

The impact of Science Literacy delivery methods - what works?

Strengths, Weakness, Costs and Feasibility

GROUP 1. Events, meetings, performances

V 1.0 | 24 April 2019

NOTES

n.d. = no data provided

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Mechanism	Content of use	Strengths	Weaknesses	Costs and feasibility	Notes	Reference
1. Exhibitions	Health promotion [Healthcare and Medicine]	<p>Museums possess unique qualities conducive to health-promoting initiatives. Although museums may not appeal to all audiences in comparison to clinical settings, they may prove to be more approachable, and through their disseminative expertise and knowledge of different audience groups, more sensitive to the complexities and dynamics of everyday life.</p> <p>The museum setting may provide an approach towards creating greater health equity, provided that museum developers are sensitive to the cultural contexts and needs of different target groups. Museums have the capacity to succeed in reaching groups that may feel alienated from traditional health settings.</p>			The health promotion potential of exhibitions may be increased by building on a broader notion of health, by increasing empowerment and equity, and by increasing community synergies.	<p>Museums and science centres for health: from scientific literacy to health promotion Christensen et al. 2015</p>
1. Exhibitions	Science education [Social science]		Utilizing SCV exhibitions for curricular learning implies guiding students towards specific educational goals determined by the teacher or SCV-staff, not by the student. Such guidance – whether it is achieved through the use of worksheets, PDAs, narratives or SCV staff – implies challenging the			<p>Exhibitions as learning environments: a review of empirical research on students' science learning at Natural History Museums, Science Museums and Science Centres Hauan and Kolstø 2014</p>

			<p>view of an exhibition as an arena for free-choice learning.</p> <p>In their study of structure, Bamberger and Tal (2007) found that students enjoyed free exploration of an exhibition. However, they also found that free exploration can create frustration and, more importantly, that this lack of structure generated little learning-related behaviour. Other research suggests that appropriate structure and guidance can lead to increases in interest. Finally, visits that are too strictly controlled can be counterproductive for learning, by restricting students' learning-related behaviour.</p>			
1. Exhibitions	<p>Science (general), environmental studies, mathematics, health [Interdisciplinary science, Formal science, Healthcare and Medicine]</p>	<p>Results enable the participating science centres - and by extension others within the science centre community, to state with much greater confidence that the presence of one or more healthy and active science centres within a community, region, or country represents a vital mechanism for creating and maintaining a scientifically and technologically informed, engaged and literate public. (Falk et al. 2014)</p> <p>Science outreach efforts can be highly valuable in fostering public engagement and in developing a knowledge-based society. (Carapuço et al. 2017)</p>			<p>The lowest achievers liked learning maths in the exhibition context, and preferred it over the school context. The fact that the present study shows that high achievers preferred the school context is curious and gives cause for further consideration. (Thuneberg, Salmi, and Fenyyesi 2017)</p>	<p>Group 1 Composite report</p> <p>Upstream public engagement on coastal issues: Audience response to a science-based exhibition Carapuço et al. 2017</p> <p>International Science Centre Impact Study Falk et al. 2014</p> <p>Hands-On Math and Art Exhibition Promoting Science Attitudes and Educational Plans Thuneberg, Salmi, and Fenyyesi 2017</p>

2. Expo						NO REVIEWS
3. Festivals	Science (general), environmental studies, genetics [Interdisciplinary science, life science]	(Para. 4.3) The key strength of festivals as a delivery mechanism for science literacy is that they can provide the general population with a wide range of activities in a variety of formats, in an informal and fun environment. They also provide the opportunity for festival goers to engage directly with scientists.	(Para. 4.4) Weaknesses included interception of audiences depending on the location of the venue and on their transient nature: being time-limited.	(Para. 4.5) Many science festivals have high levels of intensive volunteer participation by scientists, universities, technologists and engineers. Synergy and support between festival organisers and the different collaborators was found to be essential.	(Para. 4.6) Improved or new evaluation methodologies are required and future research should also consider the longer-term impact of science festivals See Gaps. While two-way individual interactions are a valuable aim for science festivals, this does not hold true if attempts for dialogue, feedback, and participation are at the expense of audience needs for health and scientific knowledge. Our view is that public engagement should be viewed on a continuum, whereby information flow enables and facilitates interaction between the public and scientists irrespective of time, age-group, or gender. (Fogg-Rogers and UK Science Festival Network 2017)	http://www.nida-net.org/en-gb/activities/connectwithscience/research/reports-and-bibliographies/festivals/ Group 1 Composite report UK Science Festival Network Pilot Evaluation 2017 Fogg-Rogers and UK Science Festival Network 2017
4. Movies	Science (general), environmental studies, chemistry,				The study recommends the use of well-selected movies and videos to expose students to the application of chemistry concepts in	Group 1 Composite report The Effect of CSI Movies on Students' Chemistry

