

The impact of Science Literacy delivery methods - what works?

Strengths, Weaknesses and Gaps in impact assessment methodology

GROUP 1. Events, meetings, performances

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Mechanism	Strengths & Weaknesses	Main gaps in the impact assessment (IA) methodology. <u>Lack of (or insufficient):</u>	Possible methodological improvement(s), recommendations and directions for future research	Reference
1. Exhibitions	<p align="center">Strengths</p> <ul style="list-style-type: none"> - may be more approachable to different audiences and reaching groups that may feel alienated from traditional health settings - may be more sensitive to the complexities and dynamics of everyday life (Christensen et al. 2015) <hr/> <p align="center">Weaknesses</p> <ul style="list-style-type: none"> - learning may be determined by the teacher or science-communication venues staff, not by the student. Visits that are too strictly controlled can be counterproductive for learning by restricting students' learning-related behaviour - although students enjoy free exploration, it can create frustration and little learning-related behaviour (Hauan and Kolstø 2014) 	<ul style="list-style-type: none"> - systematic assessment of purpose and effects and structured evaluations, especially health-related outcomes, of health in museum and science centre exhibitions - specified methodologies to give solidity to the results and overcome some limitations (e.g. bias, self-reported outcomes), transparency of methods used and the conclusions drawn (Christensen et al. 2015) - inclusion of pre- and post- visit activities at school (Hauan and Kolstø 2014) 	<ul style="list-style-type: none"> - long term follow-up studies - direct measurements (e.g. using accelerometers) (Christensen et al. 2015) - exploration of the effects of different designs on guided exploratory learning - evaluation of the effectiveness of educational activities - study the presence and quality of different explorative processes involving practical experiences, testing and observation and explorative conversations and writing during science-communication venues (SCV) visits with different types of educational activities - quality of different types of physical exploration in relation to science concept learning (Hauan and Kolstø 2014) 	<p>Museums and science centres for health: from scientific literacy to health promotion Christensen et al. 2015</p> <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>
2. Expo				NO REVIEWS

3. Festivals	Strengths	<ul style="list-style-type: none"> - theoretically and methodologically sound research and evaluative efforts on the reach, outcomes (e.g. knowledge and attitudes) and impact of public engagement practices on participants (e.g. also by understanding who attends these events) - clear and specific goals of public engagement events - validity and over-reliance of visitors' responses to science festivals 	<ul style="list-style-type: none"> - support, tools and evaluation mechanisms appear to be needed to improve both event organisers practice and the science festival experience for audiences and, moreover, for data-driven decision-making about the future of science festivals and their role in public engagement with science - care must be taken to assess the reliability and validity of the tests, feasibility of sampling and data analysis - evaluation and reflective practice methods need to be quick and easy to conduct, adapted for each audience and situation - the informality of the events and venues in festivals should be reflected in the use of unobtrusive and minimally disruptive evaluation methods - combined use of different methods can help with the triangulation of data - pre-visit and post-visit data on the same visitors might allow comparison and direct measures of impact - future research should consider the longer-term impact of science festivals 	http://www.nida-net.org/en-gb/activities/connectwithscience/research/reports-and-bibliographies/festivals/
	Weaknesses			
4. Movies	None identified	<ul style="list-style-type: none"> - control group and bigger sample to validate the results of many studies - data on the film application methodology that enable to reproduce and validate previous studies - studies that focus on the main objective of knowledge acquisition 	<ul style="list-style-type: none"> - development of checklists to evaluate the quality of the different cinematic teaching methodologies - quantify the increase in learning, either by an increase of knowledge or an increase in their values, beyond the subjective perception of students and lecturers 	Use of commercial films as a teaching resource for health sciences students Díaz Membrives, Icart Isern, and López Matheu 2016
5. Picnics				NO REVIEWS

6. Science Fairs	<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> - can provide opportunities for learners to experience self-directed inquiry, collaboration and applications of science and foster connections between students, teachers, researchers, academics and practising scientists - can facilitate across a wide range of cultural contexts and be relevant to the engagement and achievement of minority groups 	<p style="text-align: center;">None identified</p>	<ul style="list-style-type: none"> - no significant recommendations for improved methodology emerged from the analysis, 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' - science fairs might bear potential for adaptation or transition towards more recent modalities of presentation, for example online competitions 	http://www.nida-net.org/en-gb/activities/connectwithscience/research/reports-and-bibliographies/science-fairs/
<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> - need adequate preparation and guidance, independent scientific exploration, analysis and presentation, time-management and require organisational abilities and volunteer time, especially from teachers - materials and resources required for scientific experimentation can be expensive and may aggravate economic discrepancies between schools and individual students 				
7. Seminars				NO REVIEWS
8. Talks				NO REVIEWS
9. TED Talks				NO REVIEWS
10. Theatre	<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> - creative processes that stimulate imagination and thinking and encourage curiosity - reduce the gap between cognitive and creative learning - communication is based on emotions 	<p style="text-align: center;">None identified</p>	<ul style="list-style-type: none"> - suggestions for improved methodologies using theatre as a medium for delivering science literacy included the reiteration of performances in different contexts - suggestions for improved evaluation of theatre as a medium for delivering science literacy included use of 'realist-informed' approach, 	http://www.nida-net.org/en-gb/activities/connectwithscience/research/reports-and-bibliographies/theatre/

	<ul style="list-style-type: none"> - can be low-cost activities (e.g. puppet shows) 		<p>where quantitative and qualitative approaches are combined</p> <ul style="list-style-type: none"> - the relative low-cost of activities such as puppet shows and educational theatre may be promising for future expansion and adaptation of theatrical activities 	
	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> - potential misinterpretation of the performance resulting from artistic or aesthetic objectives - isolated performances might work better if embedded within programmes 			
11. Workshops	<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> - can provide training opportunities and platforms for discussion and can include practical and hands-on learning activities (e.g. experiments) - when relying on visual and verbal communication, workshops can be more interactive, which might be useful in low literacy settings 	None identified	<ul style="list-style-type: none"> - workshops could be optimized by running concerted multi-workshop series designed in advance and spread over time - the need for programme evaluation modules should be developed to provide summative as well as formative evaluations - suggestions were formulated for an increased use of visual aids, particularly among rural communities, number and frequency of workshops and time 	http://www.nida-net.org/en-gb/activities/connectwithscience/research/reports-and-bibliographies/workshops/
	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> - contents, materials and jargon needs to be tailored to the audience - the ability of triggering changes might require the use of other empowerment approaches - time for implementation of contents might be a concern - can be resource-demanding, especially for attendees 			

Bibliography

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