Science Communication in the third space

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Abstract

The "third space" exists between the cultural worlds of school and community. The informal science communication sector, because of its diversity, can populate such a third space, within which the different discourses of the formal system and the everyday world are reconciled. This space is presently quite empty, with only incoherent and sporadic attempts to provide for such engagement. This paper describes two Australian initiatives operating in this third space. The first is a unique program for the mothers of high school students called 'Science for Mums '. It enables mothers with little science to engage with their children's science at high school level. Parents, in particular mothers, often have little knowledge or confidence in science, yet their involvement in their children's schoolwork can have a positive effect on their children's choice of subjects for study or their future career. The approach was gender-specific and culturally appropriate. Evaluations indicated positive outcomes, particularly in the reported level of parent–child discussions. The second initiative is the largest outreach program in the world. Operating out of Questacon, Australia's National Science and Technology Centre, the 'Science Circus' consists of a travelling exhibition, school science shows and career showcasing. Now in its 30th year, it travels across Australia focusing on regional areas, including indigenous groups. The program has inspired many to engage with science. Evaluations

indicate that its influence is profound and long lasting. Emphasis is placed on family engagement through careful timing of the exhibitions and strong links to the schools.

Introduction

For many years now, science education as currently experienced across most of the world has been the subject of much criticism. This criticism became more vocal from the late 1980s when the movement known as the Public Understanding of Science identified gaps in public knowledge of science. The so called 'deficit model' was a powerful stimulus for reform. Nevertheless, critics have continued to assert that the formal education system is not serving our science students well.

Learning science in an informal way, however, is internally rather than externally driven and often long lasting (Stocklmayer, Rennie and Gilbert, 2010). It offers 'potentially a more holistic approach to science education, one that better integrates school, work and leisure time learning experiences ... [and] could be a more robust approach to long term gains' (Falk, Storksdieck and Dierking, 2007, p. 456). The merging of formal and informal environments is nevertheless problematic because the complex interplay of home and school does not lend itself to simple intervention.

In 2001, Moje, Collazo, Carillo and Marx suggested the need for a 'third space' between the cultural worlds of school and community. This space crosses the boundaries of these worlds in an integrated way. They recommended bringing together these 'competing discourses' to enhance science learning, although in a later paper (Moje et al., 2004) they critiqued the idea that the worlds of home and classroom are necessarily in opposition (p. 42). Rather, they can be bridged by integrating everyday resources with disciplinary learning (p.44).

Stocklmayer, Rennie and Gilbert (2010) argued that cultural considerations are also important for informal engagement. These considerations may be ethnic, or they may be gender, age and socio-economically related. These authors quoted Basu and Calabrese Barton (2006) who said that 'funds of knowledge' are important in integrating the formal and informal experiences. This knowledge is the 'historical and cultural knowledge of a community' (p. 468) or, especially, of a family.

Critical to this concept is 'the recognition of the ways in which the life

experiences of an individual within a family or community yield knowledge that is useful, powerful and transferable' (p. 468). Incorporation of such knowledge into academic instruction is grounded in 'strategic knowledge and activities essential for achieving the goals a student has for his/her out-of-school life' (p. 468). These authors found that students sustained interest when science experience connected with their own funds of knowledge. The informal experience must therefore echo students' individual beliefs and experiences (Stocklmayer, Rennie and Gilbert, 2010, p.

In a summary of the important elements for effective informal learning in this third space, Stocklmayer, Rennie and Gilbert (2010) identified critical affective factors such as providing for free choice, being internally challenging, encouraging wonder, being interesting and enjoyable. Curiosity and surprise are also important. Successful learning requires a holistic approach, with useful and transferable knowledge, a strong narrative, multidisciplinary and constructive frameworks, and simple, jargon-free science. Recognition of prior knowledge is imperative. "Recent discoveries add interest. Narratives may take many forms but should encourage personal meaning-making. Analogies and models enhance understanding" (p.25). Science should be presented as "messy, human and exploratory in nature, addressing real and current problems". It should be inquiry based. They also stated that social and community interaction should be facilitated. "If connections to community are overtly made, the point of the activity is more easily understood. Facilitating border crossing is very important" (p.25)
Finally, these authors make the point that:

> … learning about science can take place in groups that are socially convenient to the learners and supportive of their interactions, in ways that promote multigenerational learning. This community context sets science in the real world of the student, enabling a better appreciation of complex scientific and social relationships. (p.28)

Two Australian initiatives, one a short program and the other an outreach program of very long duration, have exemplified what it means to be active in this space, fulfilling the requirements for effective informal learning with flow-on effects into the formal world of school.

Science for Mums

This project originated from requests from parents for a program to help with high school science. Many parents play an active role in primary education, assisting with homework and extracurricular activities, but this often ceases when a child enters high school. Mothers, in particular, often feel helpless when it comes to assisting with science. Parental interest has been shown to have many positive outcomes, including higher academic performance and career choice. Home discussion, in particular, has been shown to be critical (Gonzalez-DeHass, Willems and Doan Holbein, 2005).

Andre, Whigham, Hendrickson, and Chambers (1999) found, however, that parents rated their own math and science competence as low. These authors state that their results 'support the need for and expansion of programmes designed to help parents perceive science as open to both males and females' (p. 742). Green, Walker, Hoover-Dempsey and Sandler (2007) stated that 'appropriate parental involvement practices have been shown to increase positive student outcomes throughout children's schooling, including the high school years' (p. 534).

