PARCOS
Participatory Communication of Science

DELIVERABLE 3.2
Protocol for a systematic review on evaluation criteria for creative and interactive dissemination practices

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SUMMARY

There is a growing body of research evidence featuring scientific knowledge translation and dissemination initiatives. These are meant to narrow down the gap between science and the public. This protocol outlines the procedure for conducting a systematic review to identify criteria for creative and interactive forms of dissemination practices to improve and evaluate the quality of research dissemination. The overall aim of the review is to generate a comprehensive evaluation framework that could be used by science storytellers in and beyond academia.

Keywords: scientific knowledge translation, dissemination practices, public science outreach, science storytelling, systematic review

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1 INTRODUCTION

These past few years, we find that creative and participatory forms of dissemination have become an important part of scientific knowledge translation to bridge the gap between science and citizens. There is a higher involvement of citizens in science and our understanding of knowledge translation is changing (Hecker et al., 2018). Public engagement with science dissemination has grown exponentially with the rise of the internet and the proliferation of modern technologies. It has led to a new era of science outreach and new and creative forms of telling science stories (Wynn, 2017). Digital media affect the dissemination of information in terms of information access and diffusion (acceleration in our ability to disseminate information worldwide) and knowledge creation (digital technologies allow easy access to new information and latest knowledge) (Dearing & Kee, 2012, p.66). Even though older practices of science dissemination remain valuable in contemporary times, digital media have transformed the remaining media as well as the way humans perceive, engage with and experience these scientific knowledge and dissemination practices. Also, the changes and challenges brought by new, digital media and technologies, along with the growing importance of big data, have changed the scientific realm itself and has made public science dissemination (and citizen science) a fundamental part of the scientific enterprise in the 21st century. The ‘popularization’, ‘openness’ or ‘democratization’ of science brought by the digital revolution means on the one hand empowerment and a stronger capacity to use scientific knowledge for citizens, but at the same time harbors the risk of quality loss and scientific misinformation in science dissemination and outreach. To date, science dissemination is still mainly unfolding as a one-way flow towards the public, leaving uncharted territories for more interactive, creative and accessible forms of science dissemination (Durham Peters, 2006). Indeed, even if research findings succeed in meeting the highest scientific standards in terms of output, they still need to be translated in an appropriate way in order to effectively reach the broader public. The question is then how to make sense of these attempts of science translations to citizens? When are they considered successful in their public outreach effort? How can we evaluate them? What criteria can be used to inform the evaluation of the ways in which science is being translated to non-academic audiences? Although there is a large body of research on evaluation criteria to assess the scientific quality of research findings, we are lacking a systematic overview of criteria that can help us to

evaluate the translation of research findings in science outputs. If at all questioned, then the majority of studies have been engaged with knowledge translation and dissemination in the domain on health (see e.g. Chapman et al. , 2020; Scott, Brett-MacLean, Archibald & Hartling, 2013; Lafrenière, Menuz, Hurlimann & Godard, 2013; LaRocca, Yost, Dobbins, Ciliska & Butt, 2012; Scott et al., 2012; Chen, Diaz, Lucas & Rosenthal, 2010; Sudsawad, 2007). A systematic review of evaluation criteria for science dissemination relevant to the field of social sciences and humanities is lacking. We assume that by expanding our scope to the social sciences and humanities, we will discover additional or different quality markers and perhaps encounter a different type of jargon used to describe quality.

To address this gap in literature, this manuscript outlines the procedure for a systematic review of the available literature on evaluation criteria for science dissemination practices by providing details on how we can identify, select, critically appraise and synthesize existing research evidence. Within this systematic review, we deliberately focus on evaluation criteria for creative and interactive science dissemination practices.

With creative, we refer to artistically and sensorially inspired ways to disseminate research findings. These creative forms can be supplementary or alternative to standard academic formats for science dissemination, such as policy reports, journal articles, books and book chapters. This choice is motivated by several reasons. Previous research has shown that creative forms of dissemination connect better with the broader public. The use of creative practices makes science more memorable, meaningful and accessible for people beyond academia (Haywood-Rolling, 2017; Barab & Squire, 2004). Moreover, creative dissemination forms are likely to positively impact the engagement and motivation of people to communicate ideas about research findings, their self-reflection and their level of understanding theoretical concepts (Bailey & Van Harken, 2014; McGregor, 2012; Sinner, 2011; Jenkins & Healey, 2010; Bazeley, 2006). With an interactive form we refer to science outputs that are designed to involve citizens in the exchange of information. We thus choose to focus on interactive forms of dissemination since interactive engagement is key to effective dissemination and knowledge translation (Wilson et al., 2010; Ward, House & Hamer, 2009; Hailey et al., 2008; Sudsawad, 2007). Interaction will involve the people *in* the information, for example via a chat box, a poll, sensorial stimulations, a quiz etc. Interactive forms of dissemination demonstrate high potential to make science more inclusive, engaging and

accessible to the public which can narrow down the gap between science and society (Hecker et al., 2018; Sudsawad, 2007). Interactive forms of dissemination thus harbor a strong potential for participative power. In sum, the envisioned contribution of the anticipated review project is to focus on evaluation criteria for innovative, creative approaches of translating scientific knowledge to citizens.

