Author:
Rivett, Alison C

Title:
A study into the feasibility and validity of using alternatives to questionnaires to evaluate the impact of a selection of physics & chemistry science communication activities

Summary of Dissertation

'A Study Into The Feasibility And Validity Of Using Alternatives To Questionnaires To Evaluate The Impact Of A Selection Of Physics & Chemistry Science Communication Activities'

Alison Rivett, September 2009

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Introduction: A major current issue in the field of Science Communication is evaluating the impact of activities designed to engage people with science and technology. Evaluation is widely seen as the primary tool to identify best practice and provide empirical evidence of the positive impact of such activities. However, there is no standard method for doing this, or for comparing the results.

The majority of published evaluations involve the use of quantitative data generated through written questionnaires. Using such methods to evaluate the impact of short-duration activities is often inappropriate or impractical. This dissertation investigates alternatives to the traditional questionnaire for obtaining feedback about the impact of some types of science communication activity. It also attempts to establish what the effects of the activities on participants are.

Methodology: A number of Institute of Physics[1] and Bristol ChemLabS[2] events were evaluated using a variety of unconventional techniques. The events were *Interactive Demonstrations* (physics); *'Meet The Scientist' Events* (physics); *Demonstration Lectures* (chemistry) and *Hands-On Workshops* (chemistry). They were evaluated using *Postcard Writing, Children's Drawings, Comments Boards & Walls, Observation, Unsolicited & Teacher Feedback*. An *Interactive Voting* system and some *Written Questionnaires* developed & administered by third parties were also utilised.

The dissertation outlines the methodological and theoretical justification for the use of these techniques. They focus on identifying the immediate to short-term impact of the activities. They generated largely qualitative data, but included a quantitative component. The data was triangulated by using different techniques for the same activity and vice-versa, to ascertain that the results were consistent and valid.

The data was analysed using the *Generic Learning Outcomes* (GLO) framework, which is becoming a common evaluative tool across the Museum & Science Centre sector. GLOs are a way to look at different types and levels of impact using one tool. The model stems from a view of learning as a personal and individual experience, which is context-dependent. 5 categories are used to code participants' responses: *Knowledge & Understanding*; *Skills*; *Attitudes & Values*; *Enjoyment, Inspiration & Creativity*; *Activity, Behaviour & Progression*.

Results: The alternative evaluation techniques tested produced a large amount of useful data and a greater range and depth of information regarding impact than might have been expected. The qualitative nature of the tools is more appropriate for small sample sizes (which might lack statistical significance). They were generally uncomplicated to use and simple to analyse using the GLO framework.

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[1] The professional body for physicists in the UK, see: www.iop.org

[2] The HEFCE Centre of Excellence in Teaching & Learning (CETL) in Chemistry in England & Wales, at the School of Chemistry, University of Bristol, see: www.chemlabs.bristol.ac.uk

- *'Write a Postcard'* feedback revealed the greatest range and depth of learning outcomes, comparable to an externally designed *Written Questionnaire*.
- *Observations* were a rich source of data, but didn't necessarily capture the impact on all participants. *Teacher Feedback* provided information about a range of learning outcomes, but not from the pupils' own perspective. *Children's Drawings* gave some useful information about a limited range of learning outcomes.
- *Comments Boards* provided a deeper insight into participants' experiences than initially expected, but generally only about a subset of learning outcomes. To generate meaningful data about impact, questions must be carefully worded to guide responses.
- *Unsolicited Feedback* does not give reliable evidence of learning outcomes, but can be analysed to provide limited information about impacts. *Interactive Voting* provided the least information about impact in this study, because the questions asked generally did not focus on learning outcomes.

The major category of learning outcome reported by participants is *Enjoyment*, but evidence for *Knowledge* gained, changes in *Attitudes* and *Behaviour* is also strong. It is the questions asked which hold the key to elucidating different learning outcomes.

