

Minutes
Forum on Education Executive Committee
Monday, Dec 4, 2006
1:30 pm EST
Dial in: 1-800-944-8766, enter: 90477#

Present: Mary Creason, Karen Cummings, Noah Finkelstein, David Haase, Paula Heron, Ted Hodapp, Ramon Lopez, Ernie Malamud, Bruce Mason, Peggy McMahon, David Meltzer, Dick Peterson, Larry Wolfe, Peter Zimmerman

The meeting was called to order at 1:35 pm ET

Ted – APS Education Initiative: Increasing the Number of Physics Majors
(Note: A draft of this report was sent to the FED Executive Committee members for study before the conference call. This draft report is attached below.)

The APS Executive Board is supportive new education initiatives and wishes to get advice on the sorts of efforts that should be pursued. The Committee on Education and the FED should provide recommendations. Questions to be answered might include: How do we encourage the implementation of recommendations from SPIN-UP? Should this be a proactive effort or a way to provide resources for current and future projects? What levels of funding may be required?

Teacher Preparation:

Larry – Does the document have a strong enough justification of the need for more physics majors? Is it to get physics majors to become HS teachers?

Ted – Many departments don't try to produce teachers, but have some students go into teaching. Increasing the numbers of majors will increase the number of teachers with a physics background.

Ernie – There are two different issues, both getting more majors and making teaching a more attractive career choice.

Mary – This is a systemic problem and an issue of certification. Physics majors are less attractive than general science people because of the need to teach a range of classes.

Noah – Physics majors can get teaching jobs because of a lack of qualified people.

Paula – If the proportion of physics majors going into teaching stays the same, you get more teachers.

Larry – We should have a goal in mind, rather than “hoping is works”.

Ted – The idea behind this document is that there are multiple goals that can happen together. An increase in teachers is one of many complementary goals.

Employment:

Karen – Is there any evidence that increasing the number of majors will cause a problem with them getting a job? What happen to bunches of new bachelors in physics? Is there an issue with graduate schools and jobs for PhD's and Masters?

Ted – This effort is not looking at PhD's. This is a low unemployment rate for phys majors. 2/3 of physics majors get advanced degrees, not all in physics. Society needs skilled science professionals.

Paula – If we will be recruiting people from new audiences, we should make sure they'll be marketable.

Peter – This should not be an issue. Consider physics in the 1930's. It is not our business to worry about the employment of our students.

Karen – It's true that decisions are up to the student, but they have to be well informed decisions. If we are to encourage active recruitment into a major, there should be a minimal job potential. We need data. Is there a tipping point where we will have too many majors?

Ted – Employment is very good.

Karen – 20% of lower achieving students don't get jobs. That's a problem.

Noah – What are our majors being trained for? Do we need to recreate the major programs for students not going to graduate school?

Karen – There is work ongoing to update the degree. This is not just technology or engineering but there need to be different courses.

Noah – This may change the point of the physics major.

Organization and Leadership:

Noah – Who leads this effort?

Ernie – There are 13 recommended actions and specific goals in the document. Someone needs to evaluate each of the actions and determine what gets the biggest benefit.

Peggy – The APS is working with the AAPT and SPS on this.

Ted – Discussions are ongoing with Warren Hein and Toufic Hakim. We are discussing ways to subdivide the activities into K12/TYC for AAPT, Undergrad Faculty for the APS, and students for the SPS. Gary White and Toufic Hakim are excited about the prospects.

Dick – The AAPT board has heard about this and don't want to shunt AAPT away from the undergraduate programs.

Ted – Everyone helps with each initiative and level.

Ted – The question remains, who does this? Do we need to hire more staff? Are the committees and the Forum going to take on projects with the support of the APS? Does this include grant writing and fund raising? The person leading the effort is going to be important. I can't take on new initiatives, but can help seed it. What can the FEd do on this?

Peggy – The Committee on Education looked through this document as it was drafted.

Ted – This is being pushed a desire to do more for education from the Board. There is the possibility for money but we need activities. This document fits in with other projects under discussion including increasing numbers of teachers and minorities.

Reports & Activities:

David M – In the past there have been site visits and SPIN-UP. Should we describe this?

Ted – The AAPT is studying HBCU's and the APS is helping. This is another look at successful colleges. There are also Teacher Prep site visits. These have the goal to evaluate and give advice.

David M – Many reports have been produced. This effort should be a move towards implementation of ideas rather than more visits. The ideas exist.

Karen – The effort should look at existing reports and support implementation.

Paula – If the goal is to revitalize undergrad majors, study how the top departments in the country for number arrange their curriculum. The SPIN_UP report isn't useful. We need more practical advice.

