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

Open knowledge activities evaluation in higher education institutions

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Abstract:	This report evaluates the 12 open knowledge activities (OKAs) conducted by INOS partners in higher education institutions. The intention was to

engage a wide audience to open knowledge co-creation activities while upskilling HEI students and staff in citizen science and open knowledge creation and public engagement. The report illustrates the OKA case studies, synthesizing the aspects of HEI's engagement with external stakeholders, the principles of creation and sharing of open knowledge across the practices. The deliverable provides an overview of the indicators: how many students, educators and external stakeholders could the INOS open knowledge activities engage (404 individuals). It also contains the survey of the individual gains among the stakeholders because of open knowledge activities (21 % of completed surveys).

Keyword list: open knowledge activities

Consortium

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1	Aalborg University	AAU	Denmark
2	Tallinn University	TU	Estonia
3	Web2Learn	W2L	Greece

4	University of Oulu	UO	Finland
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Executive Summary

This report evaluates the 12 open knowledge activities (OKAs) conducted by INOS partners in higher education institutions. The intention was to engage a wide audience to open knowledge co-creation activities while upskilling HEI students and staff in citizen science and open knowledge creation and public engagement. The OKA activity in HEIs particularly focused on citizen science as institutional citizenship and inclusive excellence, and education of open science skills by providing skills and training for staff and students in OS practices in innovative and informal settings through mutual learning opened up to the public engagement and creation of societal impact. The intention of OKAs was to promote HEIs for a cultural shift towards making them open innovation agents in society.

The report illustrates the INOS project OKA cases to inspire the future application of open knowledge activities in HEIs. The report synthesizes across the practices the aspects of HEI's engagement with external stakeholders, how to achieve participants' agency, and how the cases were achieved to create and share open knowledge.

The report provides an overview of the indicators: how many students, educators and external stakeholders could the INOS open knowledge activities engage (expected 420 individuals, final 404 individuals). It also contains the survey results of the 90 individual active citizenship competency' levels estimated after the open knowledge activities (expected 65 % of completed surveys, final 22 % of surveys).

Introduction

This document aims to assess the applicability of open knowledge activities (OKAs) in higher educational practices. OKAs in this report are bottom-up, technology-mediated forms of public engagement of HEIs within their teaching and learning activities for social and community purposes. Such events aimed to test out practices in HEIs to engage the public and external stakeholders in evidence-based activities leading to:

- the creation of shared resources in which each stakeholder has an equal interest (widely known as "commons creation"), in a participatory, bottom-up and user-driven way.
- the development of technical and digital skills or the mastering of new tools among the participants.
- the creation of evidence-based results strengthens the evidence-building effort highlighted in EU policies.
- change in mindsets of participants of OKAs (students, educators, and the external stakeholders) regarding knowledge accessibility, open innovation, social engagement, and the HE role in society
- the development of participants' agency as active citizens.

Scope. The report synthesises the results of 12 open knowledge activities conducted in the partner institutions of the INOS project. The OKAs took place as part of the opened-up learning practices in HEIs. They intended to publicly create open knowledge and data using digital technologies in the co-creation process. While the case studies were to be tested out during the Covid-crisis, many of the OKAs were conducted in digitally mediated mode. The INOS project initially defined OKAs as short-term engagement formats (one or two days), which could be sustained at the learning practice level by HEIs. In actual cases, the OKA events ranged from one-day to two or three days, and longer-term OKA planning activities in which the codesign part of the activity held jointly among several stakeholder groups added the time. The common descriptor of OKAs was the engagement with external stakeholders from HEIs, involving them in the co-creation of knowledge, production of new open knowledge and data, and promoting the development of all participants knowledge and competencies of citizen science open science as active citizenship compounds. The technical skills, as well as collaboration skills within the citizen science OKAs, were in focus. In the design of OKAs, we intended that the higher education students, educators, external stakeholders, and experts would take part in the codesign and actively implement the OKA activities. This idea aimed to develop active citizenship competencies and knowledge of open science and citizen science activities.

Five INOS project partners conducted 12 open knowledge activities, among which were datathons, service jams, designing services for and with elderly people, crowdsourcing the environmental data, collective contribution to scientific data, knowledge cafes as collective knowledge building events and Dotmocracy workshops, gamified open knowledge-building activities with STEM tools. The target groups of OKAS ranged from primary and secondary school students to higher education students at master and PhD level, higher education and secondary education educators, research experts from academia, elderly groups, and library assistants.

