The impact of Science Literacy delivery methods - what works?

Strengths, Weaknesses and Gaps in impact assessment methodology

GROUP 5. Online interactions

V 1.0 | 27 June 2019

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Mechanism	**Strengths & Weaknesses**	**Main gaps in the impact assessment (IA) methodology. Lack of (or insufficient):**	**Possible methodological improvement(s), recommendations and directions for future research**	**Reference**
35. Blogs	**Strengths** - have potential as a qualitative health research tool for a range of purposes, including data collection - can have particular application for researchers accessing populations beyond their physical reach - can be a useful qualitative tool for researchers, to gain instantaneous access to distant populations and provide research clarity and transparency with the benefit of a built-in audit trail - can capture and disseminate participants' voices can be, with the added advantage of the choice to remain anonymous in both their writing or responses **Weaknesses** None identified	None identified	None identified	**Using Blogs as a Qualitative Health Research Tool: A Scoping Review** Wilson, Kenny, and Dickson-Swift 2015
36. E-Books				**NO REVIEWS**
37. e-Zines				**NO REVIEWS**

38. Mobile Apps	Strengths			
	- have achieved wide reach and become increasingly prevalent among users (Zhao, Freeman, and Li 2016) - may be particularly suited to children and young people who may be more accepting of technology (Grist, Porter, and Stallard 2017) - can easily be downloaded (Regmi et al. 2017) - a large number of users can receive tailored text messages and information at low cost (Chen and Carbone 2017; Regmi et al. 2017) - can be easily updated with the latest information (Neubeck et al. 2015) - scalability of mobile technologies applications (Wagner 2014) - private use of the cell phone (Seko et al. 2014; Bakker et al. 2016) - can deliver health interventions (Coughlin et al. 2016; Zhao, Freeman, and Li 2016; Grist, Porter, and Stallard 2017), offer more active engagement in health care that can impact health behaviours globally, particularly in low- and middle-income countries (Zhao, Freeman, and Li 2016), and seem promising as a monitoring tool (they enable users to set targets, self-monitor and provide tailored feedback) (Dute, Bemelmans, and Breda 2016) - are constantly available, offer greater access, immediate support, anonymity (Grist, Porter, and Stallard 2017) and may reduce barriers to face-to-face help-seeking (Grist, Porter, and Stallard 2017) - may overcome geographical barriers and engage traditionally hard-to-reach groups (Bakker et al. 2016; Grist, Porter, and Stallard 2017) and overcome the distance to service providers (Neubeck et al. 2015)	- rigorous research to test mobile app effectiveness and acceptability (Zhao, Freeman, and Li 2016), use and content (Regmi et al. 2017), methodologies and context (Chen and Carbone 2017), scope and methodologies (McKay et al. 2018) - comprehensive evaluation to date of public and commercial apps (Zhao, Freeman, and Li 2016) - evidence on apps effectiveness from high-quality research studies (most apps are tested on a small scale only and for a short period) (Dute, Bemelmans, and Breda 2016). Moreover, the results in the qualitative synthesis are based on self-reports and perceptions of using different types of mobile devices (Mi et al. 2016) - experimentally trialed apps that use evidence-based frameworks (e.g. cognitive behavioural therapy) (Bakker et al. 2016) - randomized controlled trials (RCTs) evidence for the efficacy of mental health (Bakker et al. 2016), smoking cessation and sun safety apps (Coughlin et al. 2016) - evidence to support mobile apps safety or effectiveness with vulnerable populations - quality research evidence for mental health mobile apps, especially those for adolescents (Grist, Porter, and Stallard 2017) - similarity in study design (e.g. choice of a comparison group, outcome measures, and sample size) and mobile phone app functionalities increase the difficulty of drawing firm conclusions about the effectiveness of apps in promoting behaviours associated with reduced cancer risk (Coughlin et al. 2016)	- large sample, high-quality, adequately powered, randomized controlled trials, longitudinal studies are required (Bakker et al. 2016; Zhao, Freeman, and Li 2016) - further research should focus on evaluation research in low- and middle-income countries (Zhao, Freeman, and Li 2016) - research-tested mobile phone apps are also needed for non-English speakers or for persons with low health literacy (Coughlin et al. 2016) - future research should address methodological concerns (i.e. small sample sizes, inadequate reporting of demographic data such as gender and age, acceptability and use of apps with clinical groups, short duration of studies, sparse information on maintained over time positive gains, suitable Randomised Control Trial (RCT) comparing a mobile app to an adequate control group) - future research should also utilize quicker, good-quality designs since the development of apps is vastly outpacing the development of the evidence base (Grist, Porter, and Stallard 2017) - some of the methodological problems such as small sample sizes and short length of follow-up could be addressed if apps incorporated the consent process and data collection into the apps' functionality. New methodological approaches that enable large-scale app outcomes research are needed - researchers conducting interventional studies should consider the inclusion of both a control arm and an app-only intervention arm to make clearer the link between the app and the outcome (Singh et al. 2016) - further empirical research with large sample sizes and mixed research methods and	**Mental Health Smartphone Apps: Review and Evidence-Based Recommendations for Future Developments** Bakker et al. 2016 **Functionality, Implementation, Impact, and the Role of Health Literacy in Mobile Phone Apps for Gestational Diabetes: Scoping Review** Chen and Carbone 2017 **Mobile Phone Apps for Preventing Cancer Through Educational and Behavioral Interventions: State of the Art and Remaining Challenges** Coughlin et al. 2016 **Using Mobile Apps to Promote a Healthy Lifestyle Among Adolescents and Students: A Review of the Theoretical Basis and Lessons Learned** Dute, Bemelmans, and Breda 2016 **Mental Health Mobile Apps for Preadolescents and Adolescents: A Systematic Review** Grist, Porter, and Stallard 2017

