WHAT ARE THE KEY ELEMENTS FOR ENSURING AN EFFECTIVE MATERIALS AWARENESS PROGRAMME?

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Abstract

There are a number of science, engineering and technology schemes promoting all aspects of science, engineering and technology SET currently available in the UK focusing on school age audiences. What are the key factors that determine the effectiveness of these initiatives and can we identify a general set of good practice guidelines for current/future scheme organisers? Some programmes aim to raise the general awareness of SET to their audience whilst others are trying to attract students onto science and engineering degree courses (and careers). What forms of evaluation and feedback exist for the schemes currently in operation, in other words how is the success of a scheme determined? These are the questions that we (the UK Centre for Materials Education) asked a number of current scheme practitioners and deliverers at both the national and local level. Through interviews with scheme organisers and a content analysis of their literature and evaluation and feedback data categories of goals and categories of success that ensure an effective programme have been revealed. The end result will be a resource available to everyone interested in SET initiatives. It will allow them to identify the key elements that can help to ensure that current/new schemes are effective in meeting their aims and if the type of evidence collected to determine that if indeed the aims have been met.

Introduction

There is a bewildering array of science, engineering and technology (SET) initiatives on offer in the UK, predominantly directed at schools, focused on raising awareness and/or understanding of science, engineering and technology at/to/within schools. With a scheme being anything from a talk to a residential course to an extended project or competition both at a local and national level. In this initial study of the schemes available we have concentrated on the age-range of under 18 years old, the young public. The types of schemes/activities that have been looked at are those with any materials related content, however small. What are the key factors that determine the effectiveness of these initiatives and can we identify a general set of good practice guidelines for current/future scheme organisers? A need for guidelines has been suggested following a forum discussion of organisations that deliver Materials awareness programmes at a meeting in London this year concerning the Future of Materials organised by UK Centre for Materials Education (University of Liverpool).

Initially the study aimed to utilise evaluation of schemes to determine elements of effectiveness (categories), however, we discovered that evaluation was not always a common feature of initiatives despite an appreciation of the need in many cases.

> "It's now recognised good practice that evaluation should be an integral part of any good project management" (scheme funder)
>
> "we actually look at it as something we can feed into next year and its very valuable information you are getting here…"
>
> "I think it's important that the effects of the schemes are quantified…if they can see that a scheme is valuable, is going to make a difference…."
>
> " I think it's very necessary to quantify the effect a scheme has"

At the last PCST conference the importance of evaluation of public communication of science and technology was highlighted and some of the considerations for evaluation were indicated, that is the need for clearly defined aims and objectives that can be met, SMART was the acronym used, simple, measurable, achievable, realistic and time bound. [1]

In this initial study evidence collected from scheme practitioners and deliverers from interviews and literature allowed categories of goals and categories of success as described by those involved with the schemes to be identified. These initial categories can then be used to begin formulating guidelines for current and future deliverers of SET through whatever the chosen media may be and assist with meeting the goals and help us to consider the evidence that will ascertain this.

Data collection

1) An extensive web search of initiatives in the UK and any further literature available by direct contact with organisers.

2) Semi-structured interviews were held with selected organisers/people directly involved with delivery of activities/funders lasting ~60 minutes.

3) Reviewing available evaluation reports.

Methodology

Interviews were transcribed and pooled with data from websites and evaluation reports. In the first instance a basic content analysis was conducted to develop categories of description. Eventually this will lead to a phenomenographic analysis and establishment of second order conceptions using the methodology developed by Marton[2] and by Bowden et al.[3] For the purpose of this paper a pilot study has enabled initial categories of descriptions to emerge.

Results

Table 1 shows the numbers of schemes and age ranges focused on in this study with a greater concentration of activities targeting the 14-18 year olds audience. Some indications of types of activities in each range are given. Key stages are levels in the national curriculum as identified by the UK government. The Key Stages cover four age groups (5-7, 7-11, 11-14 and 14-16), during each Key Stage pupils sit national assessment tests to monitor their progress.

