FORUM PHYSICS AND SOCIETY

Report from VI Forum for Physics and Society
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European Physical Society
more than ideas

IMPROVING THE IMAGE OF PHYSICS

The Forum Physics and Society (FPS) of the European Physical Society (EPS) aims to support a more active EPS role in the relationship of physics to society, taking seriously the challenge of maintaining a strong and critical dialogue between physicists and decision makers. Workshops and meetings organised by the FPS bring together decision makers and physicists to discuss issues related to physics and society.

EPS Report

Improving the image of physics will:

- Increase the support for physics research funding through increased appreciation of physics among the public and politicians;
- Increase the contribution of physics to the economy through increasing the number or physicists using their skills in the workforce;
- Increase the numbers wishing to study physics which will ensure sufficient students entering physics departments and therefore future skills supply to universities and businesses.

Recommendations for EPS:

1. Enhance the status of physics teachers:
   - **a.** Instigate national awards for physics teachers with media coverage.
   - **b.** Ensure teachers of physics receive a bonus/salary premium to demonstrate their value to society.
2. Enhance the employability of physics students:
   - **a.** Instigate national schemes of summer workplacements/ internships for physics undergraduates with employers paying half of the cost in the first year moving to covering full costs in subsequent years.
   - **b.** Develop a Careers in Physics initiative (including on-line information and '101 jobs in physics' posters sent out to schools) to demonstrate the range of careers available to physics qualified people with training for teachers and lecturers in understanding the careers available.
3. Enhance the profile of physics including greater visibility on main stream media:
   - **a.** Nominate a 'Physics Week' within the year
     - i. Schools and universities incentivised to put on physics events.
     - ii. TV and radio encouraged to cover physics events.
   - **b.** Festival organisers encouraged to have physics 'stalls' at events.
4. Undertake a scoping exercise of all the good practice examples for teaching or enhancement activities and careers or employability activities that are available in each country and publish on-line.

RECOMMENDATIONS FOR BROADER CONSIDERATION FROM EACH THEME WORKSHOP.

Recommendations from Workshop Theme 1: Improving the image of Physics with students.

Physicists can improve the image of physics with students by working with teachers and with parents as well as through direct activity with students themselves.

Why improve the image of physics among students?

- To increase the number of students studying physics.
- To increase the number choosing to remain in physics research or careers to satisfy demand from employers.
- To enable the economy to benefit from physicists' skills
  - Increasing the impact physics has on real life, through objects, jobs, economy.
  - Increasing contribution of physics to society, eg electricity, technology, *etc.*

Recommendations for policy makers:

- ***Improve the quality and status of physics teachers:***
  - Rebrand the teaching profession to make it prestigious - elevate the image of teachers, making teaching profession "cool".
  - Identify methods to recruit the best and the brightest into teaching.
  - Educate teachers so they can teach through active engagement methods not just by lecturing.
  - Provide on-going professional development and support for those teachers who teach students through carefully thought through inquiry.
  - Put effort into familiarizing teachers with the findings of physics education research.
  - Provide more support, awards, recognition to the teachers.
  - Help teachers stay in the profession by providing an on-going support and creating communities of professional practice.
  - Attract good physics teachers to teach science (physics) in primary/elementary school.
- ***Improve the physics curriculum***
  - Support development of curricula that are based on recommendations of physics education research and have been tested in the classroom and engage students

into constructing their knowledge as scientists (*one example is ISLE by Etkina and Van Heuvelen*).
- support mechanisms for integrating new physics into education (*one example is Gorazd Planinsic and Eugenia Etkina s work on LEDs*).
- both in school and university incorporate inquiry into learning.

Recommendations for universities:

- ***Refocus universities on the importance of teaching***
  - refocus universities on teaching (see the example from Great Britain). The focus on research makes us forget about the real purpose of universities - education of the public. Such focus led to the shortage of teachers. We need to send the message that teaching should be as important or maybe even more important than research.
  - change the attitude of professors who think that the brightest students should go into research not into teaching.

Recommendations for practitioners:

- ***How to engage students***
  - provide opportunities for the students in schools and universities to be actively engaged in learning as opposed to listening to lectures and to engage in scaffolded inquiry (not uncontrolled manipulation of equipment but carefully thought-through activities).
  - help students keep their curiosity alive!
  - focus on making geeks popular ("geek pride").
  - give students new heroes – scientists.
  - simplify complex concepts without using rigor.
  - provide career education for the students (UK STEM ambassadors program for example).
  - have more TV shows about scientists and humour (Big Bang Theory, Science Club, Brian Cox).