	medicine [Interdisciplinary science, Physical science, Healthcare and Medicine]				the real world. Moreover, classroom experience must be varied and focused on the latest updates in chemistry and in chemistry education to motivate students for chemistry. (Pastor and Fajardo 2017)	Achievement and Attitude towards Chemistry Pastor and Fajardo 2017
5. Picnics						NO REVIEWS
6. Science Fairs	Science (general), chemistry, earth science, physics [Science, Physical science]	(Para. 4.3) The strengths of science fairs as a method of delivery providing significant opportunities for learners to experience self-directed inquiry, collaboration and applications of science. Moreover, connections were made between students, teachers, researchers, academics and practising scientists. Fairs were shown to be broadly applicable to a wide range of cultural contexts and especially relevant to the engagement and achievement of minority groups.	(Para. 4.4) The effectiveness of science fairs is dependent on many key factors and both students and teachers can face obstacles. In particular, time constraints and time-management were highlighted. Without adequate preparation and guidance, independent scientific exploration, analysis and presentation can provide challenges; levels of confidence, organisational abilities, anxiety and expectations need to be managed. Some disadvantages in terms of communication barriers emerged.	(Para. 4.5) Materials and resources required for scientific experimentation can be expensive and may aggravate economic discrepancies between schools and individual students. Successful fairs often rely on volunteer time, especially from teachers.	(Para. 4.6) No significant recommendations for improved methodology emerged, however, two unique approaches stood out above others: the practice for integrating science journalism activities and projects with a science fair and the enhancement of personal connection between research and researchers within the 'Reverse Science Fair'.	http://www.nida-net.org/en-gb/activities/connectwithscience/research/reports-and-bibliographies/science-fairs/
7. Seminars						NO REVIEWS
8. Talks						n.d.
9. TED Talks	Science (general)				The results showed that the presenters were predominately male and non-academics. Male-authored videos were more popular and more liked when viewed on YouTube.	Group 1 Composite report Scientists Popularizing Science: Characteristics and Impact of TED Talk Presenters Sugimoto et al. 2013

					<p>Videos by academic presenters received more comments than videos by others and were more liked on YouTube, although there was little difference in how frequently they were viewed. Giving a TED presentation appeared to have no impact on the number of citations subsequently received by an academic, suggesting that although TED popularizes research, it may not promote the work of scientists within the academic community. (Sugimoto et al. 2013)</p> <p>Given the dramatic changes in mediatization in the last decade, it may be time to reassess the ways in which the public consumes scientific information and the relationship between these modes of consumption and subsequent perception and knowledge of science. (Sugimoto et al. 2013)</p> <p>One of the limitations of this research is the partly unknown audience for TED videos. (Sugimoto et al. 2013)</p>	
10. Theatre	Computer science,	(Para. 4.3) The strength of theatre as a method of delivering science	(Para. 4.4) Some instances of weakness in fully utilising the	(Para. 4.5) The relative low-cost of activities such as	(Para. 4.6) Suggestions for improved methodologies	http://www.nida-net.org/en-

	robotics, diet & nutrition, medicine, agricultural science, botany, molecular biology, neuroscience, geophysics, science education [Applied science, Formal science, Life science, Physical science, Social science]	literacy uses the advantage of creative processes that stimulate imagination, thinking and active thought, all crucial aspects to activate problem-finding, problem-solving and encouraging curiosity. Theatre was shown to hold the potential to reduce the gap between cognitive and creative learning with good retention of concepts. Popular theatre was shown to hold particular strengths because the communications tend to be emotional. Considering the strong artistic connotation of theatre, performances could be introduced into traditional STEM (Science, Technology, Engineering and Maths) education to become STEAM (STEM + Art).	benefits of isolated performances were observed, suggesting that embedding activities within programmes might bear advantages. An additional weakness is potential misinterpretation resulting from artistic or aesthetic objectives.	puppet shows and educational theatre may be promising for future expansion and adaptation of theatrical activities.	using theatre as a medium for delivering science literacy included the reiteration of performances in different contexts, and also partnering with local organizations in programme development, promotion, and delivery to ensure greater local relevance and attendance. Suggestions for improved evaluation of theatre as a medium for delivering science literacy included use of 'realist-informed' approach, where quantitative and qualitative approaches are combined.	gb/activities/connectwithscience/research/reports-and-bibliographies/theatre/
11. Workshops	Health promotion, Statistics, agricultural science, food chemistry [Interdisciplinary science, Life science, Healthcare and Medicine]	(Para. 4.3) The evidence on the use of a workshop format to deliver scientific and health concepts highlighted a range of strengths in varying contexts.	(Para. 4.4) Not many references to weak points for this mechanism were cited.	(Para. 4.5) With regard to feasibility, some studies cited time for implementation of content as a concern. In others, the participants' willingness to cover their own costs for travel to attend workshops week after week was considered an indication of the positive perceived impact. Resource availability and practical limitations were considered important factors for designing more effective workshop interventions.	(Para. 4.6) Authors suggested that workshops could be optimized by running concerted multi-workshop series designed in advance and spread over time. Others suggested the need for programme evaluation modules to be developed to provide summative as well as formative evaluations. Other studies recommended an increased use of visual aids, particularly among rural communities, as well as	http://www.nida-net.org/en-gb/activities/connectwithscience/research/reports-and-bibliographies/workshops/ Group 1 Composite report Challenging Low Health Literacy in Rural Honduras: The Utilization of Charlas (Chats) for Patient-Centered Care Sookhoo 2014

					<p>increasing the number and frequency of workshops and time for general discussion and group-based activities.</p> <p>Public policy decisions on health should focus on health promotion that is done “by” or “with” people rather than done “on” or “to” people. If achieving health literacy to improve health is a goal for NGOs, then addressing the root problem of inadequate education is also a real challenge. (Sookhoo 2014)</p>	
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