All open knowledge activities were educationally designed following the INOS educational learning design scenarios. This design ensured the focus on the quality of the educational outcomes of the activities for the HEI students and external stakeholders. Secondly, the organizers of OKAs followed the implementation

framework guidelines, which addressed the engagement, management issues and many more. All OKAs were documented using the predefined evaluation guidelines to be comparable for assessment purposes. Additionally, the participants were asked to complete the active citizenship competencies survey in each OKA. This approach enabled us to systematically address the learning gains of the participants.

Audience. The audience of this document is higher education institutions: the educators, educational policymakers, active learners. The document intends to provide some guidelines for HEIs to work with external partners in open knowledge creation. Thus, it is of interest to various regional organizations who see citizen science as a way to collect data, engage citizens into actively contributing to their communities and make decisions based on open knowledge and data they have collected.

Structure. The structure of the document is as follows:

The first section provides a brief introduction to Methodology. The evaluation instruments can be found in the annexe section.

In the second section, the overview of the OKA cases is provided as good practices. While the summarized report of OKAs (see report O3A2) has provided the short numerical data on what was in each OKA, in the current document, we look at the cases more qualitatively, telling the story of what happened. In the third section, we summarize some lessons learnt regarding engagement practices across OKA cases. The last section provides the learning outcome results based on the active citizenship competencies survey. The summative report of the lessons learnt, and good practices will be provided in O3A4.

The conclusion takes the helicopter view of what the INOS project achieved by conducting open knowledge activities.

1. Methodology

The INOS project addressed the task of testing and assessing the applicability of open-knowledge activities as learning practices in doing the following steps:

At the beginning of the project, we overviewed current open knowledge creation practices. The learning design framework used those OKA practice examples to suggest the learning scenario templates for OKAs. Next, the implementation framework to guide the development and management of open knowledge activities was developed. This framework contained:

- the guideline of how to document the case studies (Annex I)
- the survey of active citizenship competencies (Annex II)

These were used for developing and documenting the OKAs.

The INOS partners met monthly online during the implementation phase to discuss the OKAs they planned and described the lessons learnt. This formative sharing process was used to make small changes in the assessment procedure. For example, the universal survey instrument was not suitable for all the OKA cases, and each case adopted the survey, sometimes some questions were left out because they were perceived as irrelevant (some of the active citizenship competencies were not addressed in specific activities) or too difficult for the young students.

The final assessment report is based on the formative evaluation templates collected from the partners and organisers filled in during planning and after completing their cases. The survey data from different cases were anonymously collected from educators, students, and external stakeholders. Since not all cases contain all the survey items' data, the complete dataset regarding each survey item is different. We could not achieve a 65 % answering rate for all items. The total response rate was 21 %.

The ethical and privacy guidelines were followed in collecting the data from OKAs.

The limitations of the study originate from the Covid-19 pandemic. There were difficulties in accessing external stakeholders into merely online activities. Since the face-to-face studies were inhibited at HEIs, many collaboration activities in planning the OKAs could not occur as we had initially intended. Some of the OKAs were delayed. The partners fulfilled the requirements: one partner conducted three OKAs (instead of 2), and the other conducted one OKA (instead of two). The total number of participants in OKAs was expected to be 420, but the achieved number was 4. However, more than planned, higher education students took part in the activities as part of the formal course activities than those who were engaged as part of extracurricular activities. Also, there were difficulties accessing the segments of students and teachers from secondary education since the schools were closed. It was not possible to do outdoor events to engage random citizen groups. The number of engaged elderly participants was also lower than expected because they had to keep their distance. Attending digital events was more challenging for them because of their lack of specific competencies with the tools used for design and collaboration practices. Covid-19 forced the partners to conduct digitally mediated activities, which provided an extra opportunity to develop digital competencies related to open science and citizen science practices. We could also validate digitally mediated active citizenship and public engagement activities between HEIs and the open stakeholders in the regions.