- ***Recommended examples of good practice for teachers:***
  - include projects and experimental design into learning, include results/products that students make to attract other students (*for example transforming CDIO project ideas from engineering to physics from Ramon Bragos' presentation; Project Lab by Gorazd Planinsic, Eugenia Etkina's work on engaging undergraduate student in experimental design in the instructional laboratories*).
  - use school environment and the surrounding environment as areas dedicated to physics (*for example 3-Dimensional school approach to curriculum as suggested by Mirjana Bozic*).
  - devise curricula that promote curiosity (*ISLE again is just one example but there are many others*).
  - engage students in complex problems that do not have only one right solution (*these can be multidisciplinary, water project by Stevan*).
  - provide preassembled equipment (*for example "Marie Curie box", Piotr*).

Recommendations from Workshop Theme 2: Improving the image of physics with employers

Physicists can improve the image of Physics among employers by working collaboratively with them throughout the educational journey.

Why engage employers?

- To improve employability of students.
- To enable the economy to benefit from physics experts:
  - Increasing the impact physics has on real life, through objects, jobs, economy.
  - Increasing the contribution of physics to society, eg electricity, technology, *etc.*

Recommendations for policy-makers:

- ***Increase the employability of physics students***
  - Provide funding to enable employers to engage actively with universities and their students through workplacement/internship schemes.
  - Provide funding for pairing schemes/fellowships/secondments to encourage closer links between academic scientists and employers including.

- ***Increase careers knowledge amongst lecturers and teachers***
  - School teachers to be required to attend CPD training where they meet practicing scientists/engineers from business.
  - School teachers to undertake placements in science or engineering businesses during vacations every 2 years.

Recommendations for practitioners:

- ***How to engage employers?***
  - Set up employer liaison boards for physics departments in universities to understand what employers are looking for.
  - Arrange business breakfasts to bring businesses together with academics so that they can see the research taking place and see opportunities to take it to market.
  - Set up schemes organising workplacements/internships

for students during vacations (*for example UK SEPnet scheme – see presentation*).
- Set up visits to business premises for students as part of degree or school courses for example SEPnet).
- Set up student experimental projects based on ideas provided by employers.

- ***Good Practice recommendations for engaging with employers***
  - invite employers to give guest lectures, either on physics or on employability/careers issues.
  - 'speed networking events' for employers to meet students whom they may want to employ.

Recommendations from Workshop Theme 3: Improving the image of physics with the public, engaging non-specialists

Physicists can improve the image of Physics among non-specialists, including the general public, families, politicians, policy makers and decision makers, by engaging with them in their space (rather than relying on them coming into scientific or academic spaces).

Why engage non-specialists?

- To gain public support for future funding in physics.
- To enable the public to contribute to policy decisions including decisions on funding for physics research by:
  - Increasing the public understanding of the impact physics has on real life, through objects, jobs, economy.
  - Increasing public appreciation of the contribution of physics to society, eg electricity, technology, *etc.*
- To ensure that physicists are accountable for their use of public funding.

Recommendations for policy-makers:

- ***Increase the visibility of physics in the media:***
  - Encourage mainstream media to include science in programming. Physics is often seen as separate from general culture that most people access. Currently, most young people use social media and Internet resources to access information and to socialise. These trends change rapidly and it is difficult to be responsive to quick changes.
  - Encourage closer links between scientists and the media, including funding for pairing schemes/fellowships, training, qualifications in science communication and science journalism.
  - Provide shorter term funding processes to support embedding physics in new technologies.

- ***Monitor public attitudes to physics across the EU to identify good practice in improving public attitudes:***
  - Use surveys to ensure there is an understanding of current public perception of science. Results from the UK Public Attitudes to Science survey (IPSOS MORI, 2014) showed that science is viewed as important and relevant. However, there remains a perception of what a physicist is and looks like which needs to be addressed.
  - Establish time in the science curriculum for visits to science institutions.
  - Establish programmes to place practicing physicists in classrooms in a supported way to allow more pupils to meet scientists. This would need to be carefully managed as a bad experience can do significant harm. (for example UK STEMNET Ambassadors scheme).

- ***Ensure policy is based on evidence and not on the power of lobby groups.***
  - Physics is increasingly needed to inform policy, as we move towards an information economy.
  - Policy makers with a scientific background should take a lead on scientific issues.
  - Programmes to initiate better links between scientists and policy makers could be used to support decisions making, eg MP-scientist pairings (Royal Society, UK).

Recommendations for practitioners

- ***How to engage non-specialists***
  - Engagement is carried out by a number of people, including practicing scientists and professional communicators.
  - All communicators should have appropriate support and training as well as professional recognition and reward *e.g.* promotion (*for example UK Manifesto for Public Engagement*).
  - Events should move away from academic locations to reach people where they naturally are, such as the street, festivals, *etc.*
  - Research institutes etc should open their doors so that people can see what really goes on inside.

- ***Recommended examples of good practice for communicators***
  - Consider the target audience carefully
  - Focus on what is relevant to the target audience and then lead to the physics.
  - Use appropriate words so that the audience can understand
  - Use different approaches, eg emotional, art, theatre.
  - Improve communication skills of the teachers/researchers through professional training.

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