

Chapter 24

Communication and Dissemination in Citizen Science



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Abstract Citizen science projects rely on public involvement, making a communication and dissemination strategy essential to their success and impact. This needs to include many aspects, such as identifying the audience, selecting the communication channel(s), and establishing the right language to use. Importantly, citizen science projects must expand beyond traditional top-down *monologue* interactions and embrace two-way *dialogue* approaches, especially when communicating with project participants. Further, to be effective, communication activities require good planning and dedicated resources. This chapter highlights the importance of communication and dissemination in citizen science; provides examples of successful strategies and identifies the factors that determine success; and describes some of the challenges that can arise and how to overcome these.

Keywords Community building · Face-to-face interaction · Online communication · Storytelling · Non-written communication

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Introduction

Communication and dissemination are fundamental to the success of projects in any field. This is especially true for citizen science, where projects rely on public involvement and often aim to reach policymakers. Effective communication and dissemination efforts reach and engage their target audience(s) and achieve the desired impact. They also increase a project’s visibility and reach, keep participants actively engaged, and increase the likelihood of influencing policy. Ensuring that communication and dissemination are effective requires careful planning, the use of best practice, and sufficient resources.

Communication in citizen science may change during a project’s life cycle. At different stages, it may be needed to recruit, motivate, and retain participants; to recognise and acknowledge their inputs (e.g. through reports and media coverage); to inform them of the project’s aims and scientific processes; and for exchanging information about the project’s results and outcomes (Fig. 24.1; Hecker et al. 2018; de Vries et al. 2019; Veeckman et al. 2019).

Communication activities also need to be suited to factors that differ between projects, such as audiences, geographical scales, timescales (e.g. 1-day events, multi-year projects, annual investigations), tools (e.g. mainstream media, live events, social media), and desired impacts and outcomes (e.g. new scientific knowledge and/or understanding, education, policy change). Defining target audiences is fundamental as it influences decisions on all other factors.

In this chapter, we discuss some key themes around communication and dissemination in citizen science (see Box 24.1). First, we debate *factors* that influence the success of communication and dissemination efforts. Then we describe different

	Two-way communication	One-way communication	
	Engagement	Outreach	Dissemination
Aim of communication	<ul style="list-style-type: none"> Motivate people to participate Maintain interest throughout a project 	<ul style="list-style-type: none"> Motivate people to participate Raise awareness of a project and/or methodology 	<ul style="list-style-type: none"> Feedback to participants Communicate concrete results Influence policy
Target audience	<ul style="list-style-type: none"> Potential or existing participants/citizen scientists 	<ul style="list-style-type: none"> General public 	<ul style="list-style-type: none"> General public Policy/decision makers Scientists
Channel of communication	<ul style="list-style-type: none"> Face-to-face Online and written media Social media Project channels (e.g. website, app, newsletter, web chats, etc.) 	<ul style="list-style-type: none"> Online and printed media Social media Written communication (e.g. project publications) Face-to-face (e.g. at local events) 	<ul style="list-style-type: none"> Online and written media Social media Written communication (e.g. peer-reviewed publications, policy briefs, etc.) Face-to-face (e.g. conferences)
Timing	<ul style="list-style-type: none"> Beginning of a project Throughout a project 	<ul style="list-style-type: none"> Beginning of a project Throughout a project 	<ul style="list-style-type: none"> Towards the end of a project After a project

Fig. 24.1 Types of communication and their associated aims, target audiences, channels of communication, and most appropriate time point within a project

communication approaches and provide *examples* of what works in citizen science. Finally, we consider some of the *challenges* with communication, along with *tips* for developing an effective *communication and dissemination strategy*.

Box 24.1: What Is Dissemination?

Unlike communication – the continuous transfer of information and feedback between project organisers and other stakeholders – dissemination commonly happens towards the end of a project, for example, the distribution of project results (e.g. data analysis and results) and lessons (e.g. good practice guidelines). Dissemination in science, even citizen science, is often a one-way process, frequently through published research (e.g. in scientific journals), conference presentations, or policy briefs. The importance of both communication and dissemination is reflected in the European Citizen Science Association’s *10 Principles of Citizen Science* (Robinson et al. 2018). They state that ‘citizen scientists receive feedback from the project’ (communication); ‘citizen science data and metadata are made publicly available and, where possible, results are published in an open-access format’; and ‘citizen scientists are acknowledged in project results and publications’ (dissemination). This shows that, whilst distinct from communication, dissemination remains important in citizen science: participants value access to project data and being informed about scientific findings and outcomes throughout a project (de Vries et al. 2019).