Categories	AGE-RANGE	Number of activities	Examples of activities	Examples of evidence collected by deliverers of programmes
Primary	5–7	13	Engineers/scientists assist in classrooms, resources for schools, industry visits	Numbers attending Questionnaires Unsolicited feedback Interviews (deliverers and alumni) Website hits Internal reporting External evaluation
	7-11	17	Resources, school clubs, industry visits, partnerships between scientist/engineers and teachers, construction tasks	
Secondary	11-14	30	Problem solving days, hands-on experience, resources for schools, clubs, engineers into schools	
	14–16	33	Engineers into schools, clubs, competitions, resources for classroom	
16+	16 – 19	36	Residential courses, individual and team based extended real company projects, competitions, engineers/scientist into schools, clubs,	
GAP*		2	Industrial placement	
Bursaries for teachers		11	Industrial visits, residential courses, project ideas	
University		3	Professional development,	

Table 1: Overview of age-range and type of activities reviewed in this study

NOTE

* Traditionally year taken out before university studies

This list is by no means exhaustive and no schemes with a heavy life science or mathematics content were considered. As previously stated the schemes looked at to date have some materials engineering content or reference to materials. Some activities are aimed at more than one age-range.

In table 2 the category of goals refers to aims of practitioners/deliverers obtained from both their literature and through interviews. The categories of success have been identified from the interviews as to how they considered their activity could be described as successful.

Category of Goals	Categories of Success
Careers Enhance student numbers taking science/engineering further studies Raise awareness of SET Teacher/student support in classroom Stimulate excitement of SET	Clearly identified objectives Commitment Enthusiasm Partnerships Activities Causing a change

Table 2. Goals and categories of success as identified from the data

Goals

The categories of goals were obtained from reviewing the aims as identified by deliverers/funders from their websites and literature.

- Careers
  "to consider engineering as a career"

  "the scheme encourages the UK's most able students to consider engineering as a career and be involved in real engineering problems"

- Enhance student numbers
  "we want people into A level sciences"

- Raise awareness of SET
  "to raise awareness of SET"

- Teacher/student support
  "support student learning in the classroom"

  "aim is to develop exciting, motivating resources and engineering strategies for teaching investigative science….."

- Stimulate excitement of SET
  "stimulate excitement and greater awareness of science, technology, engineering and mathematics

"it provides resources, activities and events motivating pupils to experience for the themselves the excitement of science and technology put into action through engineering"

"to design, promote and deliver activities and programmes that stimulate and motivate students in science, technology, engineering and mathematics…."

Categories of Success

- Clearly defined aims and objectives

  "..i think it is quite important to be clear about for the practitioners or deliverers of activities to be clear about which one it is they are actually focusing on to be very clear about what the objectives of the project are"

- Commitment, that is commitment of the practitioners/deliverers,

  "some of the courses have been running a long time and there's been a consistency of people that have been involved in it so every year they've been able to develop it improve it….."

- Enthusiasm

  "..again the excitement the enthusiasms got to carry on"

- Partnerships

  "we achieve this by working in partnership with higher education and local education authorities, industry and business links"

  "chance to work alongside practising scientists"

  "close contact with company engineers and staff"

- Activities

  "we always tell them to focus on the hands on practical because to be honest the lectures leave them cold in water….."

  "its the hands on activities and also the participation by different departments"

  "oh its problem solving, its real world they can actually see a result of it, its appreciated…….they've got to use their creative, their lateral thinking"

  "…….design and make type exercises"

- Change, the something changed or something happened with reference to the attendees

  "yes something happens, even though they may have enjoyed it on a scheme or within a school, something happens"

Summary

In this paper we have presented preliminary data from a pilot study and categories of goals and success have emerged. The next stage is to create conceptions which better formulate practitioners deliverers intentions and enable them to evaluate their programmes more effectively. We would welcome feedback from the international science communication arena on this study. How can this approach to developing categories about initiatives be utilised in the running and development of programmes? How does the evidence collected by scheme organisers enable them to establish if the goals have been met? What other categories of goals or success could surface?

References

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