

## PART 2

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### A - SCIENCE CENTRES, SCHOOLS AND UNIVERSITIES

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#### Discussion Workshop A Report

*Reporter: Richard Walton,*

*Centre for Science Education, Sheffield Hallam University, UK*

*DW Leader: Katarina Teplanova,*

*Schola Ludus, Comenius University, Bratislava, Slovak Republic*

#### 1. Introduction: the perspective of the group

It was clear from the outset that our group represented in microcosm the very diverse range of groups and individuals who have an interest in physics education and science communication. Alongside physics researchers were those involved in teacher training, specialists from the field of science communication and those working in museums and interactive galleries. Although it must be pointed out that these are not fields with hard and fast boundaries and that there is a degree of interpenetration and overlap between the interests and expertise of the participants. As a group the participants were able to bring to the discussion a wide range of insights and concerns.

The discussions were structured in the following way:

- An initial expression of the concerns of the group;
- An opportunity to define the ideal situation towards which Physics Education should be moving;
- A discussion of means of overcoming barriers to progress;
- The outlining of some practical actions for moving forward;
- The forming of a statement of *caveats* and principles that should inform policy.

#### 2. Concerns Identified by the Group

There was significant discussion of the social and cultural appropriateness of Physics communication. The strong case was made that physics has an important role to play in society. Alongside the utilitarian value of physics and the physical sciences the point was made that an understanding of physics is as much part of our cultural heritage as are the arts. Newton and Einstein are seen as important figures of high culture who should be regarded as on a par with Shakespeare and Goethe. But the point was also made that physics should be presented as part of general popular culture in ways that made it inclusive for the public. This means that there needs to be an engagement between the world of physics and the world of popular culture through media such as: dance, music and drama. Indeed within the group the fundamental point was expressed that any formal learning should begin with informal experience.

The group returned to the oft-expressed view that there is a problem with the image of physics and of physics related careers: it is viewed as male, middle class and difficult. Many of the images portrayed in the media of physicists represent them as eccentric and ill-

socialised individuals working on projects of baffling complexity. There was also expressed the view that some university physics departments rather like to shelter behind this image as a means of preserving their status. It was clear from the discussions of the group that children need to be influenced at an early age with regard to forming their attitudes towards physics but that this attitude change needs to go hand in hand with building better partnerships between the physics community and sources of informal education including science centres.

The concerns of the group centred upon the complex nature of the relationship between learning in informal settings and the formal world of physics research and physics-based industry. In particular the need to provide an appropriate role for evaluation in this process was emphasised as a means of providing objective evidence for the effect of learning in informal situations upon transition to formal education. The point was made that science centres and other informal activities can provide a powerful critique of the way in which physics is often taught in schools. It is necessary therefore not just to influence the attitudes of children and parents but also those of science teachers – a process which might involve the introduction of new educational methods into mainstream education. The difficulty of this latter task was stressed by the group since it was felt this would require some science teachers to work outside their ‘comfort zone’ in embracing new approaches.

### **3. Defining the Vision**

Discussion within the group shifted to trying to identify an ideal scenario as an end point towards which the process of physics communication would aim. This was a useful discussion in that it enabled the participants to identify what they really saw as the important features of effective science communication and of good relationships between science centres, schools and universities. The discussion inevitably grew out of the concerns that had been raised previously but it generally painted a picture of effective and dynamic communication between partners working towards common goals.

Central to the vision was the view that physics formed part of mainstream culture in which science communication started with the young. But the point was made strongly that the means of communication should be inspiring in itself. To emphasise this aspect the group was introduced to the Faroese notion of *Eldsál* - which means ‘the heart is on fire’ - as a measure of the commitment and skill of those who communicate physics to the public. This was seen as countering some of the public perceptions of physics as a dry and difficult area of academic study.

In an ideal world, of course, there would be such a commitment to physics education that science centres would enjoy the support of government and industry. This was expressed not simply as a vain hope but as a way of expressing the current lack of support felt in some areas. There was also the view expressed that commercial pressures can act to draw science centres away from their central educational rôle towards a situation in which their work is seen as subservient to promoting the products or services of sponsors. The ideal situation was viewed as one in which physics communication would be seen as significant enough in its own right to deserve central support on a sufficiently long-term basis in ways that would enable effective strategic planning to take place.