What Is Good Communication?

Many factors affect the success of communication activities, and ensuring these are in place is an intricate, time-consuming task. The first questions for citizen science projects, and almost all communication efforts, are to consider who is your audience and how to address them (both outlined below).

Communication is a continuous process that maintains openness between all participants at each stage, from setting research questions to publishing the results (Veeckman et al. 2019) and informing as many people as possible of the project’s outputs and lessons. Given this time frame, communications planning should be done right at the start of a project. This involves an assessment of the resources available and how much time and money to dedicate to reaching each target audience and at each stage of the project. A communication and dissemination plan is also important, for developing a schedule for each activity and later evaluating how successful activities have been (see Schäfer et al., this volume, Chap. 25).

Ultimately, good communication means that people have listened to, understood, and acted upon your messages – and, hopefully, become involved in your project.

Who Is Your Audience?

For any communication activity, in any field, the first step is to decide who your audience is, which should be done through a systematic process of determining the individuals, organisations, and groups that have an interest in a project or initiative and are impacted by its outcomes. It is typically broken down into four phases:

1. *Identifying*: listing relevant groups, organisations, and people
2. *Analysing*: understanding stakeholder perspectives and interests
3. *Mapping*: visualising relationships to objectives and other stakeholders
4. *Prioritising*: ranking stakeholder relevance and identifying issues

The audience(s) you identify for each communication initiative will determine its characteristics: where it is held, the frequency and duration, the medium used (face-to-face or online), the amount of resources invested (time and financial), and the language used. The message to be conveyed is also influenced by the audience and their motivation to participate in the project (Land-Zandstra et al., this volume, Chap. 13). Generally, stakeholders want different things: *citizens* want a sense of being part of the project and that their ideas are taken into account; *professional scientists* want their research to be seen and understood by a larger, more engaged audience; *project organisers* want more people to know about, and participate in, their projects; and *policymakers* want better information on which to base their decisions. The better you understand your target audience(s), the more personally – and effectively – you can tailor your communication (Veeckman et al. 2019).

Use of Language

Whether communicating online, through printed media, or face-to-face, the language you use – its terminology, tone, and complexity – matters. This is especially significant for citizen science projects, as these broadly aim to increase participation and inclusiveness in science (see Paleco et al., this volume, Chap. 14). Whilst certain terms can engage some audiences, getting the language ‘wrong’ can exclude people at the first step of the communication process (Eitzel et al. 2017). For instance, common words used in science need to be adapted to audiences from different cultural or literal backgrounds, and the tone should never be authoritative. In addition, texts should be easily understandable; we suggest using *readability formulas*, statistical tools to objectively measure the relative difficulty of texts.

It is also necessary to reflect on how inclusive the language used is (e.g. not describing citizen scientists as ‘he’ or ‘she’) and whether it reflects people’s everyday lives: explaining why an issue is relevant to someone’s location, culture, or community is likely to increase interest and, ultimately, participation. Even the term chosen to refer to participants is significant: are they ‘volunteers’, ‘citizens’, ‘amateurs’, ‘hobbyists’, or

‘helpers’?¹ Two-way communication with project participants is important here, as it can lead to co-creating specific language for the project.

Monologue or Dialogue

Until a few decades ago, most science communication was based on the *deficit model* (Smallman 2018). Information was sent from a sender (scientist, science communicator) to the audience in the form of a monologue, a one-way message. Scientists and science communicators saw it as their duty to inform the general public about science, to instil a positive public attitude towards science. When controversies over science arose, a lack of scientific knowledge among the public was often seen as the culprit (Bubela et al. 2009; Smallman 2018). However, this deficit model does not always increase trust and support for science; it can even be counterproductive (Bubela et al. 2009).

