INTEGRATING OPEN AND CITIZEN SCIENCE INTO
ACTIVE LEARNING APPROACHES IN HIGHER EDUCATION


# Guidelines for open science activities with citizens in higher education institutions


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# Introduction

The INOS project aimed for testing out how higher education institutions could implement open science and citizen science activities into the teaching process. Open science is "the practice of science in such a way that others can collaborate and contribute, where research data, lab notes and other research processes are freely available, under terms that enable reuse, redistribution and reproduction of the research and its underlying data and methods." (FOSTER, nd). Citizen science is one of the components of open science, actively involving and empowering citizens as active contributors to make science.

Open science and citizen science activities have been extensively conducted with different communities, but in higher education, such engagement activities were not widespread. It was believed that formal study forms could be enriched with novel community engagement formats to introduce students to how open science and citizen science can provide value for societies. Particularly, it was intended that students be involved in the design process of open science and citizen science activities for external stakeholder groups to let them experience the whole cycle of implementing these activities. It was set as a goal in the INOS project to open up the higher education learning activities to the external stakeholders by conducting several open knowledge activities as part of the student formal learning opportunities or providing them with some extracurricular experiences, such as through activities provided by research libraries. The types of activities in INOS Case studies were Crowdsourcing for knowledge such as in Wikipedia format, discussion and co-construction-based Knowledge workshops for developing ideas, designs, and events, Crowdsourcing for data such as with sensors, and Data workshops where specific aspects of the data were enriched (see in O3A2 and O3A3 for more detailed descriptions). This report summarises for the practitioners some of the lessons learnt from INOS case studies and provides some useful tips for educators.

# Lessons learnt from open knowledge-building activities in higher education

**Topics and problems for activities**

The open knowledge-building activities are not constrained to specific disciplines and may be conducted at science, art, and humanities topics. Most of all, open knowledge-building activities should be created to solve interdisciplinary challenges. The challenges should be co-developed as problem-based activities with societal value and importance for people and communities. Examples of such challenges in the INOS project were relating to science, social aspects with community needs, e.g., service design for and with the involvement of elderly groups, validating the public opinions about the developed recreational areas.

The activity must aim to introduce the knowledge of open science, let people experience open science practices and enable discussions on the openness, agency, inclusiveness values, and active citizenship. Examples of such problem challenges in the INOS project involved participants discussing how and why universities and research libraries are involved in citizen science.

**Tip. Plan open knowledge-building activities as the interdisciplinary challenges that aim for experiencing and understanding open science practices and active citizenship competencies.**

The types of problems that fit open knowledge-building represent complex problems. *Rule-using problems* enable highlighting, critically analysing, and using certain agendas, scientific resources, data, and procedural scripts (see Edu-a-Thon, SPINE, Noise pollution at Reidi Road, Knowledge jam, Life in the Zoo, Data workshop). In *trouble-shooting and diagnosis-solution problems*, a joint effort is directed to backward reasoning to engage stakeholders in identifying what causes the problem and testing what can eliminate it. In *decision-making and dilemma problems*, choosing and synthesizing for evidence-based alternative problem-solving paths and jointly mimicking the complex dilemma solving processes in role-playing could be done (see Life in Farm, Rover Adventure and Knowledge Jam). In *design type of problems,* the forward reasoning together with stakeholder groups enables to validate the best solutions (see the Elderly service design case, Catch up LET, Rover adventure).

Our trials in higher education settings indicated that very often, the lower hanging fruits in selecting the open and citizen science activity types (e.g. Crowdsourcing, Distributed Intelligence and Participatory science activity types) were chosen were only a few of open and citizen science engagement process phases were at present (participating in problem definition, harvesting the data or knowledge, interpreting the data and knowledge, synthesizing the data and knowledge), that could be easily conducted as part of short-lasting tasks with rule-using problems or design problems at the higher education courses. The collaborative science process in which the results will be taken to the real action, decision-making and policy discussions were not attempted as part of the explored cases in higher education institutions. Incorporating these would have required more iterative stages of the activity. Conducting the forward and backward reasoning activities such as decision-making and design problems requires more engagement stages to be planned and orchestrating this into the high school curriculum and bringing onboard external stakeholders may be challenging in short term tasks.