Suggested questions to discern different learning outcomes:

What was your favourite part of the day?	*Formative* / *Process* / *Enjoyment*
Was there anything you didn't like?	*Formative* / *Process* / *Attitudes*
Please tell me anything you learnt today.	*Knowledge* / *Skills*
How did today make you feel about Science?	*Attitude* / *Enjoyment*
Did you find out how to do anything new, or do anything better?	*Skills* / *Knowledge*
Do you think you will do any Science activities following this event?	*Behaviour* / *Attitudes*

The evaluation techniques differed in their level of convenience. Data collection tools such as the *Postcard Feedback* and *Post-It Note Comments* were cheapest and simplest to administer and could be analysed rapidly using the GLO method.

The majority of these techniques can only evaluate the immediate impact of the activity. This is due to when they are administered, which could be instantly after the event, or at the most up to 1 or 2 weeks afterwards. Asking participants to complete these styles of evaluation a significant amount of time afterwards is impractical and becomes more a test of memory than anything else. Teacher feedback was shown to provide an indication of longer term impact, although this may be rather subjective.

Discussion: The GLO framework is a useful coding device which allows wider comparisons with other studies. It enables outcomes beyond immediate 'Reaction' level to be investigated in a meaningful way. The GLO approach reveals that impact is not a neat, linear process, but occurs at many levels and over a multiplicity of timescales.

The learning outcomes themselves are extremely varied. There may be no or even a negative impact; a transient effect; or something deep and long-lasting. The level of impact is impossible to predict and is not the same for all participants. Discovering the medium to long-term impact of any of these activities is beyond the scope of the techniques tested.

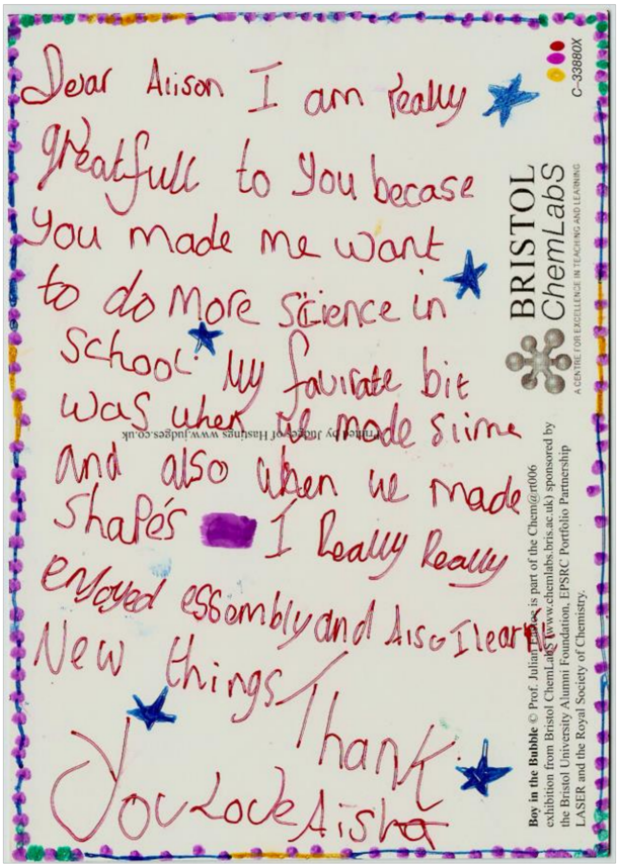
However, a learner's enthusiasm for a subject is usually retained much longer than memory of facts or content. There is evidence that memorable activities which provide positive experiences of science can affect future behaviour. Given the right support, situational interest may become sustained and so increase motivation and satisfaction with a subject.

Science communication activities like those investigated in this study are just one part of the many and varied experiences in people's lives. We cannot expect that a single event will have a significant impact on the life choices of the majority of participants. What can make a difference is ensuring, through thorough and reliable evaluation, that there are a range of high quality opportunities for people of all ages to experience different aspects of science, meet role models and develop their interest and abilities.

Conclusion: The study identified a number of techniques which provide a range and depth of information about the learning outcomes experienced by respondents. They can easily be embedded into science communication activities and do not require time-consuming analysis.

The impact of the physics and chemistry activities studied was found to be very positive for the majority of participants and were similar to those found in other studies. A myriad of effects are seen at a variety of levels and over a range of timescales.

This postcard sums up how a simple evaluation method can pay dividends in terms of the level of information gathered and show true evidence of the potential impact of science communication activities.



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