Recently, thinking in science communication has shifted towards a more interactive approach, in which *dialogue*, or *two-way communication*, is preferred (Bubela et al. 2009; Smallman 2018). The idea is that in a democracy, citizens should be consulted in decisions about scientific research and policy. This new paradigm of dialogue recognises the role that trust, participation, and relationships play in effective communication, in addition to knowledge. Citizen science fits this new focus. When considered as an avenue for science communication, it can be a way for scientists and citizens to interact and collaborate. However, its impact depends on how a project is designed. For example, crowdsourcing projects, or projects where participants collect data without ever meeting or engaging with scientists, are less able to follow this interactive approach.

When organisers and participants truly want to become collaborators, it is essential that communication goes beyond the one-way diffusion of information. Ideally, all participants should have regular opportunities to communicate with each other, and with project leaders, to share their ideas and ask questions. Similarly, professional scientists need to communicate with participants, for example, to follow up on data quality issues. Target audiences (e.g. the media or policymakers) should also have opportunities to provide feedback or communicate what information they want or need from a project. Inclusion and participation are central to citizen science, and this field has been at the forefront of the shift from linear monologues to two-way dialogues, as a way to encourage engagement, interaction, feedback, shared knowledge, and mutual learning. In a similar vein, there has been a shift to expand beyond top-down projects, where initiatives are devised and led by professional scientists and research institutions, to a range of bottom-up and co-creational approaches, where the research question is determined in collaboration with a range of stakeholders, together with researchers, or entirely community-led (e.g. to

¹Eitzel et al. (2017) consider potential pitfalls with each of these terms.

address a local concern). However, there may still be moments in a project when one-way communication is appropriate, for example, when raising awareness, sending around instructions or protocols, and updating participants about progress (Fig. 24.1).

Approaches to Communication

Technologies have been effective in engaging large numbers of people in citizen science. *Online projects* provide opportunities to support geographically dispersed groups of participants and can attract participants that want to contribute at a time and level convenient to them. However, *offline activities*, such as attending face-to-face meetings and events, remain important for social interaction and networking with other participants in person. Both channels of communication appeal to different types of participants and can be combined to overcome barriers and increase the inclusiveness of the project (Land-Zandstra et al., this volume, Chap. 13; Paleco et al., this volume, Chap. 14).

The type of project will influence the most appropriate mix. Van Noordwijk et al. (this volume, Chap. 19) define four types of citizen science projects, which have different target audiences and require various communication media. Successful citizen science projects rely on a careful choice about how to blend these channels, according to their type and target audiences.

- *Place-based actions* are targeted at audiences within a specific geographic range. Face-to-face communication can help to recruit more participants; attendees may motivate others to participate. Online communication can be useful to inform about events and milestones.
- *Interest group investigations* target existing communities and people with a shared specific interest. Face-to-face communication is important to bring like-minded people together and to grow existing communities. Online communication can maintain contact between communities and help to include participants/communities from other areas.
- *Educational research* targets educational facilities. Face-to-face communication can promote exchange between different groups. Online communication is crucial to motivate new groups to join the project and to include groups from other areas.
- *Mass census* projects target the general public. Online communication is often more appropriate, because face-to-face events exclude anyone from other areas or with time constraints. Face-to-face communication can be relevant to mass census projects if they are organised at numerous places across a large area – but this can be highly cost- and time-intensive.

Face-to-Face Interaction

Face-to-face interaction involves both verbal and non-verbal communication. Facial expressions and gestures help to build relationships as much as words, creating bonds between individuals and setting a foundation of trust and collaboration. Such interactions provide long-lasting memories and connections for people in a way that is more challenging with online participation.

Events and other ‘live’ outreach activities provide opportunities for face-to-face interactions between a project’s scientists and participants and ideally other stakeholders (e.g. policymakers, media). They are key to engagement and bring a range of benefits that can influence the social and scientific outcomes of a project. For example, ongoing face-to-face communication between project staff and participants often helps to improve data quality and reliability. In addition, events provide opportunities to recruit new participants and reward existing ones for their contributions, thereby improving participant retention rates. Events also allow project organisers to observe participants’ behaviours, which can help with efforts to monitor and evaluate project developments and impacts.

