project, and our amazing editorial director Sam McKagan) on the EP3 web site at ep3guide.org/about/ep3-team/. Of special note, we'd like to recognize the incredible work of APS staff in supporting the EP3 initiative: Kathryne Sparks Woodle (Senior Programs Manager), Sean Costello (Program Coordinator for Project Development), and the APS web development team. Their contributions have been critical to the success of the project.

We'd also like to add a special welcome to Michael Wittmann, the new Head of Education at APS. Michael has taken over the daunting role of APS staff liaison to EP3 from Ted Hodapp. (Betcha didn't know what you were getting into when you took the job, Michael! Welcome aboard.) The Guide wouldn't exist without Ted's early and consistent leadership of EP3 in his various roles at APS. While Ted has recently moved on from APS to a new position at the Gordon and Betty Moore Foundation, Ted will remain involved with EP3 until at least the completion of its initial release.

The Guide itself, however, is a direct product of the work of the physics community itself. The content of each Guide section is contributed by disciplinary experts, synthesized by a team from the EP3 Task Force, and reviewed by more experts from the community. To date we've received over 250 individual contributions and reviews for the EP3 Guide. The EP3 Guide truly is a creation of the physics community, and we'd like to acknowledge everyone who has contributed so far. You can read the list at ep3guide.org/about/contributors-and-reviewers.

While the Guide will be fully available in 2022, it won't be finished. That's because, unlike a printed report, the EP3 Initiative represents an ongoing commitment by APS and AAPT to the physics community to keep the content of the EP3 Guide up to date and consistent with current research. Once the EP3 Task Force concludes their work, the EP3 Guide will be overseen by an EP3 Board to be formed in collaboration between the APS and AAPT, with the guidance and support of the APS Committee on Education. With the ongoing help of the physics community, the EP3 Guide will be available to help physics programs improve themselves for years to come.

Using the EP3 Guide: Tips for Drinking from the Firehose!

Michael Jackson, *Co-chair EP3 Initiative, New Mexico Institute of Mining and Technology*

If you have had a chance to peruse the EP3 Guide (ep3guide.org), we believe you will find it contains a wealth of information covering a range of topics of interest to physics departments. However, we fully realize there is a LOT of information here, so we have made an attempt, through some design choices, to make it easier to find specific information that might help improve your program:

- An accordion-style display that organizes the material into themes, actionable practices, and implementation strategies that outline information with increasing detail and specificity so you can skip to a section relevant to your context,
- Several different collections of sections organized around a topic, which we call a "goal map," to guide departments through a specific challenge they face (and consequently the guide's related content), and
- providing the most important, often prioritized, strategies departments could pursue.

We are also planning community engagement programs to help readers use the guide's content to answer questions they face in their local environment.

You may still feel a bit overwhelmed. If this is the case, we recommend you start by reading through our 'Get Started' webpage that provides general guidance on how to use the guide along with considering the following tips:

1. Gather and analyze information about your current situation. To assist with this, consider reviewing the programmatic assessments that have been included in many of the sections that identify potential data departments may wish to consider. This information can (1) help the department better understand factors underlying your situation, (2) provide a baseline to track progress on how strategies are working, and (3) inform the actions, and any modifications thereof, the department is considering for implementation.
2. The guide was designed to be a conversation starter as well as a community collection of effective practices. It is critical for your department to engage in discussions about the guide's content as you evaluate which themes, practices, and strategies are the most relevant to the particular challenges the department faces within your local context.
3. Identify potential strategies to implement, recognizing the guide is not a list of tasks or a 'To Do' list. Consequently, there is no need to do everything listed in the guide.
4. Not every idea or strategy listed will be applicable to your local environment.
5. You don't need to implement all relevant strategies at once. Instead, develop an implementation (and assessment) plan for strategies that appear to be the most relevant and useful to your department.
6. Identify a committee to review specific guide sections and select elements of most interest and relevance to discuss with the department. This may include developing a multi-year plan to ensure all relevant sections of the guide are reviewed and discussed by members of the department.
7. Address easy issues first and develop a plan to address issues that are more difficult or time-consuming. We also recommend developing short-term (accomplished within a year) and long term (accomplished over a multi-year timespan) plans. This will also provide time to develop buy-in (from stakeholders, including the administration), gather information, and garner resources that may be needed.
8. Be prepared for debate and at times disagreement (we have a section on that too!), but continue trying to steer everyone toward consensus and potential action that can be assessed and lead to modifications that continue assisting your collective efforts in improving your program.