Mary – The existing reports are very popular in North Carolina.

Dick – The SPIN-UP report can be useful.

Paula, Karen – It needs to be very digestible with very specific steps. The recommendations should be "Plug and Play".

Dick – The SPIN-UP report has recommendations for crucial changes in a department. It is aimed at smaller departments.

Audience:

Mary – How do we move students through the major who don't have great background in calculus and science? We need things more welcoming to all students.

Karen, Paula – Many current students need help. Can we increase the number of majors and not get people who will struggle?

Ramon – Any effort must support the retention of students.

Document and Rational:

Ramon – We need to provide Ted with an answer to the question: Do we like the idea of doubling the number of physics majors? Can this serve as a standard to drive the initiatives? It can help improve retention as we get more students. It connects to efforts to recruit more minorities. It can be a standard where education initiatives can "find a home".

Ted – This can be a rallying point for funding and other initiatives.

Larry – This seems like a strange goal. It would make more sense to try to meet the needs of industry or increase the number of qualified physics teachers. Doubling the majors is backwards.

Karen – Is there broad agreement that increasing the number of majors is a reasonable goal? "This is good for my local department, but this is no need for a global doubling."

Ted – We should talk to people at get support. Age may be an issue, with the old guard saying everything is fine.

Karen – In early 1970s there was an overproduction of physicists (PhD). This resulted in problems in hiring.

Ramon – Half of our majors go into "other fields". A rational for the increase in majors is needed.

Peter – We need more WHY in the document. We must explain exactly why this will, and should, happen. We can't say this is to get more tuition money. More details are needed.

David M – The document hasn't convinced the group. There needs to be more. There is useful information available that can be incorporated, such as "Raising Above the Gathering Storm".

Peggy – The CoE discussion included many points for why this should happen. There are many good points in that discussion that could be used to improve the document, expand on the “Why”, and convince the audience.

Recommendations:

Ted – Is this meant to convince us or who else? What are the actions to be taken?

David M – This information is available other places so don’t just put it in the document. There should be workshops and meetings to bring in people to discuss this. It might also work to send people out to departments.

Noah – The document is to get us on board. There needs to be a one pager on Why and How more physics majors. The APS provides information to support discussions and workshops.

Peggy – What should the FEd do?

Noah – The FEd should endorse the statement and add arguments as to the Why and Needs.

Paula – More realistic goals are needed.

Ted – The FEd should. 1) Endorse the document and 2) Bring people together for next steps, priorities, and funding.

Dick – Is the goal to use external money or internal money?

Ted- Both are on the table.

Dick – Is this significant money?

Ted – I can’t give numbers, but the Board is very supportive. They want this to be something that APS does, but need a plan to support.

Ramon – The Executive Board was very supportive of putting resources into this. It should come from the CoE and the FEd.

Dick – Justifications for why are still needed. There will be communication problems and misconceptions will need to be addressed.

Ted – Justification isn’t a problem. The programs will be aligned with what people want to do.

Paula – Are there another 5,000 physicists? Will this decrease the quality? There are lots of people are not going into physics who have the right stuff.

Ted – Right now we need a plan to go to the Executive Board.

Karen – Again, the person leading this is crucial.

Ted – This person must bring many people together. More staff members are needed.

Larry – Moves approval of the document with a stipulation that there be more rational for the initiative. The motion was approved.

Ted – Everyone should send me words for the rational of the initiative.

Other Business:

March Meeting Events:

Peggy – We have been approached by TeachSpin (Jonathan Reichert) to co-sponsor a satellite social event at the March Meeting on creating support for an Advance Physics Lab consortium. He is working with the AAPT. This event will be a time to meet and interact.

Dick – They have some funding. Jonathan Reichert will support this.

Ernie, David H – Will there be conflicts? Is this going to work? This is very late for planning so it may not be possible.

Peggy – We can talk to Terri about this event. It will not be good if no one shows up.

Karen – We should tentatively approve this if there is a time when it can be held.

David H – Groups can always reserve a room, although they might not be on the official program.

Noah – The PTEC conference is before the March meeting. It would be good if FEd sessions are early in the week rather than later.

David H – I'll try.

Peggy – The Education award will be given at the ceremonial session Monday. Tuesday evening there will be a reception after the award invited session. There are two other efforts to be planned.

First, the FEd Executive Committee meeting will be 8 – 11 on Tuesday morning. This conflicts with Teacher's day activities.

Second, we need to hold a business meeting sometime. The problem is that the fellows are more likely to be at the April meeting. It would be better to have the Business meeting in April. The only business is to introduce the fellows and pass the gavel, so we don't need a quorum. There won't be money for a reception in April, so perhaps there should be a no-host social event.