Informal settings for face-to-face communication enable participants to interact and socialise with their peers, thus enabling effective dialogue, facilitating mutual learning, and increasing knowledge uptake (Cappa et al. 2016). Including hands-on activities helps to encourage questions and critical thinking and therefore learning. For example, practical experiences outdoors, such as *BioBlitzes* (see Box 24.2), have been successful in achieving this. In addition, they have the potential to reconnect people with nature and develop a sense of ownership of their local environment, which motivates citizens to take action and get involved in scientific research.

Box 24.2: BioBlitzes as a Communication Tool

During a BioBlitz, members of the public, professional scientists, and voluntary naturalists come together to record species inventories and abundances at a specific geographical site and within a predefined time frame. A BioBlitz aims to capture a snapshot of biodiversity, but it is also commonly focused on creating a social experience. Such social events often prove an effective way to engage the public and recruit new participants. When planned effectively (i.e. informing the media beforehand), BioBlitzes have often also been covered by the local media, amplifying the impact on society and raising awareness for environmental issues. Acting not only as data collection initiatives but also communication tools, BioBlitzes have become very common worldwide, and practitioners have created several user guides to enable the sharing of good practice (e.g. Robinson et al. 2013).

When planning an event, it is important to consider the different motivations, needs, skills, and available time of participants. However, scientists and citizen science project organisers often receive little or no formal training in public outreach and communication. Fortunately, the DITOs project (discussed in detail in Vohland

et al., this volume, Chaps. 1 and 3), which carried out a wide range of events – including travelling exhibitions, film nights, debates, hands-on workshops, and BioBlitzes (see Box 24.2) – provides invaluable experiences on how to enable people to participate at a level suitable for them. Some of these experiences and best practices (DITOs Consortium 2019) are summarised here.

- Regular meetings with people already active in the target area build trust and can increase participation in citizen science activities.
- It is important to be inclusive and ensure that meeting hours comply with the participants' schedule limitations.
- Events should include ice-breaking activities and playful check-ins to set a relaxed tone and encourage interaction.
- The public appreciates informal conversations with scientists. Effective and simple communication at events can help demystify science and academic research.
- In presentations, lengthy explanations and complicated methods should be balanced with photos and videos to explain results and (re)capture attention.
- The use of examples, analogies, and *storytelling* helps make information accessible to non-experts and to connect science to their interests, values, and everyday lives.
- Allowing everyone to access equipment (e.g. microscopes, projectors), and being authentic about the knowledge limits of the organisers, raises the self-confidence of participants.
- Citizen science is about teamwork. To create a supportive atmosphere at an event, it is important to be on time; ask participants for their feedback after the event; and give compliments in public, but criticism in a private and constructive way.
- Co-designing events can stimulate creativity: integrate ideas and suggestions from your team, participants, and other institutions.

Communication in a Digital World

Much of the growth in citizen science initiatives over the past two decades is due to the emergence of enabling technologies, such as the Internet and smartphones. In the digital world, we can be connected almost continuously with our spheres of interest. From a citizen science project's perspective, technology supports two key types of communication (Fig. 24.1): engagement (internal communication) with project participants and the building of communities (a form of outreach).

Online Communication with Participants

Communication with participants not only conveys information; it also acknowledges the time and effort they put into a project. Frequent exchanges also act as a motivation and prompt for regular contributions. Often, a project's *website* is the first (digital) port of call for newcomers to a project, but it should not be the only one.

Through modern approaches, such as *push messaging* features in the apps and digital tools of a project, the project team can reach out to participants directly and provide information in real time, ideally with an option to read more about the topic. For web-based projects, a newsletter function and postings via social media networks can also be effective.

Online communication should always have a distinct message and a clear writing style. The use of *emojis* can help reduce the danger of misinterpretation and can convey the tone of the conversation or a feeling about a message. They should not be seen as a gimmick, or unscientific, but rather a way to add nuance and be inclusive.

Building Online Communities

Citizen science projects often aim to create a community of participants around the core issue (see Box 24.3). Direct communication using online tools can facilitate the growth of and exchange within communities, during data collection phases and when projects are inactive.