In conclusion, no department should attempt to implement everything in the EP3 Guide. The guide is not a set of benchmarks or checklists that define "successful" departments. Instead, it is a carefully crafted resource for physics departments and programs to help them address challenges and make improvements within the local constraints they face. Good luck, and the community is here to help - please feel free to pass along any feedback you have on the document's content and its use within your department.

Toolkit for Departments Under Threat

Courtney Lannert, *former faculty member at Smith College and University of Massachusetts Amherst*
Jim Borgardt, *Juniata College*

In this challenging time for higher education, many physics departments in particular are facing the challenges of budget cuts and reduced staffing. Others are facing threats of permanent curtailments such as eliminating faculty lines, eliminating the physics major, or even eliminating the physics department entirely. The APS's Toolkit for Departments Under Threat attempts to gather and distill helpful advice for departments facing any of the challenges above, and provide strategies departments can use to avoid such threats in the future.

Gathered from interviews with over 50 physics faculty members, including current and past department chairs from previously-threatened, currently-threatened, and recently closed departments, as well as administrators such as provosts and deans, the Toolkit collects strategies that have helped departments in a variety of local contexts advocate for themselves and better stave off threats of curtailment. Because different institutions evaluate a department's success using different metrics, and because serious threats often require immediate actions, the Toolkit's advice is offered in two complementary ways: enumerating strategies that address specific metrics (e.g. number of majors or total enrollments) and various strategies to be taken on different timescales (e.g. right now, over the 6-12 months, and over the next three years).

In most cases, helpful strategies (e.g. for recruiting majors or improving enrollments in service courses) are carefully detailed, with associated resources, in existing sections of the EP3 guide. Because the Toolkit is part of the EP3 website, links take the user seamlessly to these EP3 sections and their guidance. In order to help department leaders facing challenges, the Toolkit also hosts a monthly one-hour virtual meeting for continuing conversation and discussion supported by an associated Slack channel. Email Sean Costello (costello@aps.org) if you would like to be added to the email list for these engagements with other physics faculty.

The Toolkit was launched in February of 2021, and has already proven to be helpful for departments experiencing actual or foreseen threats. One author of this article, Jim Borgardt, used strategies from the Toolkit at his institution to successfully push back against administrative concerns voiced during a campus-wide departmental prioritization process, moving the department from a "curtail" assessment up to "sustain." Other physics chairs have effectively leveraged guidance in the Toolkit to better their standing as well when addressing threats to their department.

Through updating and improvement, we hope the Toolkit will be a valuable resource for physics departments, not only those who feel they are actively under threat, but also those who want to proactively improve their relationships with their administration and serve their institution and its students better.

Your Next Departmental Review – Making the Most of It

Neal Abraham, *Mount Holyoke College*
Theodore Hodapp, *Gordon and Betty Moore Foundation*
Michael Jackson, *New Mexico Institute of Mining and Technology*

A department review usually spans researching and writing a self-study, then hosting external visitors who provide a written report, and subsequently developing a strategic plan or action plan with specific initiatives. Though some see this as a low-reward burden that comes once every 5, 7, or 10 years, such a review can help strengthen a department by providing fresh perspectives on critical issues. Particularly valuable are discussions of important issues, joint analysis of departmental data, opportunities for reflection and establishing an updated foundation for wisely choosing strategic initiatives. The EP3 section "How to Undertake an Undergraduate Program Review" offers guidance for how to get the most benefit from this process.

While most colleges and universities have specific guidelines and timetables for a self-study, the department can address key questions: Do we understand our department's mission, how effectively are we able to serve that mission, and how does our mission facilitate an environment that draws students to our program? What curricular paths do our students take? What post-graduate paths do our students choose and can we do a better job of preparing students for them? What are hallmarks of student success? And, where are the stumbling blocks leading to student attrition? The department also can consider ways to streamline the curriculum, modernize treatments of material, adopt more engaging pedagogies, and provide a more welcoming environment for all students.

Successful use of a department review usually requires identifying an individual (not necessarily the chair) or a small committee (for large departments) to develop a timetable for the work and to monitor progress. Key steps include allowing adequate time for gathering and analyzing data, identifying and contacting peer and aspirant physics departments[1], and imagining various pathways forward.