Science for Mums was designed in a workshop format, one morning a week for six weeks. The children, all in middle high school, did not attend. "The aims of the workshop were, overall, to enable the participants to initiate home discussion and activities around the high school science syllabus….in order to be successful, it would be critically important for the programme to foster self-confidence as well as knowledge" (Stocklmayer, Durant and Cerini, 2010, p. 6). The program dealt with physics, chemistry, and biology through hands-on activities which could be repeated at home. The aim was to facilitate discussion between mothers and their children.

All three facilitators were female members of the Australian National University. Sessions were held in Questacon, Australia's National Science and Technology Centre, which was thought to be a friendly environment. The workshop incorporated all the elements identified by Stocklmayer, Rennie and Gilbert (above) for effective informal learning. Every week, the participants had a homework task, and this proved significant in stimulating home discussions. An important cultural factor was that the mothers were treated as potential co-teachers, not students, and frank discussions about the difficulties of the curriculum were held on a respectful basis.

Evaluations of the program indicted that the goals were met. Confidence increased and home discussions were lively and interactive. Typical comments were (Stocklmayer, Durant and Cerini, 2010, p.18):

> When friends call, my son is very keen to tell them about what I have learnt and demonstrate some of the experiments for them. (M7)

> My Year 9 was especially keen to help me/be involved with homework. I used to ask any soccer parents for help with homework and just last week one of the parents came and asked *me* if I had worked out the periodic table yet as she is currently helping her daughter with it. (M15) (Evaluation document)

Not only did the program encourage science at home, but there was considerable evidence that it extended to the classroom (p.19):

> The kids have been very interested in what we've been doing. Other mothers have said that they wished they were taking part in the course. At least one teacher has asked for a similar course for them. (M14)

The mothers reported that their help enabled their children to grasp the principles of school science more quickly, and with more understanding. Their confidence in seeking information on the Web also helped their children. Overall, this project indicated that science in the third space can have far-reaching outcomes.

The Science Circus

An example of an outreach program operating across the boundary between school and home is the Shell Questacon Science Circus, a national program jointly run by Questacon and the Australian National University with sponsorship from Shell Australia. The program operates in remote and regional Australia, including indigenous communities, with a view to 'taking science' to those who are not well served by science centres and science events. The mode of operation explicitly addresses the boundary between school and community. A large truck containing 50 interactive exhibits travels to rural towns and villages, accompanied by a team of students who are completing a Masters in Science Communication at the University. The team goes into schools and

delivers science shows, often on a syllabus topic but not always, and gives each member of the audience a ticket to the interactive exhibition venue. The opening times of the venue are carefully orchestrated so as to bring parents and other family members along too, so that the interaction with the exhibits is a family affair. At the venue, the students act as explainers. The aims of this program are:

> To promote among people in regional Australia, particularly young people, positive and personally relevant images of science and technology, of scientists, and of careers in science and technology; to provide access for the people of regional Australia to a world class, touring, science and technology program; to assist teachers in regional Australian schools to enhance the quality of the science and technology education which they offer their students (Stocklmayer, 2003, p.408)

The Circus makes several tours every year, aiming to visit each state and territory in rotation. The shows delivered by the students are modelled on the affective aspects of informal learning mentioned above, with a large element of showmanship and excitement. They involve the audience wherever possible.

Many aspects of the Circus have been evaluated: only those relating to the nature of the third space and effective informal learning are mentioned here. According to a major evaluation of the travelling component, (Rennie and Williams, 2000) teachers appreciated the Circus not only for the enjoyment and interest for students, but because:

> Science was demonstrated to be part of everyday life, not just textbooks and test tubes. Scientists were portrayed as normal people, rather than stereotyped characters… Science was presented in a way that was accessible to students and was believed to motivate them into wanting to learn/do more science. In terms of career choices, teachers reported that students discussed careers in science extensively following a visit in which the presenters had a discussion with school students about their own university experiences. The image of science portrayed was “fun, interesting”, “not just about text books but practical and hands-on”, “communicated that science is part of everyday life and relevant”.

In terms of bridging the school-community divide, "54 visitors, too, reported positive attitudes about their experience when interviewed at a venue. Their comments about the way that science is portrayed echoed those of the teachers, with all visitors commenting favourably on the exhibition experience. The exit survey, completed by 264 visitors, indicated that most came with family groups. Just over one third were there as a follow up to a school visit, but the remainder expressed a variety of reasons including "an interest in science" or "for enjoyment". Most visitors indicated that the Circus experience had increased their knowledge of, and interest in, science and technology, their ability to recognise science in everyday life and their confidence in talking about it (Rennie and Williams, 2000).

That the Circus has inspired students is a matter of record. At first glance it seems unlikely that a single school visit and accompanying family experience can have far-reaching outcomes, but much anecdotal evidence exists testifying that many are motivated to study science. The Circus itself has had applicants who themselves saw a performance when they were in primary school and went on to get a science degree with the sole aim of joining the program. This outcome could only be achieved by family encouragement, and further research is required to understand this phenomenon more comprehensively.

Conclusion

Occupying the third space is not easy, since it requires integration of school and community in a manner that is comfortable for participants. The projects described in this paper achieved that objective because they consciously sought to put in place the aspects of effective intervention identified above. Neither presented the science in this way by accident. Science for Mums was a pilot program that is set to continue when funding can be found to allow it to be offered nationally. The Circus, on the other hand, is about to celebrate its 30th anniversary as the biggest outreach program in the world. We assert that occupying the third space is, indeed, a powerful way to address the problems of science engagement in schools.

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