Box 24.3: Naturkalender ZAMG: An Active Digital Community

This Austrian citizen science project achieved a very active community, with more than 5000 app downloads, through continuous press and media coverage. Participants contribute observations of plant and animal species throughout the year and record their changing phases (e.g. first appearance of a species, fruit ripening, leaf colouring).

The app, created by SPOTTERON, features an integrated community toolkit, which allows established users to welcome and support newcomers to the project and to help with the classification of observations via instant feedback loops in the comment sections of each contribution. To help with community management and data quality, regional project partners, such as national parks and meteorological stations, work as data moderators. For clear distinction between user types, these partners have unique profile pictures (*avatars*) with the visual design elements of the project.

The project research team also interacts directly with the community via comments and feedback on new contributions. Further functionalities to support ongoing community building include highlighting valuable contributions and being able to appreciate a spot by pressing a heart-shaped button. The project team also utilises a ‘push messages’ feature to report news back to citizen scientists or to communicate seasonal information about key species to observe.

Fig. 24.2 Communication flow in a modern citizen science community-based app based on the SPOTTERON platform model



Forms of communication between participants can have different levels. Even quick, straightforward forms of appreciation (e.g. giving ‘likes’ or ‘hearts’) to comments and discussion threads make people feel recognised and rewarded for their inputs. Through an online friendship or following model, users can build their own network within a citizen science app and interact with each other, forming an inclusive and immersive community of participants and scientists alike (Fig. 24.2).

However, not every user has the same level of digital competence; it is essential to have materials available for new users which answer basic questions about interactive concepts within an app or web application (e.g. a downloadable manual, Frequently Asked Questions on a website).

The management of online community activities is best done in a separate section of an administration interface, allowing the option for the project team to reply or intervene. For example, such an interface should have the option to unpublish comments in real time or block users if abuse of the tools occurs. In addition, report functions are helpful so that community members can report such abuse. As with the protection of users' personal data (see Tauginienė et al., this volume, Chap. 20), it is the project's responsibility to establish a healthy space for communication.

Reaching Out to the Public

Citizen science always requires 'getting the word out': a project has to actively communicate with potential target groups and spark interest for them to contribute to data collection and analysis. The first impression is a lasting one, as it conveys a project's image to potential participants and affects their decision to take part. General design and marketing principles, such as clear wording, high visual quality, *bite-size media outputs*, and a constant flow of information and activities, are crucial to this. As with all communications, it is vital to catch people's attention and have a clear, strong message.

A lot of early information is processed by people when they look at the website, app, materials, or even just the logo: known in the advertising world as *project identity*. The project identity needs strong individuality, a descriptive name, and a message that conveys what the project is about with few words and ideally connects with people and piques their interest. A distinct *visual identity* – logo and colour scheme – acts as a visual anchor that links the project to every image, media post, publication, and tool it produces (see Box 24.4). Overall, the project identity helps users build a relationship with the project.

Box 24.4: CrowdWater: An Effective Project Identity

CrowdWater is a global citizen science project which collects hydrological data. Initiated by the University of Zurich, Switzerland, its aim is to develop a cheap and easy data collection method that can be used to predict floods and low river flows.

CrowdWater has a strong visual identity which includes Droppy, a character who appears in all CrowdWater-related communication and activities.

(continued)

Box 24.4 (continued)

Having a character constantly represented creates a positive image: it can help to increase participation by appealing to a broad sector of the public, without making the project seem too serious. Droppy appears in various poses on the website, in videos, on printed material, in social media, and in presentations and acts as the mascot of the project.

In our digital and mobile world, reaching out to the public is fast and happens in real time, but attention spans are short. This makes it imperative to create a flow of information in the form of bite-size media outputs, in which project information is shared with the public in small parts. Each item can be posted on various platforms with a ‘Read more’ link to a news item when available. However, newspapers, radio, and television remain great *message multipliers*, even in an age dominated by social media and the Internet. When the traditional media reports about a project, this can not only be useful for reaching new audiences (i.e. those not using social media) but also give a project’s messages credibility that is sometimes lacking in online communication.