- reduce staff burden and costs, interview bias, and feelings of embarrassment among individuals with low health literacy (Kim and Xie 2015) - rapid and timely communication to gather patient-generated data in situ, increase treatment compliance and, if necessary, offer some interventions on the spot (Seko et al. 2014) - offer portability, flexibility, convenience, and instant access to a wide range of knowledge-based or learning resources that students can access convenient time and place (Mi et al. 2016) - can change the traditional classroom to one that is more interactive and engaging - educators can teach without being restricted by time and place and can be connected with learners on a more personal level - learning can continue after class is over or outside the classroom in places where learning occurs naturally (Zydney and Warner 2016) - open new opportunities for rural farmers who previously had limited access to up-to-date agricultural information and assistance from agricultural experts and government extension workers (Pongnumkul, Chaovalit, and Surasvadi 2015)		triangulation techniques is needed to build up a strong evidence base on the long-term efficacy of mobile technologies incorporated in educational curricula, student learning, patient care, and knowledge management (Mi et al. 2016) - need for better ways to assess the quality and effectiveness of apps in order to harness the potential of mobile health apps for behaviour change and health (McKay et al. 2018) - further research on the effectiveness, reach, and long-term use of mobile apps and on other possibilities to tackle health issues (Dute, Bemelmans, and Breda 2016) - health literacy levels of the potential audience should be taken into consideration when developing and evaluating the usability of apps for this audience (Chen and Carbone 2017) - more research is needed on how science mobile apps can be used with more varied science topics and diverse audiences (Zydney and Warner 2016) - it would be useful to extend the proposed solutions in agriculture spatially and temporally (Pongnumkul, Chaovalit, and Surasvadi 2015) - future studies need to make use of newer available technologies (Zydney and Warner 2016) - effectiveness and efficacy of smartphone alone and its comparisons with other mHealth interventions such as text messaging and emails (Regmi et al. 2017)	**Health literacy and internet- and mobile app-based health services: A systematic review of the literature** Kim and Xie 2015 **Evaluating mobile phone applications for health behaviour change: A systematic review** McKay et al. 2018 **Use of Mobile Devices to Access Resources Among Health Professions Students: A Systematic Review** Mi et al. 2016 **The mobile revolution--using smartphone apps to prevent cardiovascular disease** Neubeck et al. 2015 **Pads in higher education-Hype and hope: iPads in higher education-Hype and hope** Nguyen, Barton, and Nguyen 2015 **Applications of Smartphone-Based Sensors in Agriculture: A Systematic Review of Research** Pongnumkul, Chaovalit, and Surasvadi 2015 **Effectiveness of Mobile Apps for Smoking Cessation: A Review**
Weaknesses - unstable Wi-Fi or Internet connections, slow data processing, short battery life, and small screen size (Mi et al. 2016) - individuals' low health literacy is a significant barrier that constrains their Internet use and prevents adequate access to health information (Kim and Xie 2015) - mobile phone technology might be challenging particularly for elderly users (Neubeck et al. 2015)			