Other topics to review include: use and allocation of department-controlled spaces, how students and faculty feel included and supported, and how the department markets itself to students through hallway displays, website and social media presence, and printed materials. The program review can also be a time to identify resources needed to achieve goals associated with a commonly agreed-upon mission/vision statement that the administration endorses. Of course, one doesn't need to wait for the looming deadline of completing a self-study to ensure that annual departmental data on enrollments and graduates is saved and that some members of the department have visited other physics departments – these are good practices to follow at any time.

A department usually builds its strongest case for administrative support by identifying and planning to address weaknesses as well as building on its successes. How might the department better address institutional goals and objectives? How does the department better meet the full range of needs of the (often more) diverse student body? How might we attract and retain more students? How might we increase student engagement and satisfaction? How might we avoid/minimize low-enrollment courses, perhaps by relaxing rigid pre-requisite course requirements or creative scheduling? How can we incorporate research experiences into the curriculum so all students have access to this high impact practice?

External reviewers invited to visit the department after reading the department's self-study report can provide crucial insights. On the one hand, they may provide disciplinary perspective and context in conversations with senior academic administrators (dean, provost), while on the other hand, they can help the department identify what it overlooked in its own analyses of data and point out other departments to study and use as peers for comparisons and ideas.

Since one of the ways to gain perspectives on one's own department is to serve as an external reviewer for another department, the EP3 guide provides a separate section on "How to Serve as an Undergraduate Program Reviewer." We plan to develop a workshop to complement that section to help those aspiring to be such external reviewers prepare for that service and we hope to return to this column later this year with more information about such opportunities.

And, since one of the best outcomes of a department review is to have a focused set of goals and objectives, and specific strategic initiatives to pursue in subsequent years, the EP3 guide provides a complementary separate section on "How to Create and Use a Strategic Plan."

All EP3 sections were developed by members of the physics community. Let us know if you find them valuable or if you see ways to make them more useful to you or to others. Your feedback is always welcome.

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1 *Some universities may have an existing list of peer and aspirant institutions that departments will be required to use. However, physics departments at these institutions may not be comparable in scope or mission. Consequently, it may be beneficial for departments to also identify and include in their self-study information about peer and aspirant departments beyond the institutions identified by the university.*

EP3 Guide Section on Equity, Diversity, and Inclusion

Edmund Bertschinger, *Professor of Physics and affiliated faculty, Program in Women's and Gender Studies, MIT*

Equity, Diversity, and Inclusion (EDI) is a phrase referring to a set of values, characteristics, and practices that profoundly shape the experience of people in organizations including physics departments and labs. Many physicists are calling upon their organizations and leadership to address longstanding problems in the recruitment, retention, and success of their members including students, postdocs, employees, and visitors. The EDI recommendations of the EP3 Guide provide a valuable resource for organizations and individuals seeking to improve program outcomes.

This Guide includes plenty of treasure for everyone, particularly in the lengthy section on EDI. If you're a newcomer to the topic, you want to understand the evolution of disciplinary norms, or you simply want to help others succeed, start with the first theme on educating yourself about EDI. Experts will find useful references and lots of tips for how to how to lead and support change. But don't approach this thinking that organizational change follows an algorithm. Unlike most physics research, it requires learning about oneself as well as others, both past and present. Like physics research, this is an iterative process of discovery. The EDI Guide has the depth of a graduate-level thesis informed by research in the social sciences.

This realization leads to a challenge—how to avoid becoming overwhelmed? My advice is to approach this guide the same way one learns a new physics topic: in stages. First read through the online document (using the excellent sectional formatting as an outline) to see what is familiar. Pick up a few ideas that you can use now. Second, create or join a study group to read and discuss the guide in more depth over a period of months or even a year. We don't expect students to learn quantum mechanics in a month; enough time and problem-solving practice are needed. The same is true here, and you'll find plenty of practice problems to work on with colleagues over two semesters.

Finally, use this as a guide for a multi-year cultural change initiative in your organization. Just as you should not try to learn everything alone, you should not try to change the culture of a department in isolation. Join a community of practice such as the SEA Change community, the EP3 DALI program, or APS-IDEA. This is especially important for responding effectively to the resistance facing all such change efforts.