David H – I will be at the April meeting.

Peggy – At the FEd-sponsored Plenary Sessions at the AAPT meetings, we need to ask the divisions to pay for the event as well as the Forum. Next summer the Division of Particles Physics will be sponsoring the session, so they will fund some of this. They are excited about it. In particular, the division will pay for travel and part of reception.

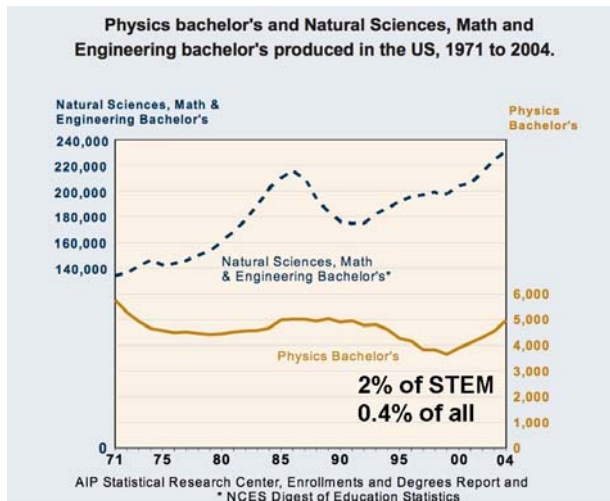
Dick – The divisions should be aware of the high standard of the materials that have been distributed in the past.

The meeting was adjourned – 2:43 pm ET

APS Education Initiative: Increasing the Number of Physics Majors

THE GOAL. Significantly increase the number of physics bachelor degree recipients.

THE NEED. In 2004, the United States produced about 5,000¹ undergraduate physics majors. This is about 2% of the 230,000 Science, Technology, Engineering, and Mathematics (STEM) degrees granted that year. This number of physics undergraduates has risen recently, but remains relatively flat and still short of the peak in the early 70's. Meanwhile, the total number of STEM degrees continues to rise, as does the total number of bachelor degrees awarded.



In the recent National Academy of Science report, *“Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future”*², there are explicit recommendations for both increasing the number of STEM graduates, as well as the number of teachers in these disciplines. Specifically,

- Action A-1: **Annually recruit 10,000 science and mathematics teachers** by awarding 4-year scholarships and thereby educating 10 million minds.
- Action C-1: **Increase the number and proportion of US citizens who earn physical-sciences, life-sciences, engineering, and mathematics bachelor’s degrees** by providing 25,000 new 4-year competitive undergraduate scholarships each year to US citizens attending US institutions.

This report is widely credited for triggering bi-partisan support in congress as well as increased funding levels in the President’s 2007 budget: The American Competitiveness Initiative³.

The joint APS/AAPT/AIP Physics Teacher Education Coalition (PhysTEC / PTEC) project continues to emphasize the need for more highly-qualified high school physics and physical science teachers. A significant increase in the number of physics majors would directly address this need.

In 2003, 22% of physics bachelor degrees were awarded to women¹. In 2004, about 7% of these degrees were awarded to Hispanic- and African-Americans¹. These later two populations make up more than 25% (2000 census data) of the US population. Each group is significantly under-represented, and any effort we pursue must focus on bringing these fractions closer to parity with the population.

Physics majors enjoy one of the smallest unemployment rates of any undergraduate major. While there is not a significant “physics” industry, as is the case in chemistry, our graduates get

¹ American Institute of Physics Statistical Research Center

² <http://www.nap.edu/catalog/11463.html>

³ <http://www.whitehouse.gov/stateoftheunion/2006/aci/>

jobs in a variety of fields using their significant math, problem-solving, and computer skills along with their understanding of the physical world. Increasing the number of majors does not have a significant down side for either departments or the students they educate.

THE APPROACH. To address this issue and begin the conversation of how to take action, we have had discussions with physicists in a number of groups including

- American Association of Physics Teachers (AAPT)
- Society of Physics Students (SPS)
- American Astronomical Society (AAS)
- American Institute of Physics Statistical Research Center (AIP)
- Council on Undergraduate Research (CUR)
- National Society of Black / Hispanic Physicists (NSBP, NSHP)
- Project Kaleidoscope (PKAL)
- National Science Foundation (NSF)
- APS Forum on Education
- APS Committees (Education, Women, Minorities, Careers)
- APS members, physics departments

The results of these conversations have brought together a number of ideas. The AAPT has identified this as a critical issue and has expressed interest in playing a significant parallel role. We see a drive to increase the number of physics majors as a multi-faceted approach with significant roles for the APS, AAPT, and SPS. To accomplish this we propose to work in parallel, with AAPT providing leadership in the K-12 and community college level, SPS leading initiatives aimed at their members, and APS taking the lead on tasks associated with faculty at colleges and universities. In each case, this would rely on traditional strengths of these organizations.