If citizen science is to truly contribute to the democratisation of science, it must strive to reach a wider range of audiences and participants (see Paleco et al., this volume, Chap. 14). When planning communication activities, it is important to consider how inclusive the chosen methods of reaching out to the public are. Rather than just considering who each format will reach, it is necessary to ask: who *won’t* it reach? And, as an essential follow-up question: how can I reach those overlooked groups and individuals? Ensuring a project is inclusive requires allocating resources, considering which communication approaches are most likely to reach excluded groups, the type of language used, and where and when these groups are already meeting (Veeckman et al. 2019).

Successful Communication Approaches

There are numerous examples of successful communication in the field of citizen science. Here, we consider in detail a specific method (storytelling) reaching a particular audience (policymakers)² and using non-written forms of communication.

²As an alternative, Veeckman et al. (2019) provide a good outline of how to engage with teachers in citizen science projects.

Storytelling to Generate and Transfer Knowledge

Storytelling is a proven way to generate and impart knowledge, one that is currently used in diverse contexts. It is regarded as an independent form of knowledge generation and knowledge transfer that can complement scientific knowledge in a meaningful way on cultural, social, and individual levels. In citizen science, storytelling focuses on communicating the ways in which citizens can get involved in projects. Stories can be personal, historical, or educational (Veeckman et al. 2019), and a narrative is created when they are linked together, which can provide people with a connection point for their own experiences. Stories can depict the immediate context, providing meaning to participants and reflecting their experiences, thereby providing a means to generate, analyse, and pass on actions, experiences, and biographical knowledge for citizen science projects in creative ways (Hecker et al. 2018; Richter et al. 2019). Good stories are memorable, often feature a ‘hero’ and describe a conflict, have a specific aim, and awaken emotions in your audience (Hecker et al. 2017). This ensures that the generated and shared knowledge is accessible to all, making it a particularly effective tool for hard-to-reach or neglected groups.

Narrative knowledge should not be regarded as less developed than scientific knowledge; it is of equal importance in the context of citizen science. Whilst scientific knowledge is directed towards the *general* (the objective), storytelling is about the *particular*: the concrete, the subjective, and the transitory. Storytelling also allows events to be interpreted from different perspectives, which encourages the discovery of new contexts and aspects. As Box 24.5 shows, storytelling can play an important role in citizen science projects, far beyond knowledge generation and communication.

Box 24.5: Storytelling as an Effective Communication Tool

In the citizen science project *BrotZeit*, people who cultivate and process grains in the Lesachtal region of the Austrian Alps report their experiences in moderated narrative cafes. Through interviews with young people, they tell stories about their former practices and the rituals around baking bread. Other residents donate photos and films on this subject. Together, these are secured (e.g. interviews transcribed, films archived), analysed, and transformed into media products such as animated films, documentary films, open-air exhibitions, and raps.

Storytelling in *BrotZeit* sets a public and collective dialogue in motion: about experiential knowledge, the landscape, the change from generation to generation, and the sustainable use of resources. It makes visible the customs and practices that have often existed in secret, leading to a new understanding of regional characteristics, functioning communities, and a sustainable use of local resources. The ongoing documentation of the 36-month project, which includes a blog, public presentations, radio features, and monthly newspaper reports, enables people to reflect on this joint work on collective memory and evaluate the project results.

Communicating with Policymakers

Policymakers are a key target audience for citizen science projects that want to contribute to evidence-based policy, but bridging the gap between research and policy is notoriously difficult. One major challenge is bridging the differing values, expectations, and needs of the research system and policymakers (Hecker et al. 2018). Policymakers deal in facts and look for a high degree of certainty (Durham et al. 2014), whilst scientists (usually) deal in terms of probability and uncertainty. Also, there is often a mismatch between the time frames of policymaking and project results (Schade et al., this volume, Chap. 18). Policymakers tend to work on far shorter timescales than researchers, requiring quick answers as policy develops, whilst research often takes place over years (Durham et al. 2014). Another issue is reaching the right policymaker; they can range from those who sign off on the final policy document (the decisionmaker) to those that advise, inform, and influence them throughout the process. Then there are the alternative – often competing – influences on policy formation (e.g. voter priorities, funding, personal views, media-led priorities, and agendas). In light of these many barriers, it is not surprising that many citizen science projects find communicating with policymakers to be a challenge.