2. Open knowledge activities - Case studies

2.1. Case 1. Noise Pollution on Reidi Road

Topic. Noise pollution and health and wellbeing in the city
Duration. 2. October 2020 (event with teachers), 8. February - 4. March 2021 (event with students at schools)
Main platform. http://Avastusrada.ee; http://Anecdata.org
Location. Outdoors, Tallinn, Saue, locations of great noise pollution
Resources
Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide a short list or links):
Similar activities. first iteration
Participants. 25 teacher education students at Tallinn University who are working as teachers, 1 HEI educator, 12 students from 9th grade (15-16 years old), and one educator. Twenty-five teacher education students working as teachers engaged school students to similar tracks that they created. We also mediated the OKA activity to 12 secondary education students from 9th grade (15-16 years old) and their teacher.
Mode of engagement. face-to face, outdoors, online meetings (event with students at schools)
Frequency of interaction. One-time data collection and discussion activities (events with teachers), meetings and discussions once a week (four meetings in total) and data collection between the meetings (events with students at schools)
Participants' pre-activity knowledge. Not knowledgeable of digital tools for outdoor learning, not knowledgeable about open science practices
Participants' input to learning design. Teachers participated in iterative changes of the learning design, tested it out by themselves and created their own designs for the students.
Learning outcomes. Developing citizen science competencies and the competence to build citizen science activities with digital and sensor-based tools outdoors.
Innovation goals. Develop the interactive sensor-based citizen science activity that can be scaled up to many schools and public spaces
Elements of openness.
Create open data.
Participate in the decision-making of the public space design.
Sustainable development goals: quality education, reduced inequalities, sustainable cities and communities, partnerships for the goals
Activity format.
Pre-training: Track for citizen science challenge was built by a teacher in avastusrada.ee

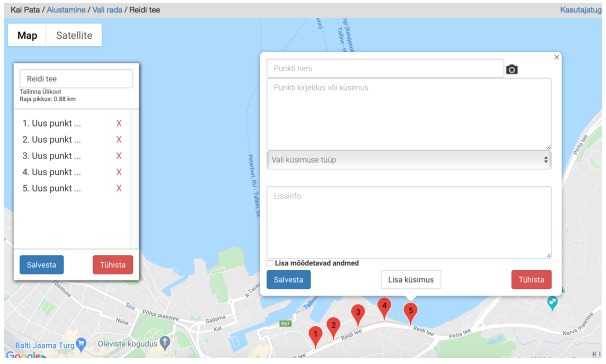

Figure 1.1. Screenshot of geolocation track building tool avastusrada.ee

Main task.

Phases of the activity.

All participants were introduced to the idea behind citizen science as a data-based decision-making activity on the outdoor lecture at the track. With different participants' groups, we tested the challenge track at Avastusrada. It was particularly studied how to use different question types to create questions for deep learning and interaction.

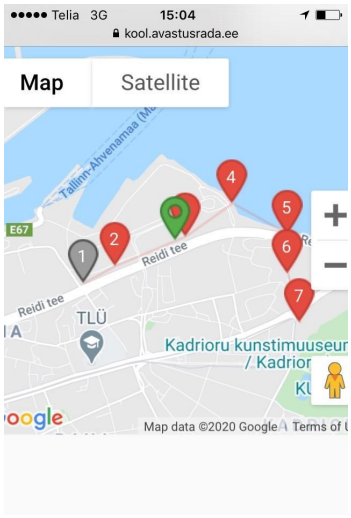

Figure 1.2. Positioning to the question.

Figure.1.3 Taking sensor data outdoors

After testing, the mentor and participating teachers looked at the data and improved the positioning of the points, the questions.

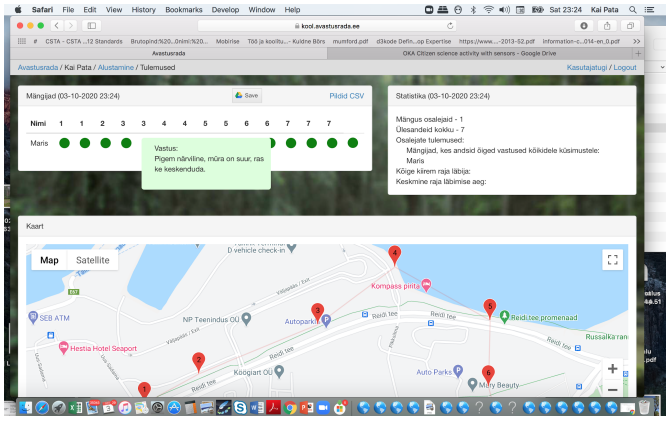

Figure 1.4. The finalised geolocation crowdsourcing track data collection points.