The advice in this guide aligns with what I've learned as a physics department head, university equity officer, and activist. The guide wisely avoids the terminology of "underrepresented minorities" and "pipelines" and explains why putting equity first is important for success. It emphasizes creating a supportive environment for all as opposed to fixing people so they can better survive in a hostile environment. While valuing allies, it encourages them to go further to become accomplices and co-conspirators. And it gave me some great new ideas like renaming office hours and tutoring sessions as well as guidance on trauma-informed teaching.

As a bonus, the guide is a living document that will evolve as the field progresses. Important new sections, such as "How to Create and Sustain Effective Change," remain to be added.

APS Committee on Education Welcomes EP3, Finding Something in it for Everyone

Josh Grossman, *St. Mary's College of Maryland*

As 2021 chair of the APS Committee on Education (COE), I am thrilled with the parts of the *Effective Practices for Physics Programs (EP3)* initiative that continue to roll out. I believe that EP3 is one of the most important new actions arising from APS in the past decade. The Physics & Astronomy New Faculty workshops provide an apt comparison. Over the past 25 years, they have catalyzed the widespread adoption of evidence-based instructional practices in physics teaching. Now, EP3 gives the community access to effective, evidence-based practices that cover nearly all facets of physics education.

The Committee on Education is responsible for APS activities in the area of physics education. It may also suggest and supervise studies and programs. A look at the Committee's current priorities shows that EP3 aligns with each of them in multiple ways. As its top priority, COE works to "promote broad access to high-quality physics and physical science education, with the goal of increasing the number of individuals learning physics at all levels." The EP3 Guide offers users sections on recruitment, retention of majors, high-school physics teacher preparation, undergraduate research, and more. New sections are under development on preparing students for graduate school in physics, implementing research-based instruction practices, and instructional labs & experimental skills. The EP3 team runs Departmental Action Leadership Institutes (DALIs), which train physics faculty members to lead departments in implementing significant changes to their undergraduate programs, according to the recommendations of the Guide. For those looking to review and improve their offerings, the guide also contains sections on program review; look in the future for even more support from EP3 for conducting program reviews.

COE's next priority is to "support schools and departments in recruiting and retaining students from groups that are underrepresented in physics, with the goal of increasing their representation at all levels in physics and physics-related fields." The EP3 guide matches this with sections on equity, diversity & inclusion (EDI -- released in December 2021!), departmental culture & climate, and other topics mentioned above. EP3 is also their material when conducting focused site visits to physics departments at historically Black colleges and universities (HBCUs) and Black student serving institutions (BSIs) to support and learn from them as they work to increase their enrollment and graduation rates of Black students.

COE strives to "promote the intentional mentoring of physicists as part of their education and professional development, with the goal of supporting, developing, and retaining students at all levels." The EP3 Guide has sections on advising & mentoring and on career preparation, in addition to the relevant sections mentioned above.

COE also works to "promote the value of physics education and careers to the public and the government, with the goal of building and maintaining the human capital and financial resources necessary for building a vibrant physics community." The Toolkit for Departments under Threat helps physics departments make the case for their value. The EP3 Guide offers sections on courses for different audiences (including STEM majors, specifically life sciences students, non-STEM students, and upper-level physics students). It will soon also include a section on community engagement and outreach. An upcoming section on assessing student learning at the program level will help programs make the case for their effectiveness, particularly to higher-education accrediting bodies that increasingly emphasize measures of performance based on learning goals and closed-loop assessment processes.

EP3 is all the things listed above and much more. I have only mentioned highlights in the interest of brevity. Perhaps it makes sense that EP3 aligns so well with the priorities of the APS Committee on Education, as it got its start in 2015 and before from discussions and a working group in COE (chaired early on by David Craig). Once APS formed what became the EP3 Task Force, Craig co-chaired it with Mike Jackson, beginning in 2016. That makes five years and counting that the full set of Task Force members have been working on this tremendous project -- some of them for longer. They are joined in the EP3 Team by consultants, researchers, and APS staff members, and AAPT staff. The EP3 Team has coordinated hundreds of contributors, reviewers, and committee members, plus supporting staff from APS. The number of people involved attests to the fact that EP3 is an initiative ***by*** the community and ***for*** the community. In 2021, to help current COE members gain an understanding of what is involved in EP3, several of us reviewed a draft section of the Guide and also served as a synthesis committee for a different section. Personally, this experience has given me even more appreciation for the thoughtfulness, research, and awe-inspiring amounts of work that have gone into EP3 as a whole. Now at long last, the Task Force is looking to complete all sections of the Guide before the end of 2022. We anticipate that it will be turning over operations to a board, guided and loosely supported by COE. The Guide will continue to grow and get updated, as a living document. Other EP3 activities will continue and more will be added.