By turning the attention to creative and interactive forms of science dissemination, we discuss inclusive, engaging and accessible practices that are distinct to traditional science dissemination efforts. The findings of our systematic review will have important theoretical implications, as it will provide a systematic inventory of all relevant studies for inclusion, which will avoid further fragmentation of the existing body of literature on creative and interactive dissemination practices. Apart from systematically mapping what is ‘out there’ in terms of criteria it also serves other important scientific purposes such as clarifying concepts and definitions, identifying key characteristics and factors related to concepts and identifying knowledge gaps (Munn et al., 2018). Finally, the findings will have important societal relevance, as they will provide science storytellers with an evaluation framework for knowledge translation and dissemination practices, making dissemination more accessible and engaging to the broader public, which will eventually narrow down the gap between society and science. In this project we will mainly focus on the field of social and behavioral sciences,

1.1 THE PRESENT STUDY

The aim of this manuscript is to present a protocol for a literature review that yields a systematic overview of evaluation criteria for creative, interactive science dissemination practices. By transparently publishing our protocol before data collection, we contribute to the call for open communication practices in the field and invite other experts to share relevant studies or join our review team (Dienlin et al., 2020). The broader aim of this study project is to develop a framework with quality criteria and dimensions to evaluate the practice of translation of scientific knowledge through dissemination.

This protocol is guided by the following review question: What evaluation criteria have been identified in previous research studies for judging the quality and impact of creative and

interactive science dissemination? How do authors describe them and what rationale do they build to motivate their choice of quality markers?

With science dissemination, we refer to the public disclosure of research and project results by any appropriate means. We hereby rely on the clarification of the differences between science dissemination versus science communication, as described in description on the EC Research & Innovation Participant Portal Glossary of the European Commission (Scherer et al., 2018). Science dissemination is the final step in the whole chain of doing science and a first step on the path toward knowledge translation and practice change (Edwards, 2015). The objective of dissemination is to translate knowledge and results to enable others to use and take up these results. The focus is thus only on the results of research and making them available for others to use. These others, the audience, may take an interest in the potential use of the results. Contrary to science dissemination, which takes place in the final stage of the research project, science communication already starts at the outset of the action and continues throughout its entire chain. Science communication thus refers to a strategically planned process aimed at promoting the research action and its results to a multitude of audiences, including the media and the public and possibly engaging in a two-way exchange as opposed to dissemination which is typically conceived as a one-way direction flow (Durham Peters, 2006). The objective of science communication is to create public awareness and to enhance the visibility of the project results by reaching out to society and showing the impact and benefits of research activities, whereas the objective of science dissemination is to transfer knowledge and facilitate scientific reuse of the results. The focus of science communication is to inform and promote the success of the project and its results as opposed to dissemination where the focus lies on the public disclosure of results.

The specific forms of dissemination that we are focusing on in our review build on four a-priori premises that will also shape the inclusion criteria for our systematic review. First, we focus specifically on 'science' dissemination. What dissemination do we label as 'science'? "Science" is etymologically derived from *scientia* and means knowledge. The purpose of science is to acquire scientific knowledge. This scientific knowledge can be in *any* area of inquiry as long as it is acquired using the scientific method. We are thus focusing on research that takes place in a scientific context. Secondly, echoing Wilson et al. (2010), we consider

science dissemination as a subset of scientific knowledge translation. Knowledge translation is an iterative process that includes the dissemination and application of knowledge generated through scientific methods. Thirdly, we posit that knowledge dissemination constitutes an active process that requires a conscious and planned effort by researchers (Rabin et al., 2008) in order to enable others such as researchers, policy makers, but also citizens to actively use the research results and stimulate interactive science. Finally, we argue that the tools by which dissemination takes place must go beyond traditional academic means and consider active forms of creative and interactive knowledge translation by science storytellers via different types of dissemination tools to the public. Science storytellers are knowledge brokers in and beyond academia, therefore we will take both academic and non-academic types of information sources (such as books, encyclopedias, journals, expert opinions, databases, magazine articles, web pages, blogs) into account that are generated through a *scientific, systematic and transparent research process*.