In the end, all participants filled in the OKA citizen science survey. The survey provided suggestions on how to improve the activity.
In the next iteration, the teacher students created similar outdoor challenge activities for their students. They tested the prepared activity with the groups of students in schools. One teacher already tested a similar outdoor activity with her students. Firstly, the students were introduced to the idea behind citizen science as a data-based decision-making activity. Then the challenge track at Avastusrada was created in collaboration with the students. The students had four weeks to participate in the challenge and collect data several times. During that time, online meetings took place once a week. At the last meeting, the

results were discussed, and conclusions were made together with students. The students also filled in the OKA citizen science survey.

HE students participation mode: Compulsory formal learning activity for your HE students, course task, not graded. OKAs engaged HE students to participate and organize citizen science activities in their job positions.

HE students' agency in the responsibility areas:

i) OKA idea generation: missing

ii) OKA co-planning and co-design: high; part of the co-design of the activity tracking

iii) OKA team management: missing an activity was self-organised for students

iv) OKA execution: high, teachers developed open-air learning scenarios with citizen science approach, students and teachers collected crowdsourced data

v) OKA evaluation: high, participated in the evaluation of the tracking

vi) OKA communication: high, teachers communicated citizen science activities to their students

vii) using the results of OKA: high; teacher students have learnt a method that is applicable in their everyday school practice and applied it in the teaching and learning process

How were "citizens" accessed/involved and by whom:

The regular course accessed teacher students in service at HEI. The teachers involved the students from schools - they created the track together with the teacher, collected data and discussed the results.

What are educators', librarians', researchers', and HE students' preconditions for participation:

None

Mentoring needs during the OKA: The HEI educator mentored the teachers. The teachers mentored their students.

Grading the HE students: Teachers were formatively evaluated for scenario building.

Please describe the difficulties in the crisis time to deliver your planned activity: Activity was conducted in the periods when there was no lockdown with teachers. With students, the teachers used online instruction during the lockdown.

History of the OKA: Conducted something similar in designing geolocation learning tasks.

Explain briefly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- *the creation of shared open data, knowledge, and resources in which each stakeholder has an equal interest (widely known as "commons creation"), in a participatory, bottom-up and user-driven way.* Data and scenarios were created by participant teachers and students
- *the development of technical and digital skills or the mastering of new tools among the participants.* Both teachers and students learnt digital competencies.
- *the creation of evidence-based results strengthens the evidence-building effort highlighted in EU policies (decisions, problem solutions).* Teachers and students created crowdsourcing paths and data but did not use these data for decision-making.
- *change in mindsets regarding knowledge accessibility, open innovation, social engagement, and the HE role in society.* Teachers learnt how to create open innovation in geolocation spaces making the citizen science tracks. Students and teachers learnt about shared access to crowdsourced data and the need to be active for collecting such data.

How long can the OKA outcomes be used: short-term/long-term, teachers, can reuse the tracks

How did you follow ethical, privacy requirements and copyright policies?

- **How did you follow ethical guidelines in recruiting participants? (e.g., consents, information sheets)** All participants were recruited as part of regular learning activities. Without consents, information was provided orally.
- **How did you manage the data? (describe using FAIR principles)** The citizen science crowdsourcing portal provides data for scenarios and collected sensor-based measurement data.
- **How did you follow copyright policies?** The data and scenarios are open for public use. The track authors can also share the activities in a more closed format using a pin code for access.

