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CHEMISTRY INREACH: UNIVERSITY EMPLOYEES' CHILDREN EXPERIENCING UNIVERSITY CHEMISTRY

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Abstract: Many university departments provide public engagement activities, often referred to as 'outreach' to school students, their teachers and other members of the public. It is less common for University Departments to run activities for their employees let alone the children of these employees. This paper looks at the value put on an engagement activity both by participating students and their parents who are employees of the host university. Analysis shows that the students welcome the opportunity to experience aspects of their parents' workplace and those parents are extremely supportive of such initiatives.

Key words: public engagement, inreach, chemistry, aspiration raising.

1. Introduction

The School of Chemistry at Bristol University, UK hosts the UK's Centre for Excellence in Teaching and Learning (CETL) in practical Chemistry [1]. This project, called Bristol ChemLabS (Bristol Chemical Laboratory Sciences) has as one of its aims the promotion of Chemistry through a major outreach programme with 27,000 -30,000 per year currently being engaged [2-6]. The aims of the outreach provided are to enthuse, excite, entertain, engage and educate participants. Where outreach activities are aimed at members of the host institution such as undergraduates, employees or their children the term 'inreach' has been applied.

The engagement undertaken here was a one day workshop comprising a 2.5 hour practical in the Chemistry undergraduate teaching laboratories, a tour of the department, a short lecture by a young Postdoctoral Research Assistant and finishing with a lecture demonstration.

2. Details of the engagement

Forty two students aged 14 to 16 attended the event. Groups of 10-12 students each had a postgraduate Chemist as a demonstrator. It is not often that school students have the opportunity to work with young professional scientists at such close quarters. In the UK, adults who work with students under 16 years of age (including all postgraduates and technicians) have to have a Criminal Records Bureau (CRB) 'police check'. Bristol postgraduate chemists involved in all outreach are CRB checked and are initially trained through a scheme (until 2009 was called the Science and Engineering Ambassadors (SEAs) Programme) now called the STEM[1] Ambassadors scheme [7]. Further informal training is provided by the Bristol ChemLabS School Teacher Fellow [8].

The experiment chosen was the extraction of caffeine from tea leaves as this uses solvents and equipment not normally used by school students under 17 years of age. The equipment and techniques used included filtration by Buchner funnels, use of electric heating mantles rather than by Bunsen burners, separation funnels for solvent extraction and vacuum distillation apparatus. The products were analysed by melting point and infra red spectroscopy where the students were trained to use the latest apparatus including diamond infra red spectrometers. The beauty of the experiment, is that it involves a natural product from which a common compound is extracted; there is no complex chemical reaction to be understood in addition to learning new practical techniques.

[1] STEM refers to the areas of Science, Technology, Engineering and Mathematics.

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After a lunch break the students were given a short tour of the department which included the research laboratories, departmental library, diamond synthesis labs, NMR centre and mass spectrometry unit. The afternoon session contained talks including; a short talk on 'The Chemistry of Toothpaste' given by a young researcher (who is nearer the age of the students than majority of academics) and a lecture demonstration entitled 'A Pollutant's Tale'. The latter involves demonstrations involving liquid nitrogen, dry ice and a few minor explosions linked through the chemistry of atmospheric pollution and climate change [9].

The whole day was designed to show the students what it would be like to be an undergraduate science student in that it was a mixture of practical work and lectures. Similar events had already been tried and tested having been successfully run with similar age students on several occasions. The event was advertised with an email to all university employees and a follow-up article on the university's news pages [].

3. Findings & Analysis of Participants' Feedback

Forty-two children provided feedback via questionnaires administered at the end of the day. A questionnaire containing several Likert-style was used (Table 1) to gauge the level of enjoyment. The mean enjoyment rating was 4.3 out of a maximum of 5. Having fun is important but it is also desirable that the students gained intellectually from the day. Table 2 suggests that the students themselves recognised that they did learn from their experienced; a mean of 3.9 (maximum 5) suggests that they learnt quite a lot. The promotion of chemistry is of national importance to many countries. This event was able to do this. One parent reported of his daughter 'She was very enthusiastic about the day and came home full of all they'd done and keen to go to University, which I'm not sure she'd really thought about much before!'. Responses (Table 3) show that the day did have the effect of raising interest in chemistry with 83% of participants (mean score 4.1). It was not possible to know whether the 7 students expressing 'no change' may have already been keen chemists or still disliked the subject.