Fortunately, communicating with policymakers is not impossible, and there are examples of citizen science projects that have done this successfully (see Box 24.6). One popular approach is to produce policy briefs which summarise the key project results and findings in a clear style. Policy briefs can also provide interim results and updates, which fill a timely gap, as final project findings can take years to be published (e.g. in academic journals). Another method is to invite policymakers to project events and discussions, such as round tables. Whilst this can be harder to achieve, it has the advantage of being a place to start a dialogue (e.g. answering queries they might have or gaining feedback on future research they would like to see). Face-to-face contact can also establish personal connections, making future engagement with policymakers easier to plan and realise.

Box 24.6: Case Study on Policy Engagement for Citizen Science

The DITOs project's policy engagement strategy included producing 13 policy briefs³ to provide inputs and recommendations on key topics in policy discussions. These were disseminated online via DITOs and partner communication channels and were also printed and distributed at events. The dissemination was amplified through the inclusion of experts not directly involved in the project.

A second strand involved organising events such as local and European stakeholder round tables, delegation visits, and the final conference

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³All available at: <https://discovery.ucl.ac.uk>

Box 24.6 (continued)

Pan-European Policy Forum. These were organised with the aim of mobilising communities of practitioners, sharing of good practice, and strengthening the science-policy interface by opening up dialogue with decisionmakers. This successful strategy enabled the DITOs project to establish networks and influence national science policy; provide information for policy improvement; promote citizen science as an approach to research and science communication; demonstrate that citizen science can be an instrument to advance political agendas; and use citizen science as a direct governance instrument via non-policy actors (Göbel et al. 2019).

In some projects, policy engagement is planned from the outset, but too often it is an afterthought. Whilst not all projects should – or want to – link to policy, those that do should consider the expectations of policymakers from the beginning (Durham et al. 2014). Policymakers are more likely to engage with a project and use its results if it can provide what they need and expect. Further, collaborations with similar projects can increase the chance of reaching policymakers and provide a stronger evidence base for the policy advocated. Furthermore, projects that explicitly include efforts to communicate with the general public, especially through media channels, are often better received and taken more seriously by policymakers (Hecker et al. 2018).

Non-written Communication

Alongside considering how language can be inclusive, it is important to recognise that for some, language will always present a barrier: people who are visually impaired or illiterate (for written communication), deaf or hard of hearing (for face-to-face interaction), or not fluent in the language used. To reduce this barrier to participation, it is necessary to think beyond words and consider how pictures, graphics, charts, and video or audio clips can play a part in your communication activities.

Non-written communication should be used regularly throughout a project. Two effective approaches are *video blogs* (vlogs) and *podcasts*. These non-written forms of communication require equipment and software skills, and the production is often time-intensive. However, they will increase engagement and thus a project's impact. They are easily shared via social media, which can capture the attention of people that might otherwise not stumble across your project. There are a few general rules for both of these (adapted from Welbourne and Grant 2015; Gray 2020):

1. *Decide on a frequency:* Will you produce vlogs and podcasts on a regular basis or after specific milestones in your project? Bear in mind that these can be relatively resource-intensive.
2. *Identify your reporter:* Consistency is important – if vlogs and podcasts always feature the same reporter, your audience will get familiar with this person and be much more likely to join or follow your project.
3. *Find a style:* Will you appear in your vlogs, or will it feature only your voice? Will your podcasts be a monologue or feature interview guest(s)?
4. *Keep it short:* Both vlogs and podcasts should get to the point quickly. Front-load them with interesting information to catch people's attention.
5. *Make it inclusive:* Vlogs and podcasts should be presented in an inclusive way, for example, featuring participants (whether citizens or others) that represent a wide range of genders, ages, races, and living environments (e.g. inner cities as well as the countryside).

Challenges

Communication can be one of the main challenges for citizen science projects. Despite outreach gaining importance in the scientific community, many scientists still receive little or no formal training in public communication. Those organising citizen science projects are often surprised by the amount of time and effort it takes to communicate well with participants and other stakeholders.