If you have read this far and you have not yet visited the EP3 website, what are you waiting for? Go check it out now! (https://ep3guide.org/) If you have visited the website, then please refer a colleague who has not yet used EP3 and suggest they add their name to the EP3 mailing list. I am no longer able to count how many times I have consulted the Guide, nor the number of times that I have started an answer to a question from a colleague, "Read the relevant section in the EP3 Guide." Furthermore, keep checking back on EP3, as more is yet to come.

Reflections on the First Cohort of the EP3 Departmental Action Leadership Institute

Joel C. Corbo, *Senior Research Associate at University of Colorado Boulder*

The Effective Practices for Physics Programs (EP3) initiative, an APS and AAPT collaboration, aims to help physics programs respond to challenges and improve how they function with a collection of knowledge, experience, and proven good practice disseminated via the EP3 Guide. As part of the project, we are piloting Departmental Action Leadership Institutes (DALIs), which support faculty members and their departments in implementing significant changes to their undergraduate programs.

Starting in January 2021, two faculty members from each of five departments joined the first DALI, which is co-facilitated by David Craig and me. These faculty members were charged with creating and leading cross-constituency teams in their departments to engage in a change effort, following the Departmental Action Team (DAT) model. This DALI started with an intensive virtual kickoff workshop, followed by twice-monthly meetings and the opportunity for individual consultations with the DALI facilitators. These activities were designed to help DALI participants learn about and implement critical aspects of engaging in a change effort (e.g., defining a vision, setting goals, gathering and analyzing data, assessing results), of supporting a high-functioning team (e.g., recruiting diverse team members, managing conflict and power differentials), and of interfacing with stakeholders outside the team (e.g., cultivating allies, managing resistance). These are all practices that align with the literature on organizational change and effective teams, both within and beyond the higher education context.

At our last meeting, we asked members of our first cohort to reflect on some of the biggest lessons they learned from their DALI experience and on how they are thinking differently about change compared to a year ago. Here are some of their responses:

- "The biggest lessons that I learned was involving students in the change process and gathering data before deciding on a project. Those two thoughts would not have crossed my mind prior to joining the DALI."
- "Two things that I have found most important is a more methodical approach to change that involves data collection and a real assessment of the impact on the whole program, rather than the somewhat piecemeal changes we have been making (and not really assessing). Also, I don't think we should ever make a major programmatic decision again without consulting students and alumni. I also feel overall more confident that I can find the resources I need to learn about best practices and I have a better set of ideas to present to administration."
- "Most broadly, the DALI helped give me confidence that we could implement big change in our department...I got both specific help on implementing [our large programmatic change] from the DALI, and more broadly, examples of what change can/should look like at the departmental level… [A] senior faculty with administrative experience did not think we could implement the change on the timescale we did, and it was the influence of the DALI that made me confident we could. A second thing that I have learned is the value of student contributions to departmental committees. While I was excited based on the DALI to try incorporating students into the DAT, I found their contributions were more valuable than I expected."

Overall, their responses and the subsequent conversation in the meeting highlighted themes that have been central to the content of the DALI: including students as partners in change efforts; being data and analysis driven; building confidence as change leaders; leveraging collaboration, community, and teamwork; and being methodical and intentional in one's approach to change.

This first DALI cohort will formally wrap up in January 2022. Our hope is that at least some of the participants will continue to meet informally on their own to support each other's progress in their departments. Additionally, a second cohort of five departments launched in October of 2021 and will continue working together for the next year. Our hope is to launch two more cohorts in fall 2022, with the ultimate goal of a sustained program. David and I also plan to publish as much as we can about the DALI approach and curriculum. If you have any questions, please feel free to reach out to us!

Accreditation: Threat or Salvation?

