

The impact of Science Literacy delivery methods - what works?

Strengths, Weaknesses and Gaps in impact assessment methodology

GROUP 3. Traditional publishing and journalism - print and broadcast

V 1.0 | 24 June 2019

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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
17. Animations (Games & Simulation)	<p align="center">Strengths</p> <ul style="list-style-type: none"> - can facilitate the understanding of graphical representation, abstract concepts and changes across time or space - can provide active approaches to learning research methods and statistics 	None identified	None identified	<p>A narrative literature review of games, animations and simulations to teach research methods and statistics Boyle et al. 2014</p>
	<p align="center">Weaknesses</p> <p align="center">None identified</p>			
18. Books				NO REVIEWS
19. Brochures				NO REVIEWS
20. Cartoons	<p align="center">Strengths</p> <ul style="list-style-type: none"> - pictographic health education can be effective regardless of race/ethnicity - can help comprehension and communication in health care, especially in low literacy settings - can increase the recall of instructions and medication information (Park and Zuniga 2016) - Concept Cartoons: are effective across geographical and cultural boundaries; can encourage learners to explore alternative ideas; can be a very effective way to challenge misconceptions; make it relatively easy for learners to engage in a language that is not their home language (Naylor and Keogh 2013) 	<ul style="list-style-type: none"> - standard tools for the assessment of health literacy - appropriate measurement - intervention studies and an adequate number of participants for assessing the effectiveness of pictographic health care education (Park and Zuniga 2016) 	<ul style="list-style-type: none"> - need for more diverse health-related research studies using pictography-based health education materials for elderly - future researchers will need more meaningful and consistent health literacy assessment tools - most of the health education materials currently available are not appropriate for people with a low health literacy level, so improved materials are highly needed - more intervention studies and greater numbers of participants would enable generalizability (Park and Zuniga 2016) 	<p>Concept Cartoons: What Have We Learnt? Naylor and Keogh 2013</p> <p>Effectiveness of using picture-based health education for people with low health literacy: An integrative review Park and Zuniga 2016</p>

	Weaknesses None identified			
21. Comics	Strengths	<ul style="list-style-type: none"> - carefully designed empirical studies that are required to understand the full effects of comics on learning, engagement and attitude toward science - consistent quality of the studies and, at times, objectivity on the analysis of results (Farinella 2018) 	<ul style="list-style-type: none"> - future research should aim to distil the fundamental components of visual narratives, and explore how each of them can benefit the communication of science - an area of future investigation could be to compare different types of visual narratives (e.g., comics and animations are often associated in popular culture but they probably rely on different cognitive mechanisms) - more studies will be required in order to determine which visual strategies are more effective, on which topics and for which audiences (Farinella 2018) 	<p>The potential of comics in science communication Farinella 2018</p> <p>An Overview of Comic Books as an Educational Tool and Implications for Pharmacy Muzumdar 2016</p> <p>Quantifying and Visualizing the History of Public Health Comics Schneider 2014</p>
	Weaknesses None identified			