Table 1: *Responses to the question to participants 'How much did you enjoy today's activities?'*

Response	Frequency
A great deal (5)	17
Quite a lot (4)	21
Somewhat (3)	4
Very little (2)	0
Not at all (1)	0

Table 2: *Responses to the question to participants 'How much did you learn from today's activities?'*

Response	Frequency
A great deal (5)	7
Quite a lot (4)	25
Somewhat (3)	9
Very little (2)	1
Not at all (1)	0

Table 3: *Responses to the question to participants 'Has today had an effect on your interest in the subject of chemistry?'*

Response	Frequency
Much more interested in chemistry (5)	13
A little more interested in chemistry (4)	22
No change in interest in chemistry (3)	7

A little less interested in chemistry (2)	0
Much less interested in chemistry (1)	0

The responses to an open-ended question as to what they enjoyed about the day were coded & categorised (Table 4). There was a spread of responses to identified individual activities such as the lecture demonstration or practical work or specific parts of these activities. One third of the students' responses reported that the enjoyment was the level of individual participation i.e. the hands-on practical work.

Table 4. *Responses to the question to participants 'What did you like about the activities you took part in today?'*

Category	Frequency
Particular named activities during the day	19
Certain aspects of individual activities	16
Amount of participation/involvement	13
Enjoyment	6
Personal development	4

4. Findings & Analysis of Parents' Feedback

All parents (or guardians) of participating students were contacted and twenty-six parents provided feedback. The parents were contacted shortly after the event via email. The parents' email addresses were readily available as they had originally been in communication about the visit through that medium. Seventy-four percent of the students' parents were from Science or Engineering departments (Table 5). Perhaps this reflects the parents' desire to encourage their offspring to follow in their footsteps or simply to support their children's education as the science is compulsory until sixteen years of age in the UK.

Table 5: *Parent's faculty or section at the University of Bristol*

Faculty	Frequency
Science	10
Medicine and Dentistry	10
Medical and Veterinary Science	8
Support Services	7
Engineering	3
Social Sciences & Law	2
Arts	2

The parents paid a nominal charge per student towards the full economic costs of providing such a day. The encoded responses to a question as to why the parents had wished to enrol their students for this event are in table 6. The majority of these were to support their child's studies, interests and confidence in science and to help with future decision making.

'*To give an idea of what happens in a University in general, and because Chemistry in particular is an almost certain A-level [a pre-university course] choice for my daughter and a potential first degree subject.*' Parent.

'*I think it's terrific that these days are arranged and my niece's enjoyment of the day is testimony to how good it was. Thank you to everyone who helped make it a success.*' Uncle.

Table 6: *Coded responses to the question 'What were your reasons for nominating your child to attend the chemistry day?'*

Category	Frequency
Help child with their studies.	15

Their child would enjoy/interested in subject.	13
Give their child experience of science/university.	11
Encourage interest / confidence in science.	7
Help their child with decisions (i.e. future subject choice or university entrance.	1
Improve on their child's current science education.	1
Aid their child's social skills.	1
Specific aspects of event.	1

Several of the immediate benefits (Table 7) stated were in line with the general outreach aims in that the enthusiasm, enjoyment and to assist their learning (education) were identified.

'*He [the respondee's son] found the practical aspect very rewarding. Overall a really worthwhile activity and one that should be repeated each year. Well done!*' Parent.

Where there were long term benefits identified by parents these were varied (Table 8) but mainly concerned with interest gain and improved knowledge of both subject and university life.

Table 7: *Coded responses to the question*
'Do you think there were any immediate benefits for your child after attending the chemistry day?'

Category	Frequency
Enthusiasm/Interest	8
Enjoyment	7
Insight	6
Learning	5
Experience	2
Social	2
Other	1

Table 8: *Coded responses to the question*
'Do you think there were any long-term benefits for your child after attending the chemistry day?'

Category	Frequency
Unsure	7
Increased interest	7
Helped decisions	5
Increased confidence/attitude change	4
Gained insight	3
Increased learning	2
Improved performance	2
Social	1
Gained work experience	1

Apart from the parental feedback that was sought some immediate, impromptu feedback in advance of that survey was received demonstrating the value that colleague within the university put on the event:

'*I'd just like to say on behalf of my daughter, [name provided], a very big thank you for yesterday. She thoroughly enjoyed the day and it gave her a real insight into the type of work that is carried out in labs. I think it has also given her extra enthusiasm for chemistry and I'm sure this will make her work harder for her GCSE next year. Thank you for a very well organised and enjoyable day.*' Parent (Anatomy Department).

In the following days there was also feedback given orally via phone calls and impromptu meetings expressing the wish that such events occur annually and questioning why other departments don't provide such activities for employees.

Conclusion

University science departments who engage in public engagement may wish to consider provision of activities for the children of colleagues within its own department and across the whole university. Well structured events can enthuse and excite students, support school level studies, raise aspirations, give experiences not often readily available and increase the feel good factor of employees for their own institution. It also has important effects on staff within the institution, many would like to bring their children to work but on an individual basis this is often impractical.

Literature

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