**Tip: Plan the open knowledge-building activities as problem-solving tasks that last throughout a longer study period to reach complex challenges with external stakeholders.**

**Codesign and agency**

All the INOS project educators were involved in developing the learning design framework for open knowledge activities (see Theo, 2020). This approach describes the activities' topics, example learning goals, general method descriptions, learning approaches, learning sequences, advantages of use for learning approaches, learning outcomes, collaboration/innovation facilities, tools, and resources (human resources, apps, digital and OER resources, open data, open-source software/hardware, specialist scientific equipment), motivators for learners, and challenges for learning. Through the developing process, four general types of learning scenarios were identified in open and citizen science activities: Activities for developing open collaboration in science and innovation, citizen science activities for inquiry learning, activities for open data training and innovation, and open innovation and design activities.

Many learning designs in open and citizen science activities incorporate passive learning components, informal science components, discussion-based components, inquiry-based components, and problem-based learning components. Rarer in open and citizen science learning activities are components of decision-making and policymaking. The learning design framework (LDF) (Theo, 2020) was developed and provided for practitioners in design guideline worksheets that can be used with student groups.

In the next stage, the project partners developed the learning design scenarios for open knowledge activities (pilot cases). In the planning phase, it appeared in our pilots that the educators did not systematically use these design guideline worksheets with students. The main learning design elements from LDF were considered when designing the learning scenarios for open knowledge-building activities. The planning took place in digitally mediated discussions that may have hindered using LDF worksheets among teachers and students.

At the beginning of our case studies, an extensive literature review was conducted to develop the Implementation guidelines for open knowledge-building activities (Pata, 2020). This approach emphasized the stages of Co-planning; Co-design; Co-delivery and Co-Evaluation, and the pervasive stage of Dissemination. The project also developed the framework for implementing the open knowledge-building activities (Pata, 2020) that followed the co-design stages and contained several learning sheets that aided the process using design thinking elements. We noticed that these co-design framework principles with students were not followed in most of the INOS pilot cases. Several educators explained that they did not plan the activity with the students. Thus, it was of little purpose to introduce them to the learning design and implementation frameworks.

**Tip: The INOS learning design framework (Theo, 2020) and the implementation framework for open knowledge-building activities (Pata, 2020) provide useful guides and working sheets for planning the open knowledge activities with higher education students and external stakeholders.**

INOS project aimed to engage higher education students in all the co-design and implementation phases of the open knowledge activities for engaging external stakeholders into open and citizen science practices. Most of the activities were co-planned by several HEI educators and library network partners

from different domains and experts. Some revisions were made during the actual process reflections every day.

In several cases, the students and academic staff collaborated intensely during the design/planning phase. Regular check-in conversations between academic staff and the students were held to share updates about the event plan and its development. Students were introduced to the idea of open knowledge activity as part of the course and guided in different planning stages. The students were responsible for the event implementation on their own (Catch up LET!, Rover adventure, Life in Farms). Our findings in explored case studies highlight that it was not familiar for the educators to create tasks within their higher education courses where they give partial or full responsibility for the students to plan their learning outcomes and plan their own learning activities as open knowledge-building with external stakeholders. The success of such cases where responsibility for planning learning outcomes and activities is shared with students indicates that it could be a fertile ground for higher education activities to create more self-direction intent and agency among students.

**Tip: To develop agency, involve students and colleagues and experts and external stakeholders in co-designing open knowledge-building activities for higher education students and external stakeholders.**

In some case studies, such as the Sensor-based CS problem-solving activity, the activity was planned so that the agency was moved to create the knowledge appropriation stages: from training the secondary education in-service teachers towards letting the teachers in schools explore the same practice with their students.

**Tip: Develop in your open knowledge-building activities the agency of your students using the co-design approach and create giving-forward chains to spread this to the next level stakeholders.**

In all the case studies, educators participated in iterative changes of the learning design, tested it out by themselves and made changes as the activity was running. The monitoring of the activities was based on oral feedback and the final evaluation surveys.