2.2. Case 2. Designing public services for the elderly with external stakeholders

Topic: Designing public services for the elderly with external stakeholders
Topics for design: Using the potential of elderly people for the society; challenges of gender-related ageing and equal opportunities; raising the digital potential of elderly people; removing the discrimination of elderly at work and society; Developing the professionals with mentors from the elderly workforce.
Duration: 16 hours, 15-16 December 2020
Main platform: Google classroom, Zoom.com, Trello.com
Location: Tallinn, Tallinn University
Resources: digital co-creation platform Trello.com and canvas examples developed for design thinking
Similar activities: It was a new activity
Participants: stakeholders representing an elderly group (ten people), higher education facilitators (three)
Mode of engagement: Only in a virtual mode on Zoom.com
Frequency of interaction: two days (2x8x45 min)
Participants' pre-activity knowledge: They were activists of senior organizations interested in actively changing services for the elderly.
Participants' input to learning design: The seniors were not part of the learning design. The educators participated in jointly designing the activity.
Learning outcomes: Design thinking competencies for open innovation of public services
Innovation goals: The conceptual design for public services targeting elderly groups. The activity used the input from Public documents that govern the life of elderly people. The goal was to design services for elderly.
Elements of openness: The activity teaches open innovation, the conceptual design ideas are developed in co-creation, the conceptual design ideas are shared as semi-open knowledge and open services.
The activity taught co-creation, open design ideas using design thinking practices.
Ideas were shared among the groups and will be developed further by the groups after the training.
Three ideas were developed: The Garage for elderly lonely men, The Community collaboration and inclusion projects, and How to sustain longer happy work-life for elderly 50+ groups.
Sustainable development goals: quality education, reduced inequalities, partnerships for the goals
Clearly directed to reducing inequalities and creating partnerships in the communities.

Activity format:

Pre-training.

There was no pre-training in this module, but the participants had formed earlier groups and developed their ideas.

Main task.

To design the services for elderly groups

Phases of the activity

Day 1. Introduction to design thinking. Phase 1. Mapping the values for design in Trello.com board (all groups together) and simultaneously discussing in Zoom.

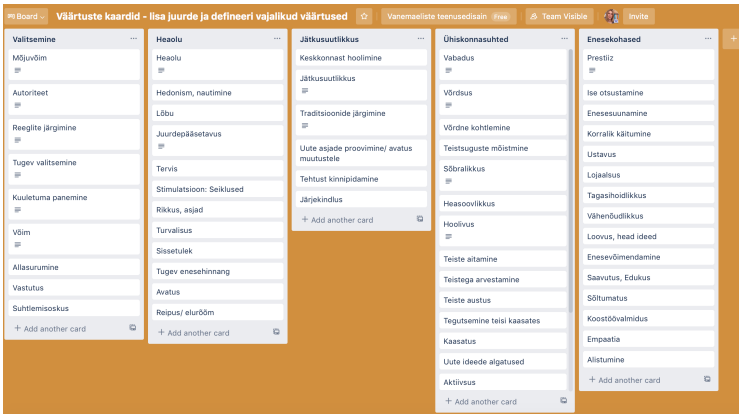

Figure 2.1. Values map screenshot in Trello com.

Phase 2. We created the templates in Trello the Teams and the templates for the design process in team space in separate groups. First, they filled in the Future wheel (using Trello, we modified the wheel to the path). The Future wheel discussions were in separate ZOOM groups.

The teams presented the future wheels on Zoom.

Figure 2.2. A screenshot of the Future wheel method with Trello com.

Day 2. Introduction to User-centred design. Phase 3. Persona mapping in Trello.com board in groups with Zoom discussions. Teams presented their results to each other.

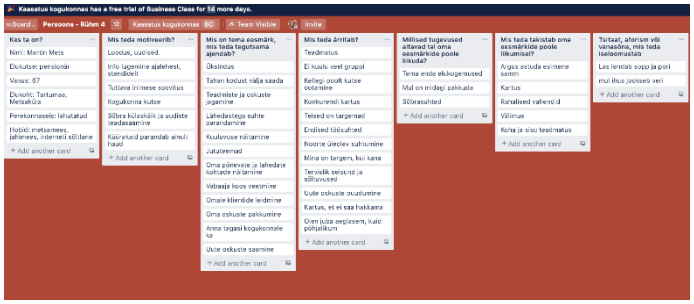

Figure 2.3. A screenshot of the persona mapping with Trello.com

Phase 4. User journey mapping in Trello.com with Zoom discussions. Teams presented their results to each other. Discussion on co-creation digital tools.

