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chemistry they want to
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with professional
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scientific issues*

The Genesis of an Adult Education Programme in Science

Abstract

Science and technology are now part of our everyday lives, and their impact will undoubtedly continue to grow in ever more sophisticated and subtle ways. Inevitably, this will lead to debates and controversy about the ethics and risks that science brings with it; debates in which the general public should be fully engaged. But many adults inevitably feel alienated from any involvement in such a debate because of their lack of scientific knowledge. There is a very urgent need to engage not only young people but also more mature adults in scientific discussion at levels that are both meaningful and serious. In Newcastle we are developing an adult science education programme which brings together local adult education providers, universities and industry to supply a cohesive series of short events which not only allow adults to learn and engage with contemporary science (and how it impacts on their everyday lives), but also offers the opportunity to progress to more advanced courses leading to formal qualifications. In this article we outline the development of this programme which was greatly assisted by the appointment of an 'Adult Education Fellow' (funded by The Higher Education Academy Physical Science Centre). Over the course of one year the Fellow established the consortium, identified what the detailed demand was, prepared the course and raised funds ready for its start in 2006.

Introduction

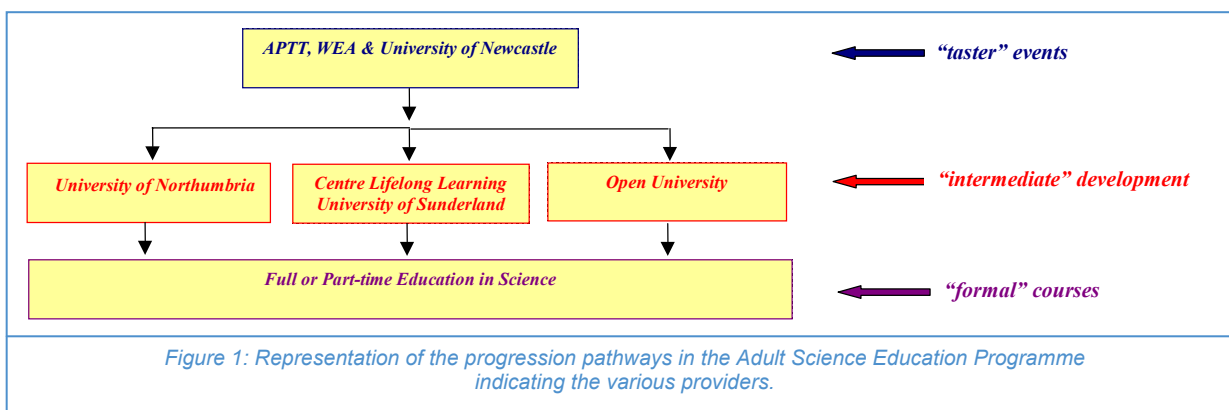
Since about the middle of the last century the picture of the benevolent, absent minded, scientist has been replaced with a more demonic image. Issues such as nuclear weapons, pollution, global warming, genetically modified foods and stem cell research have over the last 50 years been taken up by the press highlighting the dangers of science to society. There is a growing concern about the way in which science is perceived by the general public. It is clear that the science is becoming more sophisticated and raising issues of concern to the public. But many adults feel unable to make a judgement about articles in the media; for the majority this is because they have only a rudimentary understanding of science that they learnt at school many years ago, and for some no knowledge of science whatsoever.

Scientists need to enter into a meaningful dialogue with the general public to present the impact of their work on society today and dispel the 'boffin' or Frankenstein image of scientists which has been presented. A great deal of effort in Public Awareness of Science has been targeted at school children. In contrast, science education for mature adults has been grossly neglected, despite the fact that this group is exposed to current scientific issues on a daily basis when reading newspapers or listening to radio and television. Many adults are enthusiastic to learn more about science but feel they are being left behind in the technological world. In Newcastle we are developing a Science Adult Education Programme (REACT – Rudimentary EducAtion in ChemisTry) which presents one aspect of scientific development within the reach of most adults: chemistry. REACT emphasises the importance and pervasive nature of chemistry and related sciences in the world today, specifically targeting a mature adult audience who have only rudimentary scientific knowledge. We believe that, to be successful, this programme needs to involve adult education specialists working together with university-based chemists. Thus a group comprising members of the Association of Part Time Tutors (APTT), Workers Educational Association, Newcastle upon Tyne Branch (WEA) and the Chemistry Department at the University of Newcastle (NCL) originally conceived an approach which has now expanded to include a variety of other providers. This article describes our preparations for starting the programme and how it developed from a series of 'taster' events, to involve a consortium of educational providers and industry, supplying not only introductory scientific material and experiences suitable for the general public but also providing pathways leading to more advanced courses and qualifications.