1.2 PARCOS PROJECT

This review is part of the EU funded ParCos research project that has a participatory focus. The process of dissemination is becoming more and more a co-creative, inclusive, interactive or participatory activity. These past few years there has been a higher involvement of citizens in science and we find a paradigm change in the field of science communication that challenges basic scientific practices and concepts and consequently our understanding of knowledge translation (Hecker et al., 2018, p. 447). Davies & Horst (2016) and Schiele (2008) call this an engagement paradigm that understands science dissemination as scientific citizenship. What this scientific citizenship precisely might entail is still not clearly defined in literature, but the public dissemination of scientific knowledge is closely related and a crucial part. To incorporate a participatory element in this review, we select creative and interactive dissemination practices that are more likely to allow people to become engaged and involved in the research activity than traditional dissemination practices. These engaging forms of dissemination we are looking for and are referring to are not on the level of collaboration such as with participation. Interaction is, however, the preliminary phase that proceeds the open-ended, creative level of participation. There are, however, levels of participation within the context of this research. The participation of the public in our research is located at the

end of the research process (the dissemination) and happens on the participation ladder at the level of informing (Arnstein, 1969, p.217).

2 METHOD

2.1 THE SEARCH STRATEGY

In what follows, we specify the research strategy by elaborating on the rationale underlying our choice of databases and search terms.

2.1.1 Databases

To conduct this review, we search in databases that cover the fields of education, humanities and social sciences, while simultaneously acknowledging the cross over to the arts and design sector from many of these disciplines, namely: DOAJ, ERIC (OvidSP), Web Of Science, PsycArticles, LEARNTechLib, PUBPsych, IEBS (Elsevier), JSTOR, Francis, ProQuest Central. Via the EBSCO interface, we will search a diversity of databases.

We will include relevant information sources delivered by academic and non-academic experts in the field per request of the reviewers. Furthermore, the information sources need to be published between 2004 and 2020. This choice of limitation is motivated by changes in the relation between citizens and science (communication) introduced by the emergence of digital media and the use of digital technologies. We specifically chose 2004 as the limit because, according to the Our World in Data platform (2019, Table 1), the number of people using social media platforms started to rise from 2004 on with a million monthly active users on MySpace and the launch of Facebook. It can therefore be seen as the start of social media as we know it today. This choice of limitation in publication dates does not imply that we solemnly focus on digital forms of public outreach for our criteria list, but that we are looking for criteria that are generated in our societal and scientific time spirit.

2.1.2 Search terms

The search terms will be clustered in search strings. In total, we anticipate upon the iterative development of the search strings based on the identification of two consecutive search strings.

2.1.2.1 First search string

The first string captures the variety of different dissemination practices. This would help us to identify the labels and indicators that are common in previous literature to refer to a broad set of dissemination tools and practices. Such an overview and classification are currently missing in literature. However, it is a first preparatory and necessary step in order to find and select creative, interactive practices meaningful for our inquiry and identify the related specific keywords.

We select the following keywords for our first search string

creative or
arts or
interactive and
- science dissemination
- science storytelling
- research dissemination
- knowledge translation
- knowledge dissemination
- public dissemination
- dissemination or communication tool
- dissemination or communication channel
- channel
- instrument
- project output
- dissemination practice
- creation
- production
- prototype
- science outreach
- display

After exploring these keywords in a first phase, we will narrow down our scope and look more specifically at creative and interactive dissemination practices in a second phase. We identify the following relevant keywords:

arts-based
media coverage or
- blog
- video
- broadcast

online channels or
- social media
- games
- webinar
- website

event
exhibition
- theater exhibition
- museum exhibition

creative or
interactive and

journal
conference proceedings
dissertation
VR
AR
presentation or co-presentation
visualization or visual methods/practices or
photography
paintings
cartoons
still images
drawings
performing arts or performance methods/practices or
dance
drama
musical productions
literary works or
poetry
fictions
short stories
blogs
creative writing
projects or
designs
installations
3D sculptures
poster
installation
audiovisual or
cinematography
design
performing arts
visual arts
narrative methods or narrative practices

2.1.2.2 Second search string: criteria for public science dissemination

With the second search string we intend to generate information resources that present evaluation criteria or speak of quality assessment and critical appraisal.

We identify the following relevant keywords for our second search string:

evaluation or
criteria and
assessment
quality
guidelines
techniques
critical appraisal
strategies
methods
framework

These search terms are based on the works of Lafrenière & Cox (2012) and Heyvaert, Hannes, Maes and Onghena (2013). These studies have been found during the exploratory literature study that we performed to build the rationale and background of this manuscript.