Theodore Hodapp, *Gordon and Betty Moore Foundation*

When I joined the American Physical Society (APS) Committee on Education (COE) in 1999 there were many calls from members, mostly from small to medium sized departments, to mount an effort similar to what the American Chemical Society (ACS) does: de facto accreditation. Professional society endorsement can be a lever with university administrations to argue for funding, positions, required courses, and other related things, and it can be a salve to concerned parents that their daughter or son's education will result in a well-paying job. Putting aside the hidden reality that individuals with physics degrees already receive some of the highest starting salaries, there are real, tangible advantages to endorsements like those given by the ACS. There are, of course, also concerns on the other side of the coin. Examples include shutting down departments that graduate too few students or who are so under-resourced that they cannot provide some of the basic components that many of us see as pillars of a physics education. There is also a deeply held concern that accreditation or program endorsement would force physics curriculum into a predefined mold and remove the opportunity to innovate (the ACS provides program approval but it has become a de facto form of accreditation).

These concerns, both positive and negative, were among the findings that COE found in 2014 when Gubbi Sudhakaran (UW La Crosse), Kurt Fletcher (SUNY Geneseo), and I (APS staff at that time) conducted a survey of department chairs that probed their interest in having APS serve in a similar capacity to what the ACS does for the chemistry community. There was a bimodal distribution of those strongly in favor and those strongly opposed. The COE then had extensive discussions on the topics – clearly there was a significant unmet need (as evidenced by numerous requests received by the APS to serve in this capacity). There was also a new player: ABET. ABET serves as the accreditation body for most engineering disciplines and decided around this time to extend their reach to all science disciplines as well. We heard from many people at the time that they were deeply concerned that ABET would impose restrictions and a "check the box" mentality that would add a significant administrative burden without much benefit. After much debate among members of COE it was decided that what would be valuable is a comprehensive guide that outlines best practices and provides practical advice on how to improve physics programs. If accreditation was seen, down the road, as important, the guide could also serve as a backbone for providing departments with guidance on their programs.

The construction of this guide was the genesis of what has become EP3: Effective Practices for Physics Programs. Along the way we realized that it was not just about the curriculum or the library holdings. We needed to address leadership issues, departmental review, equity and inclusion, ethics, careers, strategic planning, and a host of other issues faced by departments. We also began to understand that creating the guide was only the first critical step and that helping more departments thrive would take a long-term commitment by the APS and AAPT to provide the professional development we all need to excel in our roles as educators and program administrators. We (the EP3 team) hope you will find some excellent suggestions in the guide and that you will let us know where we need to improve things. Physics plays a critical role in advancing science and educating the next generation of scientists. Physics departments are at the core of this mission, and we need to work collectively to continually reflect on how to improve how we do this.

PhysTEC Section on Teacher Preparation

Alma Robinson, *Virginia Tech*

The High School Teacher Physics Teacher Preparation section of the Effective Practices (EP3) Guide outlines strategies for physics departments to strengthen and evaluate their teacher preparation programs, which in turn, may help recruit students and increase graduation rates.

Gay Stewart describes the evolution of the Teacher Preparation section of EP3 and highlights the positive impact that a strong physics teacher preparation program can have on physics students, physics departments, and the local community.

Ron Henderson explains how the guidelines put forth in the EP3 guide dovetail well with both the goals of PhysTEC and the findings of the TEAM UP report to encourage an inclusive community for all learners and future physics teachers. He then shares a few examples of how the EP3 practices have been implemented at Middle Tennessee State University.

Teacher Preparation is a Best Practice for Undergraduate Physics Programs!

Gay Stewart, *West Virginia University*

The Effective Practices in Physics Programs (EP3) started as the Best Practices in Undergraduate Physics Programs, but that had a lousy acronym! The High School Physics Teacher Preparation section was actually the first section to be nearly completed, and through multiple iterations of testing with intended users, it has helped shape how EP3 sections are presented. Ramon Lopez and I led the synthesis of contributions from experts in the field into the section and its many iterations, describing not just the effective practices in physics teacher preparation but also those relevant from the general teacher education literature. Effective physics teachers are best served by a sophisticated approach to their preparation that requires some specialized knowledge by the faculty involved. The guide points to effective practices that address this.

Each section of the guide begins with a brief discussion of the benefits to a department. The benefits section for improved teacher preparation as part of the work of physics departments was very easy to develop. In the current economic and policy climate, it is vital to send a positive message to both the education sector and the public about the importance of higher education. Producing teachers to meet a substantial need is an easily understood outcome that can help. Physics teachers are among the most needed, and the impact felt locally can be substantial. For instance, nearly two-thirds of PhysTEC graduates teach within 50 miles of the university where they were educated, and only 1 in 6 teach further than 200 miles away. Improved high school math and science education, made possible by such highly qualified teachers, has been linked to improved economic outcomes of the students whom they serve.