Since the last war, the post-compulsory sector (comprising what is now loosely termed 'adult education' plus the FE colleges and university-provided HE access) has been responsible for the scientific training of adults in the period after their 'compulsory' education. That this has largely been 'remedial' in strategy is not surprising; colleges tend to mainly provide what the labour market demands, which in the vast majority of cases is GCSE and A-Level provision allowing adults to make up for ungained qualifications at school. Outside this remit, FE college courses involving pure science of any sort are thin on the ground, and have been for some considerable time. Adults are reluctant to take up study unless it either provides a pragmatically useful qualification, or adds to their hobby interests. FE courses, being targeted to qualifications, do not allow the flexibility to encourage the background discipline of scientific thought in the broadest sense. Syllabi tend to specialise in 'must know' theory and practice, which often deters the stimulation of casual enquiry. Consequently, most general scientific education for adult laypersons who are not intending a science career has fallen to HE extra-mural departments (for example, Sunderland University Centre for Lifelong Learning at Newcastle, CLL) and adult and community learning bodies such as WEA, APTT, etc. Government financial support for all of these however has been meagre.

allowed progression from these non-accredited events to certificated study at foundation HE, or into related areas of technological study offered by APTT (Association of Part-Time Tutors). The overall message this experience brings is that once adults have been suitably enthused and their confidence raised, then there can be a demand for growth of serious scientific training. However, it is fostering this initial state of enthusiasm (in effect, forming a 'community of practice') which is fundamental to defending scientific knowledge amongst laypersons.

When first developing a Science Adult Education Programme the initial objective was simple: to supply 'taster' events lasting only a couple of hours, where participants would not only be presented with the salient facts pertinent to selected contemporary scientific issues, but also have the opportunity to discuss the issues as they saw fit. To this day, these remain the project's principal objectives. But on further reflection, achieving these goals required the presentation of a cohesive series of such 'tasters', all with the common theme of science. Furthermore, there were two other features necessary to raise the educational credibility of the programme. First, that the participants experience working in a laboratory. This will allow participants to have a greater appreciation of the ways scientists operate and how hypotheses are proposed and



Subsidising what has often been characterised as 'leisure' learning has been politically unpopular, and hence declining funding has pushed up the cost of all non-FE provision. This increasingly market-led environment has led to fewer adults trying out new and unfamiliar topics, such as science.

Initial Objectives

Even with declining funding, adult education providers have tried to encourage scientific study. The WEA Northern Region has a long tradition of offering non-accredited accessible introductory courses and Day Schools. Recent 'Days' on even supposedly 'difficult' topics such as quantum mechanics and cosmology have attracted substantial attendances (15 to 18 students per course), which indicates that, given the right presentation level and teaching style, it is possible to enthuse adults about even the most esoteric of scientific concepts. WEA Newcastle upon Tyne Branch was willing to chance its arm by funding what seemed thorny science subjects, and encouraged the tutor concerned to promote science as part of existing courses in history of ideas and philosophy. Due to confidence in the WEA method of learning, adults were willing to take on board these initiatives – with the pleasing outcome described above. In addition, the WEA's links with CLL

tested by experiments. Secondly, to provide further support and more advanced courses for those participants who were sufficiently enthused by the 'taster' events. The educational process necessitates that enthusiastic participants should have an outlet for their increasing enquiry, and potentially could take progressively more advanced study. This required the involvement of other adult education providers.

Development of the Programme: Involving other Education Institutions and Industries

The funding from The Higher Education Academy Physical Sciences Centre allowed appointment of an 'Adult Education Fellow' (Dr Sundus Henderson) who spent 1 year developing the Science Adult Education Programme. Thus, after a series of meetings, the following institutions became associated with the programme: Centre for Lifelong Learning, University of Sunderland (CLL); University of Northumbria (UoN); Open University (OU); Procter and Gamble (P&G) and Centre for Life, Life-Lab (LL). Thus, APTT, WEA, NCL, P&G and LL will be involved in presentation of the 'taster' events, whilst CLL, UoN and OU already offer a few more advanced science topics which would be suitable for those participants of the 'taster' events who wish to continue their studies.

Question	Summary of Responses
(1) Please tell us about any science learning you have undertaken in the past.	There was more interest from those who had previously done more than one science subject. 97% of replies studied at least one science subject in a structured setting but only 29% of those were actually interested in the subject and only 58% obtained a qualification.
(2) Please tell us if you would consider taking part in courses/ discussions/ experiments to discover the truth and myths behind the following subjects, in the next 3 years.	The most interest was shown in 'Medicinal Plants' and 'Food and Risk'. Other popular topics were 'The West's Fuel', 'Genealogy', 'Understanding Evolution', 'Water', 'Weapons of Mass Destruction' and 'Jewels from the Earth'.
(3) How do you like to learn?	Attending a talk/lecture is the most favoured method of learning followed by group discussion. Computer related learning scored low maybe due to the fact that most scientific learning requires observation and demonstrations of experiments.
(4) Please tell us which of these statements you agree with. (Statements about importance of science and preferred learning patterns).	91% agreed that science is part of life long learning; 88% like being with other learners; 81% agree that chemistry forms the basis of most of their households; 68% agree that learning chemistry is easier if it relates to their lives; 66% prefer to learn at set times each week.
(5) When do you learn best?	78% prefer learning in the morning which could reflect that most applicants are economically inactive (retired/unemployed) or have flexible working hours.
(6) What stops you from learning about science?	Work commitment (47%) was the major barrier to learning.
(7) How far would you be prepared to travel to take a course?	63% of applicants do not mind travelling 7-10 miles to attend a learning event.