**Tip: Collect feedback on your open knowledge building activity to make relevant corrections on the run.**

In many cases, the initial learning task designers experimented in shifting the agency to different target groups. The mentoring and facilitator's role-modelling was crucial in this. For example, the agency of elderly stakeholders was grown in teamwork where mentors shaped the creative co-design practices in teams (Elderly co-design of services). Students' high agency in the discussion was considered to shift the activity in the run towards discussion groups (Knowledge building jams). Students' agency was grown in their own projects while presenting and debating about them. The augmentation examples and best practices were provided to students by mentors, growing their agency in transforming the ideas and debating. While mentoring was pre-planned by the open knowledge-building activity organizers, and one mentor was assigned to each group, not all the groups requested mentorship, and leaders arose naturally. There was an opportunity to ask questions from the mentor during the sessions (coaching), which some groups utilized, but in general, many groups did not need mentoring (Knowledge building jams). This outcome may depend on the experiences the participants have. For example, elderly participants requested mentoring help.

**Tip: Use mentors' tips to shift the agency to the participants.**

In many cases, small group interactions in the activity phases were conducted without facilitation using few e-mail communications (Knowledge building jams). Students' high interest in the activity results triggered the activity in editing Wikipedia related with their PhD study knowledge to be a very self-organized activity. It brought along the high agency of students (Edu-a-Thon case).

**Tip: Plan and structure activities and choose the tools to motivate participants and work in self-organized mode.**

The mode of engagement in the activities varied from moderated to free group discussions. Some of the activities were conducted in one big group. In others, the parallel sessions for group work were organized. It should also be noted that when the facilitators see that the groups self-organize, they know how to work. In what modes and environments to work, the facilitators should try to lessen the facilitation and enable the participants to grow their agency (see the cases of Knowledge building jams).

**Tip: Do not over-facilitate when groups can lead their work.**

Agency development and stakes for external participants

The agency of students in leading the engagement with external stakeholders and planning the whole knowledge-building activity was found to be successful in several cases (Rover adventure, Life in farms, Catch up LET). These cases used the co-design activities where pre-service teacher students interacted with in-service teachers to co-design the open knowledge-building activities for their schools. Regular digital check-in conversations were used to share updates about the event plan and its development while co-designing open knowledge activities. In many explored cases, the agency of higher education students in planning the open knowledge activity for themselves and external stakeholders remained low. Higher education educators and librarians led the design of the whole learning activity and tried to shift the agency to the students and external stakeholders in the mentoring sessions. The examples of shifting the agency were demonstrating effective argumentative practices (The knowledge building jams), or design thinking practices / The elderly service design case). In some cases, students led the activity design and managed the evaluation of the open knowledge activity (Catch up LET). This practice enabled the students to discover the stakes they would like to take to their future career and create actual capacities building networks, knowing about the future careers.

One of the stakes the open knowledge activities create is open knowledge or data and resources in which each stakeholder has an equal interest (widely known as "commons creation"). The value of such "creative commons" for the participants is related to their ownership, which is increased in the co-creation process. It was found in the pilots that some of the "creative commons" were perceived as personally valuable for their creators (such as in Edu-aThon, knowledge building jams, designing elderly services cases). At the same time, the open public value was not so evident. Also, the results were shared in semi-open formats. These were planned to be reused mainly by the related stakeholders in their further activities that were not part of the planned open knowledge activity. In other INOS open knowledge-building activities, open data were created. However, since the activity was short term, the amount of open data appeared insufficient to generalize. There was a missing stage to bringing the datasets to the policymaking level in such activities, such as for city planning (Sensor-based citizen science event). Such activity had a somewhat lower impact on the users' active citizenship competencies than the activities that also collaborated on the knowledge and data for problem-solving.

**Tip: It is all about growing the agency to be an active citizen in their communities - let participants have the stakes in the open knowledge-building activity that they want to carry to the decision-making and policies.**

**Involvement of external participants**

Engaging mentors

Engaging expert mentors in the different phases of the open knowledge-building activity appeared to be crucial because participants' wanted to hear the expert opinions and learn from expert practices. The invited experts, educators, research library specialists and students may be used as mentors for the involved citizens. Especially in group-work activities such as design-problems, it is important to facilitate the process stages with an expert mentor who can present expert ways of working and explain but who should not lead the group-work to enable the agency to grow in the team. Mentoring is also important in the discussions, such as structuring the discussion activities and managing time and groups. We could observe more need for mentors in digital mode, where the participants are divided into breakout rooms. While in face-to-face settings, the mentor can easily overhear many groups. The mentor can rather stay with one discussion group in digital settings. Moving between the groups may be perceived as an intervention to the group processes. Reaching out for the alumni was one of the success cases in the INOS pilots that brought them back as stakeholders into the open knowledge-building process with students (see Catch up LET case).