	- a digital divide still exists between socioeconomic groups (i.e. low socioeconomic groups retain old technologies such as mobile telephones that can only send and receive short message service texts, and which do not have apps) (Neubeck et al. 2015) - it is difficult to provide up-to-date information because of the dynamic and rapid development of apps and the long processes of doing research and publishing (Dute, Bemelmans, and Breda 2016) - the long period of time research to the release new apps (Neubeck et al. 2015) - ensuring confidentiality and privacy can be a common concern (e.g. how sensitive and personal data are handled, transmitted and stored, potential loss of the mobile device) - the persistent and compulsive nature of self-monitoring tools warrants particular caution, as it may put youth under too much pressure - being unable to adhere to the monitoring routine may contribute to feelings of shame and guilt, which could reduce control users have over the ways they interact with interventions (Seko et al. 2014) - evidence-based guidelines developed for other self-help mental health interventions have not been applied to many Mental Health apps (MHapps) - lack of appreciation for experimental validation among MHapp developers, with the risk that researchers are developing MHapps primarily for research needs rather than to meet the needs of end users (Bakker et al. 2016) - there is a lack of innovative pedagogical guidelines on how best to use mobile devices (i.e. iPads) to improve academic processes and achievements (Nguyen, Barton, and Nguyen 2015)			Regmi et al. 2017 **Youth Mental Health Interventions via Mobile Phones: A Scoping Review** Seko et al. 2014 **Patient-Facing Mobile Apps to Treat High-Need, High-Cost Populations: A Scoping Review** Singh et al. 2016 **Mobiles for Reading: A Landscape Research Review** Wagner 2014 **Can Mobile Phone Apps Influence People's Health Behavior Change? An Evidence Review** Zhao, Freeman, and Li 2016 **Mobile apps for science learning: Review of research** Zydney and Warner 2016

39. Podcasts	**Strengths** - can be used in the education sector (Oloo and Elijah 2015) - are a cost-effective communication tool - can empower listeners with health information and create social networks for information-sharing - are uniquely accessible (e.g., require less literacy than text-based resources; easy to share via social media, websites, and email; can be accessed on mobile devices while doing other activities) - certain features of podcasts align with larger media trends (e.g. on-demand entertainment) - may be particularly good vehicles for emotional intimacy and disclosure and may provoke more emotional responses than written information on a website - can be produced by amateurs with little technological expertise -they don't have geographic limits to their reach (Williams 2015) **Weaknesses** - may be time-consuming (Williams 2015)	- depth [of IA] (Oloo and Elijah 2015)	- need for further investigation on the utilization of podcasts as tools for developing strategic knowledge in teaching of practical subjects and in higher education - the use of methods such as focus groups discussions should be explored (i.e. where podcasting is used for collaborative learning among students) (Oloo and Elijah 2015)	**Methods of Investigating the Use of Podcasting in Higher Education: A Review of Recent Studies** Oloo and Elijah 2015 **How could an effective podcast about alcohol use be designed and evaluated? A review of the literature** Williams 2015
40. Social media	**Strengths** - allow for personalisation of the content, presentation and participation - cost-effective, accessible and wide-reaching modality for administering certain types of interventions (e.g. when logistics make arranging in-person appointments difficult) (Hamm et al. 2013)	- scope, methodologies and context (Dumas, Lapointe, and Desroches 2018), focus (Hamm et al. 2013) and study design (Merolli, Gray, and Martin-Sanchez 2013) - evidence from Randomised Control Trials (RCTs) and longitudinal studies (Moorhead et al. 2013) - impact of social media for health communication in specific population groups, such as minority groups, patients' groups, culture	- future research should aim to identify which social media interventions are effective and describe all aspects of the interventions, including how they are implemented and utilized - research should explicitly document any increased negative behaviours, stigmatization or exacerbation of existing health inequities if some populations are excluded	**Users, Uses, and Effects of Social Media in Dietetic Practice: Scoping Review of the Quantitative and Qualitative Evidence** Dumas, Lapointe, and Desroches 2018