Table 1: Summary of the Responses to the Questionnaire.

Furthermore, the involvement of a recognised multi-national industrial company, such as Procter & Gamble, exposes the participants to the industrial and commercial side of science leading to a broader appreciation of how science impacts on their everyday lives. By working together, the assembled consortium can offer provision in chemistry and related sciences, and additionally enable educational progression for adults across the whole range of scientific subjects. The participants of the Science Adult Education Programme can gradually build participants' scientific knowledge and with it their enthusiasm and confidence to (if they wish) re-enter full or part time education with the aim of obtaining formal qualifications in science. The range of provision offered by the consortium is illustrated in Figure 1.

Delivering what is Wanted.

In order to establish what aspects of science the adult public are most interested in attending and how they would like to be taught, a short questionnaire was constructed which contained seven general questions with a selection of tick boxes for answers.

The full questionnaire can be found on the REACT web site at www.REACT.no-ip.com, and the key findings are summarised in Table 1. The responses to the questionnaire guided our design of the 'taster' events which are shown in Table 2.

'Taster' events principally comprise 2-3 hour workshops in which participants will learn about science through presentations, demonstrations, debates and discussions on selected topics. However, 'taster' events will also involve visits to university laboratories (University of Newcastle) to experience 'hands-on' practical chemistry and industrial laboratories (Procter and Gamble) to experience industrial chemistry. In addition, The Life Lab (LL) currently runs short introductory courses on topics such as Forensic DNA for the general public which are suitable for the participants of the 'taster' events. By offering a wide range of short courses and lecture/demonstrations we allow the public to choose which aspect of chemistry they want to learn more about, and participate in discussions with professional scientists about controversial aspects of chemistry and related scientific issues. Many of the topics in the adult programme have been chosen particularly to attract women.

Theme Title	Title of Taster Event	Brief Summary
The West's Fuel	Weapons of Mass Destruction (WMD) – What are They?	A look at the science of WMD emphasising the early history of chemical weapons.
	The West's Fuel	Petroleum refining – the antecedents, the chemical processes and political implications.
	Food and Risk	A look at genetic modification of food and the perceived risk to the public.
	Drugs and Sporting Achievement	How the body functions at the chemical level and how this might be enhanced.
Summer Events	Poisonous Plants – from Magic and Murder to Medicine	In collaboration with Alnwick Gardens Poison Plants display. The role that plants have played in medicine, including some contemporary uses of plants.
	The Laboratory Experience	An afternoon in which participants will perform selected chemistry experiments.
Earth Matters	Give me Sunshine: How the Sun Shines and Where the Chemicals of Life were Made.	How the Sun maintains its output of energy and created carbon and oxygen and other elements.
	Jewels from the Earth	A look at the origin of gemstones; their chemistry and the creation of jewellery.
	Chemistry and Cosmetics	The way chemistry is used to improve our looks and smell.
	Understanding Evolution	Examination of how life has arisen and is maintained by chemical processes.

Table 2: Summary of the Taster Events

The Next Stage: Presentation of 'Taster' Events

In the first instance we are offering 'taster' events in central Newcastle, North Tyneside, Gateshead and South Tyneside, especially focusing on areas where adult education is generally neglected or under-supported. This has been made possible by the award of an Engineering and Physical Sciences Research Council (EPSRC) Partnerships for Public Engagement grant. We will use a combination of local venues around the area. The first series of 'taster' events were held in the CLL which is situated in the centre of the city.

There will be an emphasis on familiarising adult participants with university life and 'hands-on' experience in chemistry. Advice and guidance will be given by the tutors to help participants further their scientific knowledge. Courses on more advanced science topics are already offered by CLL, UoN and OU. For example, the 'Science and Environment' programme of CLL contains courses which link in very closely to nearly all of the 'taster' events. Discussions with CLL have resulted in CLL planning new courses for 2006 to provide

opportunities for participants of the 'taster' events to progress into more in-depth, HE level courses. The OU currently offer broad-based science courses, such as, 'Another Breakthrough in Mathematics, Science and Technology' (Y155) as well as more focused courses, such as, 'Food and Health – A Chemical Story' (S191). The UoN offer courses entitled, 'Chemistry, Plant Biology and Ecology, and Sports Science'.

After local piloting we anticipate that the programme will be expanded to national level, given suitable resourcing.

Acknowledgements

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