Of course, in discussing the relationship between the informal and formal sectors, the point was made that the major influence upon science education are classroom teachers. The comment was made that these teachers should be ‘relaxed and happy’. This sounds like a superficial remark but it relates to the deeper issues of uncertainty and stress faced in the

classroom. The introduction of new approaches – however desirable – can be viewed either as a threat to current practice or as a means of provoking increased workload. The view was expressed that, if the relationship between schools, science centres and universities was right then teachers would themselves be happy to participate in the process. Indeed, this triangular relationship was seen as symbiotic with each partner benefiting from being involved with the other: schools would become more motivating places with access to contemporary ideas in physics; Science centres would have increased numbers of visitors with access to the physics community for support and advice; universities would have an increased supply of well-motivated students with a better understanding of the purpose of their research.

The discussion also wanted to place science centres into a wider network of informal science providers and activities. In part this reflected the general desire for physics to be seen as part of the mainstream culture but also recognition that informal learning takes place in a wide variety of settings and situations of which the interactive centre is a part. There would be dialogue between each of the participants sharing ideas as equals which would serve to prevent science centres being seen as an interesting, but rather unusual, sideline for physics education.

#### **4. Overcoming Barriers**

In trying to realise the ideal situation outlined above it became clear that a number of practical actions need to be taken. In the main these are actions that could be taken immediately as stepping-stones towards improving the general level of physics education. The use of good rôle models was seen as key element in addressing many of the image problems beset by physics. This means that young people should be used to challenge some of the stereotypes of physics. It was suggested that the best mentoring relationships do not normally have an age difference of more than 7 years and that rôle models themselves should be chosen to be culturally relevant.

The relationship between teachers and universities was also discussed. In the main it was felt that more collaborative working practices should be adopted between universities and schools. There was felt to be some reluctance on the part of teachers in asking questions for fear that they may be seen as saying something that was perceived as inappropriate or irrelevant. What was stressed was the belief that the authority of the university could be used to validate the questions asked by teachers. This may require a change in approach in some university departments to build up the confidence of the teachers with whom they work.

Schools themselves were felt to have a part to play in establishing a more active approach to promoting physics. To this end it was suggested that each school should have an individual ‘physics champion’ who would have a responsibility for promoting links between the formal and informal sectors. In this way it was hoped that schools would engage strongly with physics promotional activity whether this took place within the curriculum, in university or in the science centre. In saying this, the point was made that it would be unreasonable to expect teachers to do such a job without giving them appropriate support. In particular the effective use of science centres by teachers requires preparation before the visit as well as the provision of appropriate supporting materials.

#### **5. Moving forward**

It is clear from the comments of the group that a number of practical changes need to be made to the ways in which schools, universities and science centres work together if the

physics community as a whole is to benefit. The main recommendation is that there should be more effective links between each of the partners but for this to happen there needs to be a modification in attitudes and in structural relationships. Currently there exists a hierarchy in which universities stand at the top of the structure and feed down to schools within the formal education system who then interact with science centres as places offering an informal quasi-educational / quasi-entertainment experience. What is suggested is that a more democratic, horizontal structure should exist where each participant is seen as having equal status.

The effect of this suggested re-alignment is that each party can more easily understand – from a position of enlightened self-interest – that they are working to the mutual benefit of all because each has an important part in the process. Of course this also requires those taking part to modify their working practices. In the same way that universities can act as a forum for disseminating ideas at the forefront of research, so the science centres and schools can offer support to researchers in developing their communication skills.

## **6. In conclusion**

It is clear that the group felt that there is enormous potential in developing more effective links between schools, science centres and universities but that for these links to be effective there need to be changes both in working practices and relationships. It was also felt that there needs to be a further systemic change in attitude amongst those who are in positions of influence in government and universities.

The first change was one of attitude: physics communication should be accorded the same parity of esteem as research. This has enormous benefits particularly for academics who work to promote the wider public understanding of physics. At present this is often seen as an ancillary or voluntary activity subordinate to the main work which is physics research. However, the case has been made that science researchers and science communicators co-exist in a symbiotic relationship in which each is needed for the other's well-being.

Similarly, recognition should be given for physics communication work within the academic structures and career paths of universities. At present little recognition is given for promoting the public understanding of physics and, indeed, in some cases it has been viewed as a diversion away from the central academic task of physics research and mainstream teaching. A better understanding is required by the physics community as a whole of the importance of physics communication as a cultural tool for disseminating the products of research but also for recruiting the rising generation of researchers.

Clearly such change will not take place without the support of those in positions of authority. In universities and schools this means that rectors, deans, directors and heads of department need to be convinced of the need for more effective physics communication. For Science centres it means that there should also exist an appropriate career structure offering rewards and progression that is on a par with work in the formal education sector.

Finally, physics should never be viewed in isolation. It was the strong view of the group that the social, cultural and economic importance of physics should be stressed and that this should act as the spur to ever closer working between schools, universities and science centres.

Dr Richard Walton

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