**Tip: Use mentors from experts, alumni, and trust your students to be mentors for external participants. Digital work in several focus groups should be mentored by different mentors rather than one.**

Engaging policymakers

The active citizenship survey's lower results regarding policymaking intentions indicated the need that open knowledge activities should be developed with the outreach to the active, relevant policymakers who are willing to take the results to the next policy level. The policymakers should create an open and easily traceable communication approach on how various types of public engagement, open knowledge-building activities' results are related and openly acknowledged in the justification of the policies. This approach will ease the higher education institutions, schools, and the citizen organizations to involve the policy discussions in the learning and open knowledge-building activities for solving challenges because they can tailor it with their activity scenario stages, showing the participants how their engagement will actively contribute to policies building societal value.

**Tip: Plan the policy discussions as part of your activity's final stage. Have a policymaker on board from the start who is interested in carrying on the message to the decision-making process.**

Engaging external stakeholders

The pilots in higher education settings demonstrated that higher education institutions could access different age groups and external stakeholder types as part of their opened-up learning activities. Primary and secondary education stakeholders may be accessed as part of formal learning in pre-service and in-service practice of educators. The library visitors may be invited to the open knowledge-building events using digital channels. The elderly interest groups and different interest groups, in general, may be accessed by the higher education institutions as part of the social science, digital technology,

communication science study programmes to include these stakeholders actively to discuss and design the solutions and services from their interest points.

One good example of accessing external stakeholder groups is using the open courses, winter- and summer schools, and research projects that target specific groups. While the participation of external stakeholders may be provided for free, some funding is needed for the mentors, experts, and organization of the activities that specific projects' funding can cover. Our pilots in higher education institutions engaged higher education students in such emerging project opportunities where the project educators were involved. The difficulty from the higher education pre-planning is to keep each course's learning tasks open and flexible so that the current projects and engagement with the public opportunities (such as educational hackathons, events, competitions etc.) could be made use of for developing open science activities for the students and external stakeholders. To enhance this, the higher education institutions should increase the collaboration among their educators and staff so that the knowledge of actual relevant project activities and other initiatives could be accessed in time and cross-used for developing relevant learning tasks at the higher education level.

Higher education students and external stakeholders could take similar active roles in such joint open knowledge-building activities organized by universities or research libraries. That way, the higher education institutions provided learning experiences to the external groups that could inspire them to take an interest in considering higher education studies.

**Tip: Be agile. Leave space in your annual course programmes for upcoming collaborative activities, projects and hackathons that could be used for your course tasks and may provide an excellent ground to engage with external stakeholders.**

Accessing stakeholders

In all the project cases, the accessing channels for external stakeholders' involvement were used that the educators and librarians already had as part of previous engagements (with schools, with organizations, with networks). Targeted social media invitations were successful in professional networks. Also, the mailing lists were used. In some cases, the students as event organizers also used social media to market the event for anyone interested in learning, education, and technology. All participants were given information about the activity and its schedule, and they voluntarily signed up to participate. All participants agreed to the use of their data for project reporting and gave vocal consent to publish their results after their presentations were submitted. OKA organizers were actively communicating with the Vice-Principal of the secondary school and the classroom teacher of the pupils about the planned activities.

**Tip: Inform stakeholders in personal networks, social media, and official channels about the open knowledge-building activities to gain more interest among the external from the higher education participants.**

**Timing the events**

In the INOS project, short term open knowledge-building activities (OKA's) were differentiated from longer-term open innovation activities (OIAs) arbitrarily, conducting pilots in both types. The open knowledge-building activities were conducted as short time interaction sessions where participants were met in 1-2 days in a few sessions. However, this factor limited the design of open knowledge activities to incorporate sequential stages and iterative developments into the open knowledge building, which specific types of problem-solving challenges would require. Many conducted open knowledge-building activities focused on the initial stages of the open and citizen science process - opening up the problem, crowdsourcing the data, maturing the data and knowledge in active discussions, composing ideas. There were not many opportunities for actual data collection in the field due to Covid-isolation, limited time to validate the ideas in actual situations, and the knowledge and datasets and idea descriptions were not moved to policymaking and decision-making levels.