- can remove geographic and physical access barriers, promote health equity and reach certain populations at risk for disadvantage (Welch et al. 2016) and may provide an opportunity for anonymity (Taggart et al. 2015) - the collaborative nature of social media allows for a meaningful contribution and interaction from all user groups (Hamm et al. 2013; Moorhead et al. 2013) and peer/social/emotional support (Hamm et al. 2013) - high reach potential of dissemination that can be used by healthcare professionals to improve knowledge translation of evidence-based health information to health consumers and patients (Dumas, Lapointe, and Desroches 2018) and ease the burden of self-management for chronic disease sufferers (Merolli, Gray, and Martin-Sanchez 2013) - valuable additions to traditional face-to-face clinical encounters to deliver behavioural interventions (Dumas, Lapointe, and Desroches 2018) - foster support, information sharing, empowerment and improved disease-specific knowledge (Merolli, Gray, and Martin-Sanchez 2013) - has the potential to influence health policy (Moorhead et al. 2013) - Facebook is an informal, dynamic, social and flexible environment where more or less structured learning experiences can take place and it can facilitate the interplay between formal education and real life, bridging personal experiences and institutional knowledge (Manca and Ranieri 2016)	differences (Moorhead et al. 2013) - evidence available for harder-to-reach populations in the primary studies or the systematic reviews - evidence of the design and implementation features (e.g. intensity and duration of interventions) that could lead to improved effects (Welch et al. 2016) - knowledge of the longer-term impact on the effectiveness of social media for health communication and of the most suitable mechanisms to monitor and enhance the quality and reliability of health communication using social media (Moorhead et al. 2013) - clarity on how the studies measured learning outcomes and whether the latter support learning objectives (Manca and Ranieri 2016)	- future systematic reviews and primary studies should collect and analyse the effect of the intervention by different population groups - more research is needed on social media that engages with existing social networks, acceptability and use of social media, and assessment of both desirable and undesirable effects (Welch et al. 2016) - additional research is needed to clarify whether the use of social media truly confers an advantage, or if the novelty of the medium is solely responsible for its use (Hamm et al. 2013) - further research and trials with larger sample sizes and more robust methodologies are required to fully determine the role of social media for health communication (Moorhead et al. 2013), health promotion (Dumas, Lapointe, and Desroches 2018), in supporting the patient-health professional relationship (Moorhead et al. 2013) and clinically significant behaviour change (Dumas, Lapointe, and Desroches 2018) - further research is suggested using systematic and thoughtful study designs to investigate how the particular affordances of social media are best suited to addressing different patient needs (Merolli, Gray, and Martin-Sanchez 2013) - key recommendations for future health communication research focus on robust and comprehensive evaluation and review, using a range of methodologies - determine the impact of social media for health communication in specific population groups with large sample sizes (representation of population groups), using RCTs and longitudinal studies to determine the longer-term impact	**Social media use among patients and caregivers: a scoping review** Hamm et al. 2013 **Is Facebook still a suitable technology-enhanced learning environment? An updated critical review of the literature from 2012 to 2015: Is Facebook a suitable TEL environment?** Manca and Ranieri 2016 **Health outcomes and related effects of using social media in chronic disease management: A literature review and analysis of affordances** Merolli, Gray, and Martin-Sanchez 2013 **A New Dimension of Health Care: Systematic Review of the Uses, Benefits, and Limitations of Social Media for Health Communication** Moorhead et al. 2013 **Social Media and HIV: A Systematic Review of Uses of Social Media in HIV Communication** Taggart et al. 2015

| | | **Weaknesses** | | - explore potential mechanisms for monitoring and enhancing the quality and reliability of health communication using social media
- investigate the risks arising from sharing information online and the consequences for confidentiality and privacy
- determine the impact of peer-to-peer support for the general public, patients, and health professionals to enhance their interpersonal communication
- explore the potential for social media to lead to behaviour change for healthy lifestyles to inform health communication practice (Moorhead et al. 2013)
- future studies need to take into account how cultural differences between countries affect the propensity to adopt Facebook for learning and the ways students react to their use in education according to several cultural variables
- adopting learning design approaches that deal with cultural variables (e.g. religion, ethnic identity) can provide hints on what happens when a new digital tool is introduced to different cultures and whether the tool can potentially bridge those cultures
- design approaches can also contribute to point out whether Facebook, has been globally 'exporting' the same implicit 'pedagogical' model throughout the world (Manca and Ranieri 2016) | **Interactive social media interventions to promote health equity: an overview of reviews**
Welch et al. 2016 |
| | | - increase health inequities for people who do not have access to or do not use social media
- possibility of limited access to the Internet
- people with few social networks may be at a disadvantage
- acceptability of social media interventions, related to cultural acceptability and norms, might be a problem
- some populations may be particularly sensitive to hostile or misleading comments (Welch et al. 2016)
- quality concerns and lack of reliability, confidentiality, and privacy (Moorhead et al. 2013), which may be an issue for certain populations such as older adults and may affect the use of social media interventions (Welch et al. 2016)
- inappropriate substitution of online information and availability of misinformation are risks, as healthcare providers are unable to control the content that is posted or discussed that can potentially lead to harmful results (Hamm et al. 2013)
- limited capacity for self-regulation and vulnerability to peer influence, and promotion of high-risk behaviours (Hamm et al. 2013)
- potential of information overload for the user (Moorhead et al. 2013)
- health care professionals reported limitations in their ability to form relationships with social media users in comparison to face-to-face interaction
- developing new social media platforms may be costly or resource intensive (Taggart et al. 2015)
- the use of Facebook requires digital and media literacy skills in order to face the cognitive (e.g. information overload and reliability) and ethical | | | |