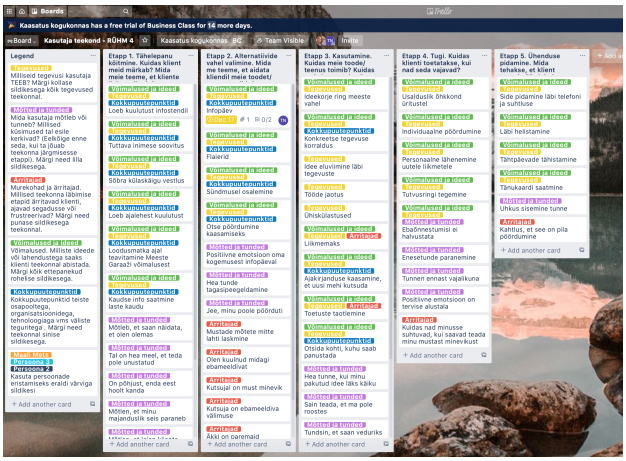

Figure 2.4. A screenshot of the journey mapping with Trello.com

Phase 5. Filling in the INOS survey.

Figure 2.5. The final homework was done in Trello.com as teamwork after the activity. The teams created a Business canvas for their service as the screenshot demonstrates.

HE students participation mode: Optional formal learning activity for elderly who participated in the module. Participants were from external elderly organizations.

HE students' and educators' agency in the responsibility areas: no HEI students were involved, only HEI educators and external stakeholders from elderly groups

i) OKA idea generation: high, educators designed the activity idea, but it was not codesigned together with elderly groups

ii) OKA co-planning and co-design: high, educators were engaged in activity design, but it was not codesigned together with elderly groups

iii) OKA team management: high, educators as mentors were engaged, as well as elderly stakeholders had their own design teams formed

iv) OKA execution: high, elderly stakeholders and educators as mentors were engaged in design thinking phases

v) OKA evaluation: high, educators as mentors were engaged as well as peers evaluated each other

vi) OKA communication: low, cross teams' communication was used among elderly groups
vii) using the results of OKA: high, educators received new cases and experiences, elderly increased the ownership of their designed services

How were "citizens" accessed/involved and by whom:

University educators accessed the elderly participants by the public call directed to organizations for the elderly that was mediated by their network Golden League. They were accessed by targeted social media invitations.

Educators', librarians', researchers', and HE students' preconditions for participation: There was no precondition for elderly participants. The mentors had to have digital design thinking process experience and experience with the elderly target group problems and their learning needs.

Mentoring needs during the OKA:

Mentoring was done in all the phases of the design thinking activity in Zoom subgroups and the main group.

Grading the HE students, explain what way grading was organised for OKA

Formative evaluation of design products was used for providing feedback.

Please describe the difficulties in the crisis time to deliver your planned activity:

There was a slight technical difficulty since not all elderly had good digital facilities, Trello.com did not work with Internet Explorer.

Past history of the OKA: Conducted earlier/Conducted something similar/Totally new

It was a new activity design, especially using Trello.com for design thinking canvases that were not tested for this purpose.

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- *the creation of shared open data, knowledge, and resources in which each stakeholder has an equal interest (widely known as "commons creation"), in a participatory, bottom-up and user-driven way.*
  The elderly stakeholders created service designs, the future services (such as engagement garage for elderly men) will be public resources for elderly
- *the development of technical and digital skills or the mastering of new tools among the participants.*
  The elderly participants learnt design thinking skills and several digital collaboration and co-creation competencies with digital tools.
- *the creation of evidence-based results to strengthen the evidence-building effort highlighted in EU policies (decisions, problem solutions)*
  The elderly participants solved the problems for elderly groups. They were directed to end with working solutions. Potentially when they finish their solutions, there is a high impact on the communities.
- *change in mindsets regarding knowledge accessibility, open innovation, social engagement, and the HE role in society.*
  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.

How long can the OKA outcomes be used: The final services have long-term usability and high impacts for participants because they continue the development of their ideas or projects.

How did you follow ethical, privacy requirements and copyright policies?

- **How did you follow ethical guidelines in recruiting participants? (e.g., consents, information sheets)** Participants were informed of the opportunity to participate in the design course by the Golden League network for the elderly. No consents were used regarding participating.
- **How did you manage the data? (describe using FAIR principles)** No private data were collected.
- **How did you follow copyright policies?** A two-day activity used codesign to transform to develop the conceptual design ideas for elderly groups. The design thinking approach was used. The final artefacts are in groups' Trello boards. Teams kept ownership of their design results.