Finally, there are various recommendations on how to proceed on key ingredients of these issues. Perhaps the most compelling was a joint AAPT/AIP/APS study completed in 2003 by the National Task Force on Undergraduate Physics. Their report, “*Strategic Programs for Innovations in Undergraduate Physics*” (SPIN-UP)⁴, provides concrete suggestions on how to proceed.

THE ACTION. A goal as significant as this will require actions on a number of fronts. One way to break this down is to focus on areas where there are significant shortfalls, and consequently opportunities. Two areas of substantial shortfall include underrepresented groups (minorities and women), and supply of highly-qualified secondary physics teachers. Further, there is considerable “carrying capacity” available in college and university physics departments¹. Increasing the enrollment in these institutions can improve the vitality of these departments as well as the quality of the educational experience for students by reducing isolation and building a community of learners within the discipline. This is especially true in smaller physics departments.

Department Type ¹	Average Degrees per Department	Median Degrees per Department	Number of Departments	Degrees (2004-2005)
Bachelor - granting	4.1	3	513 (67%)	2126 (42%)

⁴ <http://www.aapt.org/Projects/upload/SPIN-UP-Final-Report.pdf>

Masters - granting	5.6	5	66	(9%)	379	(7%)
Ph.D. - granting	14.0	9	185	(24%)	2608	(51%)
Total:			764	(100%)	5113	(100%)

Considering increases to an average of 8, 10, and 20 majors per year from each of the Bachelor, Masters, and Ph.D. level institutions respectively, would produce about 8500 graduates per year. Most institutions would find these numbers well within their capacity.

Our first step should be to capitalize on existing resources, and help disseminate successful programs. Some examples of actions that the APS could take are included below. These are suggestions made by APS committees that were charged this fall with providing suggestions of how to proceed on an initiative of this type. Further discussions are planned, and this list is meant as a starting point for suggested actions and to frame the type of activities APS could pursue to further this goal.

- Re-package the SPIN-UP (and other key) document and send key suggestions on a regular basis to chairs and faculty members.
- Create a pamphlet / web-site aimed at department chairs and deans to debunk stereotypes commonly associated with increasing minority representation within the department or school.
- Create documents (electronic and paper) aimed at high school students and their parents, emphasizing career options, salaries, and courses of study that will lead to STEM degrees (a brochure / web-site aimed at minority students is already underway in this effort).
- Create recruiting fair materials (pamphlets, posters, etc.) for use by departments to help them reach out to prospective students.
- Pair up high school teachers in minority-serving districts with speakers from APS’s minority speakers list.
- Work with SPS to expand the presence of students at APS meetings.
- Endow or fund scholarships for women or minorities who want to teach high school. APS might also apply for an NSF Noyce grant that would be distributed nationally, and focus on physics teachers. These grants fund up to \$10,000 per year for two years for students who then go on to teach in high-need districts. They often do not reach many physics teachers, as the numbers are too small at any one institution to guarantee enough applicants.
- Strengthen our speakers lists with more non-academic speakers to emphasize the variety of possible careers, emphasizing careers pursued by bachelor degree recipients.
- Launch a second round of site visits similar to those that produced the SPIN-UP report, but focusing on women and minorities (one such task force has just formed to focus on historically black colleges and universities).
- Develop a self-study guide for departments that would include concrete suggestions of how to improve the number of majors while keeping quality high.
- Develop a program of outreach through museums that would link exciting demonstrations with practicing physicists.
- Hold workshops on the introductory course (a number of these have been done, but the need to address this critical course remains high) with emphasis on proven pedagogical as well as structural solutions to providing a course that is enticing, challenging, and leads students along a natural path to discover more of the discipline. Similar ideas can also be spread to upper-division courses.

- Re-initiate the Local Physics Alliance program from the early 90's that brought local high school teachers in contact with university physics departments. Many of these alliances have built lasting relationships between university faculty and teachers that exist to this day. Because of inevitable turnover of both faculty and teachers, this could be an on-going venture to build bridges between these two communities.

MOVING FORWARD. This is a preliminary outline of our thinking on this issue. We continue to be in close discussion with AAPT leadership and other organizations on this. We expect to come forward in the near future with recommendations of specific budgetary requests. For now, we welcome commentary and thoughts about the initiative's directions and goals.