The first, and most essential, step to overcoming this is a communication and dissemination strategy. The effectiveness of this should be monitored and evaluated as soon as the project begins, using the principles for project evaluation (see Schäfer et al., this volume, Chap. 25). Following well-established practices from a range of fields, including science communication, can also increase the effectiveness of communication and dissemination across a project's life cycle. Even better, appoint a communication expert as part of the team, if there is sufficient budget to devote to this.

In citizen science projects, there is sometimes an initial burst of awareness-raising activity, after which attention on communication peters out until the project is nearing its end. Although this may in part be due to insufficient resources (or inadequate planning), it can also be an indication of changing circumstances. To catch such changes and address them effectively, it is important to build *health checks* into the project to account for changes, such as a shift in the research question being pursued and new stakeholders becoming involved, or simply to see if one communication medium is working more effectively than another. This should include a review of the project goals, a reassessment of the key stakeholders and their needs, a review of the effectiveness of communication activities and channels to date, and an update on the resources left (or that have become available). The outcome of this health check should be a renewed action plan for the remainder of the project.

Dissemination towards the end of the project, such as publishing in peer-reviewed journals and presenting papers at conferences, is much more within the comfort zone of academics and researchers – albeit outside those of many citizen scientists. However, two unique challenges are common within the field of citizen science.

The first is the importance of giving credit to all participants who contributed, directly or indirectly, to the generation of new knowledge or new discoveries. This requires some creative thinking. Examples of how to address this are the inclusion of schoolteacher Hanny van Arkel in the list of authors for the publication of the discovery of a new celestial object (Lintott et al. 2009) and the listing of all contributing participants in the Radio Galaxy Zoo project, which ensured they were directly acknowledged in the resulting publication (Alger et al. 2018).

The second challenge is how to make published outcomes, which are often written in academic language, accessible to all participants. Apart from publishing as open access and sharing the full academic publication or conference paper with all stakeholders – without presumption as to their ability to understand it – it is good practice to write up or visualise the outcomes in simpler terms and with a clear connection back to the original stated goal of the project.

Conclusions

There is not one perfect solution to effective communication in citizen science, as there are many factors in each project that must be taken into account. Furthermore, no communication and dissemination strategy should be static: it must be monitored, adjusted, and updated throughout the life cycle of a project (and possibly beyond). Many citizen science projects – including those highlighted in this chapter – have developed successful communication and dissemination strategies and have shared their best practice for others to learn from and adapt to. To conclude, we list some key communication tips (see Box 24.7).

Box 24.7: Tips for Communicating in Citizen Science

1. Create a communication and dissemination strategy for your project by asking the following:

- Who are the main participants? Who else do you want/need to reach?
- Who has the skills and resources to communicate effectively from the pre-project phase through to the post-project phase?⁴

(continued)

⁴Veeckman et al. (2019) suggest this is split into three roles: community manager, science communicator, and science trainer. This breakdown provides a useful way of mapping the different communication skills needed to reach different audiences/achieve a range of aims.

Box 24.7 (continued)

- What information do you need to communicate, and how often?
 - How will this communication take place?
 - How will you invite feedback, and how will you respond to it?
 - Are there guides, resources, and networks already out there that can help you to communicate your aims to your target audience(s)?
2. Communicate clearly: use simple language, strong messages, and different approaches to ensure you reach a wide and diverse audience.
 3. Actively communicate your project outside the scientific community, to increase visibility, raise awareness, and stimulate participation.
 4. Use online tools (e.g. blogs, social media, newsletters, vlogs, podcasts) and supplement them with offline tools (e.g. newspapers, radio, television) to reach people who do not have access to online media.
 5. Use non-written tools and approaches such as storytelling to increase people's understanding.
 6. Evaluate the success and impact of communication strategies to understand which are effective and which mistakes can be avoided in future projects.

Adapted from Pettibone et al. 2016; Hecker et al. 2018; Veeckman et al. 2019

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Philipp Hummer has been fascinated by nature since his childhood when he had had his first citizen science experience, reporting European green toad observations for herpetology research. In 2015, after a 15-year career in media design, Philipp founded SPOTTERON, a platform for citizen science apps and toolkits with a focus on design, interactivity, and community engagement.

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