<p>22. Games</p>	<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> - games, animations and simulations provide active approaches to learning (Boyle et al. 2014) - elements of video games could be used to improve classroom-based science education and can provide an authentic context in which players can demonstrate what they have learnt, as opposed to standardized tests (Morris et al. 2013) - playing good video games in itself is a process of thinking and learning (Cheng et al. 2015) and can facilitate collaborative problem-solving (Li and Tsai 2013; Siko and Barbour 2013) - can help to contribute to rich experiences that are often not found in a traditional classroom setting, which can provide skills that students need in the twenty-first century (Siko and Barbour 2013) - games are engaging, offer opportunities for social interaction and practice of different skills in a safe environment and provide individualized feedback - can be a channel to reach those who are hard to reach with traditional health education methods - can provide a remarkable resource in children's health promotion and self-management intervention since, in general, children are interested in games regardless of age, gender, and background (Parisod et al. 2014; Lazem et al. 2016) - games-based Learning (GBL) is a potentially engaging form of supplementary learning that could enhance the educational process (Hailey et al. 2016) 	<ul style="list-style-type: none"> - sound empirical evidence, validity, conclusive results and overarching methodology for effectiveness research on digital game-based learning (DGBL) (All, Nunez Castellar, and Van Looy 2014) - scope and methodologies (Carnahan 2014; Parisod et al. 2014) and content (Lu, Kharrazi, and Baranowski 2016) of existing impact assessment - studies exploring students' affective outcomes or learning processes (Cheng et al. 2015) - (little or inconclusive) evidence that games can promote developing scientific skills, understanding of science content, or an understanding of the nature of science (Morris et al. 2013) - longitudinal studies to show if the games really maintain their impacts and outcomes over time (Abdul Jabbar and Felicia 2015; Hailey et al. 2016) and Randomised Controlled Trial (RCTs) (Abdul Jabbar and Felicia 2015) - evaluations of student's learning outcomes are still limited to knowledge learning although game designs were guided by different theories or models to provide a variety of learning opportunities - examinations of how or to what degree game-based learning could promote the affect and engagement of science learning (Li and Tsai 2013) 	<ul style="list-style-type: none"> - formulation of a clear definition of effectiveness in the context of DGBL and a common methodology for assessing the effectiveness of DGBL and motivation - according to several authors, an analysis of covariance (ANCOVA) with pre-test scores as a covariate, is a preferable method (All, Nunez Castellar, and Van Looy 2014) - need for RTCs studies (Hailey et al. 2016), high-quality systematic reviews of RCTs (Parisod et al. 2014) and qualitative methods (Cheng et al. 2015) - bigger sample size, research design, outcome (Li and Tsai 2013; Lu, Kharrazi, and Baranowski 2016) and effectiveness measurement and precise research questions to support learning are needed (Morris et al. 2013) also in the long term (Carnahan 2014; Hailey et al. 2016), to decrease the risk of misinterpreting short-term changes in behaviour (Abdul Jabbar and Felicia 2015) - need for research, especially on sedentary health games with large sample sizes, homogeneity of interventions, settings, and outcomes, on different patient groups and in a wider range of health issues - need for evaluation of the long-term effects of games in health promotion (Parisod et al. 2014), nutrition and healthy eating (Lu, Kharrazi, and Baranowski 2016) - need to see games as cultural tools for science education, rather than potential replacements for science instruction (Morris et al. 2013) - the relationships among in-game performance, game playing experience, gaming behaviours, and science learning outcomes need to be 	<p>Measuring Effectiveness in Digital Game-Based Learning: A Methodological Review All, Nunez Castellar, and Van Looy 2014</p> <p>Gameplay Engagement and Learning in Game-Based Learning: A Systematic Review Abdul Jabbar and Felicia 2015</p> <p>A narrative literature review of games, animations and simulations to teach research methods and statistics Boyle et al. 2014</p> <p>The effects of on-line math games and e-books use on elementary student achievement Carnahan 2014</p> <p>The use of serious games in science education: a review of selected empirical research from 2002 to 2013 Cheng et al. 2015</p> <p>Digital Games, Design, and Learning: A Systematic Review and Meta-Analysis Clark, Tanner-Smith, and Killingsworth 2016</p>
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	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> - gameplay must be supported with appropriate feedback and scaffolding (Abdul Jabbar and Felicia 2015) - there are many commercially active videogames on the market and fewer sedentary health games, which anyway require a lot of resources (e.g. a multidisciplinary team, substantial expertise, creativity, time, and funding) (Parisod et al. 2014) 		<p>analysed to validate the assumption that students learned when they played the digital games (Li and Tsai 2013)</p> <ul style="list-style-type: none"> - researchers should carefully weigh the benefits of experimental designs in light of fundamental issues of ecological validity, authenticity, and specific requirements of the research questions under exploration - ongoing development and research should focus more heavily on accurate and reliable assessment of higher order learning outcomes (Clark, Tanner-Smith, and Killingsworth 2016) 	<p>A systematic literature review of games-based learning empirical evidence in primary education Hainey et al. 2016</p> <p>Games and Diabetes: A Review Investigating Theoretical Frameworks, Evaluation Methodologies, and Opportunities for Design Grounded in Learning Theories Lazem et al. 2016</p> <p>Game-Based Learning in Science Education: A Review of Relevant Research Li and Tsai 2013</p> <p>Digital games for nutrition and healthy eating Lu, Kharrazi, and Baranowski 2016</p> <p>Gaming science: the “Gamification” of scientific thinking Morris et al. 2013</p> <p>Promoting Children's Health with Digital Games: A Review of Reviews Parisod et al. 2014</p> <p>Game Design and Homemade PowerPoint Games: An Examination of the</p>
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				Justifications and a Review of the Research Siko and Barbour 2013
23. Graphics				NO REVIEWS
24. Posters	<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> - beneficial to conference organisers, authors and delegates, posters can facilitate informed discussion between the presenter and audience - provide the viewer with a concise overview of the project/topic - can promote active learning - relatively inexpensive to produce, given that they can provide the audience with information that can be viewed by a number of individuals at their own pace <hr/> <p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> - graphical design and physical appearance of the poster can determine its success in promoting knowledge transfer - need to provide clear and logic navigation - if not accompanied by an active intervention (e.g. oral presentation, physical interaction), the 'traditional' poster may only reach a limited proportion of its intended audience - are quite expensive in terms of the man hours, publishing costs and travel expenses 	<ul style="list-style-type: none"> - studies that evaluated the effectiveness of posters in direct comparison with other educational intervention - studies that have evaluated the effectiveness of the poster presentation in actively changing user knowledge, attitudes or behaviour 	<ul style="list-style-type: none"> - well-designed empirical studies are required to establish an evidence base to inform how posters may best be developed and implemented in order to achieve successful knowledge transfer - research is required to identify the effectiveness of incorporating aspects of information technology into poster presentations. This may promote an interactive learning environment for users and counter the current passive nature of poster design 	What is the evidence that poster presentations are effective in promoting knowledge transfer? A state of the art review Ilic and Rowe 2013
25. Publications				None identified
26. Radio				NO REVIEWS
27. Reports				NO REVIEWS