**Tip: To have more impact on active citizenship competencies, plan the knowledge-building activities not as short-term tasks within the higher education courses but as longer course-wide sequential tasks that move towards the final target and cover all the open science process phases.**

The piloting of different open knowledge activities demonstrated that, particularly, the policymaking discussions were not planned into the open knowledge activities where specific data or knowledge was crowdsourced. This background diminished the meaning of such activities for the participants. It could have resulted in their lowered intent to be engaged in policymaking using open knowledge and data to justify their expectations, as indicated in the survey results of the active citizenship competencies.

**Tip: Integrate policymaking discussions and decision-making into the final stage of your activity.**

**Environments for interaction**

Digital interaction

The projects' open knowledge activity pilots were conducted during the Covid crisis, where mostly the digital mediums were open. Yet we found it possible to conduct various problem-type open knowledge activities using digital mediation. Open knowledge-building activities in higher education settings that reach external stakeholders benefit from being mediated by open digital tools (see Sensor-based citizen science problem-solving case, Edit-a-thon case). The tools should enable:

- setting the challenge together with different stakeholders; - sharing the challenge publicly in social media environments where the stakeholders can find it.

- asynchronous and synchronous interaction opportunities.

- crowdsourcing for open data and knowledge in the commonplace with a specific structure (e.g., data sharing, Wikipedia and other platforms).

- automatically creating the data visualizations, open knowledge representations that may be used for discussions with different stakeholders.

- pulling out the datasets for analytical procedures or reusing the open data and knowledge for novel services.

- launching policy discussions and digital deliberations or polls about the challenges.

- ensuring that the products of knowledge-building activities could be digitally shared and preserved in the open common spaces for later access.

**Tip: Plan first the interactions and action stages and then look for supportive digital modes to mediate this.**

Useful platforms and apps for open knowledge-building events were:

- citizen science geolocative platforms http://Avastusrada.ee; http://Anecdata.org for setting up crowdsourcing
- knowledge crowdsourcing platforms: Wikipedia
- online meeting platforms for instructing and mentoring discussions: http://Zoom.com, Anymeeting, MS Teams, e-mail, Microsoft Teams, SharePoint, One Note, Discord https://discord.com/brand-new, Minecraft Education Ed.
- co-creation and teamwork platforms Trello.com, Wonder.me, Flinga, Jamboard, Kahoot, Google Forms
- resource sharing LMS platforms, Google classroom, Google drive
- tools for managing open data

Preparing the digitally mediated design and data workshops knowledge-building activities required pre-planning the datasets and the digital co-creation canvases.

**Tip: If needed, use the digital environments that the participants have already experienced and easily grasped.**

Results sharing places

Providing public and easily findable open access to the results was not easily achieved in the higher education pilots because universities and public places do not have such hubs were to present the open knowledge-building results and datasets so that a wide range of people would get to know of these results and may reuse them.

**Tip: Plan publicly popular places for sharing the results of the creative commons. The shared open data and knowledge should be valuable for more than only for your activity participants.**

**Learning assessment**

Preconditions for participants in knowledge, competencies, resources

In most cases, there were no preconditions for participation for external stakeholders regarding knowledge. However, motivation and interest were essentially required. For HEI students, the preconditions were set as part of the course programmes where the open knowledge activities were embedded.

The learning outcomes from open knowledge activities

The open knowledge-building activities in pilot cases intended participants to achieve citizen science knowledge, practices and values (active citizenship competencies); developing open data, knowledge and resources "creative commons"; changing mindsets to open knowledge usage processes in the society and the higher education role in it; creating evidence-based results for policymaking in HEIs; as well as developing participants' soft skills and creativity, digital competences and the level of mastering new tools.

The types of creative commons that resulted from the activities were open geolocative data and citizen science and learning tracks in geolocative space, enriched informally audited Wikipedia pages, project idea descriptions, digital discussions of open science, canvases with knowledge creation products such as idea walls, journey maps, personas, business canvases, value wheels and others such as Minecraft educational tools. The following ideas were co-developed further: future service designs for elderly groups such as a male garage, how to sustain a longer happy work-life for elderly +50 groups, inclusive for the elderly work environment, accessible cultural routes for all, a course design introducing citizen science as an elective in a university, contesting pseudohistory through citizen science, visualizing a workplace of the future, Inclusive City, the impact of pesticides on infant growth, the use of citizen science in cognitive psychology.