2.1.2.3 Visualization of the two search string phases

	First search string	Second search string
Phase 1	creative or arts or interactive and science dissemination science storytelling research dissemination knowledge translation knowledge dissemination public dissemination dissemination or communication tool dissemination or communication channel instrument project output dissemination practice creation production prototype science outreach display	evaluation or criteria and assessment quality guidelines techniques critical appraisal strategies methods framework
Phase 2	arts-based media coverage or blog video broadcast online channels or social media games webinar website event exhibition theater exhibition museum exhibition creative or interactive and journal conference proceedings dissertation VR AR presentation or co-presentation visualization or visual methods/practices or photography paintings cartoons still images drawings performing arts or performance methods/practices or dance drama musical productions literary works or	evaluation or criteria and assessment quality guidelines techniques critical appraisal strategies methods framework

	poetry fictions short stories blogs creative writing projects or designs installations 3D sculptures poster installation audiovisual or cinematography design performing arts visual arts narrative methods or narrative practices	

2.2 SELECTION CRITERIA

The following inclusion and exclusion criteria are used to make an information resources selection:

(1) The dissemination practice is a subset of knowledge translation.

(2) The terms to identify the object that is disseminated are “science”, “research” and “knowledge”.

(3) The goal of the knowledge translation is to enable others (citizens, the public) to actively use and take up the research results and stimulate interactive science.

(4) There are two main groups that are included in terms of perspective from which the selection for information sources is made, namely: (creative) science storytellers and citizens (the public). These perspectives align with the position of the makers and the target groups they intend to reach.

(5) The tools by which dissemination takes place go beyond traditional means. The creative and interactive forms can be supplementary or alternative to standard academic formats for science dissemination

(6) Only studies that contain criteria to evaluate dissemination practices are selected for our research.

(7) The criteria need to be relevant for public outreach. There needs to be a public engagement angle.

(8) This review will include information sources that are theoretical, empirical and methodological, and reviews that display quality criteria that are in line with our proposal.

(9) The use of quality criteria for critically assessing science outputs that disseminate research results for citizens in and beyond academia surpasses disciplinary boundaries and cuts across different research fields such as social sciences, humanities, education. While social-behavioral sciences are the main disciplinary focus, we will consider information sources with a social-behavioral focus from the socially engaged arts and design sector. etc.

2.3 THE INFORMATION SOURCES SELECTION AND SCREENING

To extract data from the information sources, we will select and screen potentially relevant information sources by the following procedure: (1) an initial screening undertaken by one reviewer who will examine the title and the abstract of the retrieved studies to determine their appropriateness in relation to the purpose of the review project. After this preliminary screening, we will (2) organize a screening exercise for the predetermined inclusion criteria in the abstracts, undertaken by two additional reviewers, who work independently. A final step is (3) retrieve full-text copies of all potentially relevant information sources selected for inclusion. When there are information sources labeled as unclear, or there is a disagreement on the relevance for inclusion, a fourth researcher will be involved.

2.4 THE ANALYTIC APPROACH

The extraction of data will be conducted by one reviewer and controlled by another. The data will be tabulated in a standard MS Excel sheet. To develop an evaluation framework for creative and interactive dissemination practices, we will synthesize findings of qualitative research with a thematic synthesis approach (Thomas & Harden, 2008). With this approach, the information resource is itself an analytic unit. We will identify all possible ideas and group them to clusters with label captions for categorization of criteria.

3 TIMELINE

	Month								
	3	4	5	6	7	8	9	10	11
Writing protocol									
Search									
Screen									
Analysis									
Writing Systematic review									

4 DISCUSSION: CHALLENGES

This review process introduces a few challenges that are caused by on the one hand the broadness of the research topic and on the other hand the ambition of the research project to be comprehensive in what is presented.

4.1 IMPROVING SCIENCE COMMUNICATION BY DISSEMINATION?

We are mindful of the fact that science dissemination is only one part of the whole chain of doing science: starting from the framing of the science inquiry, the gathering of data, the interpretation of the data, and finally the dissemination itself. Since dissemination is the last step in the process, it is important to notice that the quality of the research can only be preserved and not added. The aim of dissemination is to translate knowledge acquired through scientifically sound research as good as possible, so that the value of the findings will not be lost in translation. Improving science communication thus starts on the level of the inquiry and interpretation of the research. However, specific judgements related to the methodological quality of studies preceding dissemination is beyond the scope of this evaluation framework.

A real challenge here for the science community is to guard scientific integrity when entering the larger field of broader science communication. It is characteristic for communication dissemination that the communicated information is directed to an audience without direct contact to a receiver or clarification method (Durham Peters, 2006). For example, an excellent dissemination practice from an aesthetic evaluative perspective does not prevent from citizens misinterpreting findings, nor does it protect us from data manipulation and misinformation.

4.2 TARGET GROUP: SCIENCE STORYTELLERS... AND THE PUBLIC

The evaluation framework to be developed from the identification of relevant evaluation criteria is intended to guide all kinds of science storytellers with their knowledge translation to the public. This framework, however, might perhaps also help people critically assess the quality of science stories that are directed to them. Even though our focus is on informing science storytellers (our target group), the framework in development can be used by citizens as a quality assessment tool to judge the quality of dissemination practices they are engaging in. Within our research we are unfortunately not exploring this potential.

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