28. Television	<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> - still the most popular source of information on health and illness - constitutes an important source of information and education in terms of prevention and identification of simple symptoms - it is accessible and present in a wide spectrum of formats that make it possible to reach a vast and diversified group of viewers regardless of age, education and place of residence (Burzyńska, Binkowska-Bury, and Januszewicz 2015) - entertainment education (EE) can be effective in health campaigns in developing countries, where traditional text-based literacy is limited - Information and Communication Technology (ICT) expansion in developed and developing countries has increased audiences' ease of access to entertainment narratives such as feature films and border-free TV productions (Kato et al. 2017) 	None identified	None identified	<p>Television as a source of information on health and illness – review of benefits and problems Burzyńska, Binkowska-Bury, and Januszewicz 2015</p> <p>Mapping research on health topics presented in prime-time TV dramas in “developed” countries: A literature review Kato et al. 2017</p>
	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> - broadcast messages do not focus on the content but the mere fact of making it public - television messages can be of low quality and of insufficient factual level refer to health topics - recipients ought to be aware that the series are fiction features and do not aim to faithfully reflect the reality (Burzyńska, Binkowska-Bury, and Januszewicz 2015) - narratives may convey both negative messages and positive messages (Kato et al. 2017) 			

29. Videos	<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> - offers multimodal opportunities to learn, teach and present ideas - can be paused and replayed as needed, supporting repeated and self-paced viewing - can serve as a less-resource intensive tool to provide standardized content across learners - particularly useful for meeting specific educational needs (e.g. individuals with low literacy levels, communicating abstract concepts that may be challenging to demonstrate in classrooms) - technologically affordable, can be made available and accessible through a variety of technologies and online platforms - flexibility of potential use, e.g. videos can be readily modified and edited to allow use and application across diverse cultural settings - scalability across multiple platforms, technologies and devices - have potential as a tool for agricultural extension, farmer-to-farmer exchange and health literacy in developing countries 	<p style="text-align: center;">None identified</p>	<p style="text-align: center;">None identified</p>	<p>http://www.nida-net.org/en-gb/activities/connectwithscience/research/reports-and-bibliographies/videos/</p>
	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> - infrastructural constraints, i.e. the reliance on power and connectivity, affordable access to the internet and mobile/smartphone ownership and use, particularly in rural and resource-deprived contexts - effectiveness can depend on additional instructional scaffolding around the intervention (e.g. instructor facilitation, materials and participant activities) - reach is dependent on physical location and timing of videos in order to enable participation 			

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