The soft skills learnt related to common approaches of tackling the design type of problems iteratively using design thinking approaches and the technical tools. Digital collaboration and co-creation and networking competencies were learned, which also related to diversity management and tolerance. Since many activities were digitally mediated, many learning opportunities with collaboration, discussion, and co-creation tools were provided. Students, external participants, educators, and experts became more familiar with working practices in these digital tools. The participants also gained experience in a gamified collaborative learning environment.

Several creative commons results were created in crowdsourcing, discussions, and co-creation, but these results were mainly supported with digital evidence due to digital mode mediation. GDPR and FAIR principles were learnt and followed while conducting the results. The participants could not act in real settings in most of the cases. They often remained semi-open and difficult to find for other target interest groups. The results of open knowledge-building activities were not brought to the next level of policymaking because there were few stages for policy discussions built into the scenarios. As a whole, the case studies of INOS provide several valuable insights on what hinders using open and citizen science approaches at higher education institutions and why collaboration with external stakeholders is difficult.
In the survey, the participants expressed their active citizenship mindset regarding knowledge accessibility, open innovation, social engagement. The HEI students could broaden their knowledge base

on open/citizen science and how these can be integrated into their work, as libraries act in many cases as hubs for OS and CS activities. The students could broaden their mindsets in the discussion about citizen science pros and cons. and how these can be integrated into their work, as libraries act in many cases as hubs for OS and CS activities. There was a change in mindsets among HEI students regarding knowledge accessibility, open innovation, social engagement, and the HE role in society. Students as organizers gained insight into open science and citizen science in event planning. Students were developing active citizenship skills by strengthening their professional identity and the idea that they could impact addressing bigger problems in society. Students strengthened their active citizenship skills and abilities to use different tools and resources to collaborate through long-term intervention. The elderly participants changed their understanding of how to co-create open innovation. They have developed a high inclination to social engagement between the elderly and other age groups. Educators gained insight into open science and citizen science.
In different cases, all stakeholders could learn about sustainable cities and communities, reducing inequalities and creating partnerships in the communities, they gained access to a wider/bigger community of learning sciences and ed-tech, they strengthened the international and cross-border intercultural community, the students in schools inquired and learnt about aspects of farm life such as growing plants, animal husbandry and food products.
**Tip: Plan the open knowledge-building activity impact criteria broadly: cover people's competencies, capacities in the communities, and values in the societies.**

The assessment of learning outcomes in the INOS case studies was product-based. In most cases, the assessment was formative and was provided by mentors and experts. In a few cases, the Digital Open Badges were used to assess project work, collaborative learning process, individual reflection, and participation in each phase of the course.
Gamified approaches to merit the participants such as educational badges, points, leader-boards, levels, viewing other participants' contributions can support social motivation during the open knowledge-building activities. Game-based experiences have fostered engagement and collaboration in some pilot cases and helped direct participants towards achieving specific learning objectives that the open knowledge activities intended (see Life in Farms, Rover adventure with schools).

**Tip: Gamification of the open knowledge-building activity may deepen the motivation of participants.**

# Conclusion

This overview of lessons learnt and some tips from INOS cases is intended to encourage the higher education educators to creatively try out the learning activities with the open and citizen science approaches that are planned with the students, implemented with and for the students and external stakeholders and can provide value for all. The most important lessons that we learnt during the Covid crisis implementation of open knowledge-building activities is to be agile and flexible in finding opportunities for engagement between higher education students and the external stakeholders. We found that developing higher education students' agency by involving them in the co-design and implementation of citizen science activities with external stakeholders was challenging and should be focused on as a specific objective in planning the students' learning tasks. It became evident that the policy discussions should be promoted more frequently by the engagement of the policymakers. Also, we found that universities generally do not have good spaces for sharing the co-created knowledge publicly to provide long-term benefits for the communities.

INOS projects' vision is that communities should be guided to partake in the open and citizen science practices and higher education has a leading role in it. We believe that such an approach to have cross-border open knowledge-building activities between higher education and the communities will develop active citizenship competencies among students, educators, community stakeholders, and policymakers. It will help to increase the joint capacities for building better futures. As a long-lasting impact of the joint agency, new knowledge building practices, mutual trust, and shared values are created among all, and the communities can use open science creative commons in future actions.

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