For the department itself, engaging in effective practices to support physics teacher preparation improves the undergraduate program and outcomes for all undergraduate majors, can increase both recruiting and retention within the department, and can significantly increase program graduation rates. Graduates who feel valued by their departments and then go on to teach in high school classrooms also recruit students for those departments, students often better prepared for success in the physics major.

In synthesizing the Teacher Preparation section, we also drew upon the T-TEP Report [1], two books [2,3], and a commissioned article [4] in addition to our own deep experience with physics teacher preparation (in both PhysTEC and UTeach). There are seven important effective practices listed in the guide (High School Physics Teacher Preparation (ep3guide.org)). At University of Arkansas, we saw that the changes we made in our undergraduate program to support preparing more teachers significantly increased the number of graduates. Teaching your introductory classes for all students as if they were going to be future teachers can help far more students succeed and develop a love of the discipline, which, in turn, helps to build a successful undergraduate program. Importantly, supporting diverse learners and ensuring that your graduates believe that anyone can succeed in learning physics means your students know they can be successful, and are more likely to become your graduates.

Gay Stewart has led several NSF-funded education projects, one of the first PhysTEC sites (University of Arkansas) and is part of the PhysTEC team at West Virginia University. She has published articles related to improved student learning and recruitment and retention of physics students and future teachers, resources for teachers, and a textbook to support AP Physics teachers.

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Preparing Future Physics Teachers is as Easy as E-P-3

Ron Henderson, *Middle Tennessee State University*

What department practices provide the best environment for students who want to become physics teachers? The EP3 guide contains a succinct to-do list of small important steps to guide departments looking to answer this question and improve their High School Physics Teacher Preparation program. The focus is squarely on student success. For those scientists who value clear instructions and evidence-based reasoning, this guide is even better than a review article when seeking to branch into a new research area. You can stick the EP3 guide on your department refrigerator and check the boxes to keep track of your progress. The EP3 guide aligns well with the goals of PhysTEC and provides a path that focuses on the experience of students. I would like to share some insights into how the EP3 practices have been implemented at Middle Tennessee State University (MTSU).

Among the most useful tools (and easiest to implement) is a 1-credit introduction to the department that we require of all new physics majors and transfers. The content of PHYS 1010 is focused on career preparation, and new majors are challenged to think about life after their degree. We highlight physics teaching often and devote one meeting for students to experience a 5E lesson plan [1] from the eyes of a high school student. Students have built helicopters and airplanes, and both learned and had fun in the process. These activities advertise our early teaching experiences, communicate that we value teaching as a career, and are among the most successful means of promoting our teacher preparation program.

While it took only one semester to implement PHYS 1010, reforming the pedagogy of introductory algebra- and calculus-based physics required much more time and effort. Evidence-based, active-engagement curricular design represents an important way for students to learn physics in the way that high school teachers are expected to teach, and even warranted an entire section of EP3. Our focus is on using multiple representations for each physics topic and providing opportunities for students to share their reasoning with each other. There is another topic, possibly more important, that informed our efforts in curriculum design – diversity and equity. Student experiences in the first semester of college strongly influence their eventual success, and the introductory sequence is almost always a part of year one. Minoritized students have often overcome tremendous hurdles to gain acceptance to the university and line up funding for tuition and fees. Future physics teachers enter their introductory physics class with excitement and uncertainty. What happens in the first few weeks may alter the course of that student's life. One of the primary barriers experienced by minoritized students is the lack of a supportive environment in the department and classroom. I will just emphasize that a combination of EP3 and the TEAM-UP report can help departments change the way they think about diversity and provide concrete actions to inform pedagogy reform. A department focus on diversity, inclusion, and equity coupled with intentional pedagogy decisions really can positively affect our future physics teachers.

Ron Henderson has worked to improve teacher education with help from PhysTEC and the Robert Noyce Teacher Scholarship Program. He is currently chair of Physics & Astronomy at Middle Tennessee State University.

References

[1] *http://NSTA.org/topics/5e*

Executive Committee of the FEd

Upcoming newsletter deadlines:

Summer 2022: June 1, 2022

Fall 2022: October 1, 2022