	challenges (e.g. privacy) (Manca and Ranieri 2016)			
41. Websites				**NO REVIEWS**
42. Wikis	**Strengths** - are an accessible user-friendly space, where users can easily locate, create, edit, and share information - hold great potential as an instructional strategy to aid students in learning various skills (i.e. improving writing performance) and gaining new knowledge - allow learners to interact and connect with each other within a virtual learning environment where students can appreciate divergent views and demonstrate team-based skills - help to construct knowledge by linking and connecting individuals within a learning environment - offer great potential to complement and improve online peer's collaboration - have the potential to expand the amount of feedback from only one instructor to peers - support the development of a community of learners who engage through cognitive and social processes (Trocky and Buckley 2016) - can enable health professionals, patients and policy makers to implement evidence-based practice at low cost (Archambault et al. 2013) - collaborative writing applications (CWAs) (e.g. wikis and Google Documents) can improve the use of evidence in both public health and health care and positively affect the education and knowledge translation of health professionals	- methodology (Archambault et al. 2013) - studies with experimental designs, random assignment and controls for the influence of extraneous variables. These research findings were primarily derived from descriptive designs, small samples over narrow time frames, student or instructor perceptions, researcher developed instruments and multiple interventions (Trocky and Buckley 2016)	- further trials with objective outcomes need to be conducted, given that the majority of the literature presently exists in the form of case reports with self-reported measurements - future trials should identify implementation processes that can be influenced by collaborative writing applications (CWAs) and how to measure them (possibly using Web metrics) as intermediate outcomes of a complex knowledge translation intervention - before conducting such trials, researchers and decision-makers must reflect on defining the purpose of using a CWA as a knowledge translation intervention - studying each specific behaviour involved in using CWAs (ie, to use, to contribute, to edit, to delete) with the help of theoretical frameworks will also help inform future interventions - future studies should explore the impact of collaborative writing and conversational features on information sharing and investigate what kind of knowledge (explicit vs tacit) is shared. This could help knowledge users choose an appropriate CWA - as future communication tools, the impact of using different types of media embedded within CWAs (audio and video recordings) should also be explored - more research is needed to determine which stakeholders benefit the most from using CWAs, to address the barriers to their use, to find ways	**Wikis and Collaborative Writing Applications in Health Care: A Scoping Review** Archambault et al. 2013 **Evaluating the Impact of Wikis on Student Learning Outcomes: An Integrative Review** Trocky and Buckley 2016

| | | Weaknesses | | to ensure the quality of their content, to foster contributions, and to make these tools effective knowledge translation tools for different stakeholders | |
| | | - collaboration does not occur easily or without guidance
 - nurse educators need to anticipate the discomfort of students using wikis, be clear on expectations for editing, model expected behaviours, provide timely feedback, offer rewards for contributions, and monitor students closely for contributions (Trocky and Buckley 2016)
 - safety, reliability, lack of traditional authorship, and legal implications for decision making regarding the use of CWAs in health care
 - information overload, fast dissemination of poorly validated information, loss of autonomy, feeling of working in isolation, increased stress, perceived unequal distribution of tasks within teams, biased editing, editing wars, and vandalism/wikispam (Archambault et al. 2013) | | - need to conduct systematic reviews to further synthesize the results of experimental and quasi-experimental studies in the field of health professions education and to further synthesize evidence about implementation strategies addressing the different barriers identified (Archambault et al. 2013)
 - future research in nursing education is needed and should focus on the design of wiki-based writing and the amount of structure that should be provided to encourage variation and creativity
 - another area of potential research is finding the best strategies to help students feel comfortable and confident to edit not only their own work but also that of their peers, and move from the role of reader to writer and editor (Trocky and Buckley 2016) | |

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