2.3. Case 3: Integrating Citizen Science at Universities: from 'What' to 'How

2.3.1. Case 3-1 in Serbia and Bulgaria

Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible:

LIBER; Belgrade University (Serbia); St. Cyril and Methodius National Library (Serbia); University of Library Studies and Information Technology(Bulgaria)

The topic of the activity: Open/Citizen Science

Domain area: social sciences/ humanities

The length of the activity (planned execution period):

Three sessions: session 1 – 1 hour; session 2 – 45 minutes; session 3 – one hour

Activity duration: short-term

Who are participants in OKA: 18 HE students: bachelor/master/PhD); two HE educators, and librarians

Mode of engagement: small groups

The delivery mode of the activity: online

Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide a short list or links):

apps, software: Anymeeting, MS Teams

learning resources: three videos of lectures prepared specifically for the activity

Frequency of interaction: periodic interactions – three consecutive days, one session per day

Activity approach:

The online activity was designed to allow the participants from Belgrade University (Serbia), St. Cyril and Methodius National Library (Serbia) and University of Library Studies and Information Technology (Bulgaria) time to interact, discuss ideas and challenge outdated concepts in smaller international groups. The event focused on:

• what citizen science is,

• why it is important for the society as a whole and individual communities around the world,

• requirements to take into consideration when involving citizen scientists in research projects,

• examples of how citizen science is integrated into education programmes and benefits such integration produces.

Three speakers presented Citizen Science, Copyright and its relevance to Citizen Science projects, and data mining and its possible application to the participants during the first day. They did so through 15-minute online lectures with questions and answers sessions at the end.

After the presentations, participants were split into three groups, in which they discussed ideas for a citizen science project to develop and present during the debates in two days.

The second day presented an opportunity for those participants chosen to represent their teams at the debates to participate in the coaching session. Tatsiana Yankelevich (Training Coordinator) and Vasso Kalaitzi (head of International Projects) from LIBER advised the attendees to effectively construct and deliver an argument online. They further guided the participants to better structure and presented their projects during the debates. Participants also asked several questions about the projects they were developing and how they could be best arranged as citizen science projects.

The culmination of the event was the debate, organized on the third day. Each group had seven minutes to present their ideas and ten minutes to answer questions from other groups and judges. While judges chose a winner based on the previously defined criteria, they noted that all three projects were innovative and topical and had a lot of potential for implementation. One of the projects focused on creating accessible cultural routes for all in Sofia, Bulgaria. Another was a course design introducing citizen science as an elective in a university. The winning project was designed around the idea of contesting pseudohistory through citizen science. In their feedback, participants noted that they particularly enjoyed the opportunity to learn from each other and to challenge their ideas through project development.

Preparation and implementation of the activity: Prepared and implemented by LIBER, with the collaboration of two LIBER members: Belgrade University (Serbia), St. Cyril and Methodius National Library (Serbia) and University of Library Studies and Information Technology (Bulgaria)

HE students participation mode: Voluntary, informal learning opportunity they can do in their free time

HE participants' agency in the responsibility areas:

i) OKA idea generation: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity

ii) OKA co-planning and co-design: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity

iii) OKA team management: missing/low/high: Because of COVID-19 restrictions, students could not be engaged in the design of the activity

iv) OKA execution: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity

v) OKA evaluation: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity

vi) OKA communication: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity

vii) using the results of OKA: missing/low/high. Participants, including HE students, mentioned that they would like to use the ideas generated during the activity to further develop them and implement them in their universities.

How were "citizens" accessed/involved and by whom: Citizens were not involved. The design of the OKAs delivered by LIBER mostly targets University staff (lecturers and librarians) as well as library students as multipliers of Open Science (OS) and Citizen Science (CS) in their universities. LIBER designed the OKA to train them in integrating OS and CS in their work.

Educators', librarians', researchers', and HE students' preconditions for participation: We had no preconditions for participation but collected information about prior knowledge on the subject to prepare accordingly.

Mentoring needs during the OKA: While the OKA organizers foresaw mentoring and one mentor was assigned to each group, the groups did not request mentorship, and leaders arose naturally. There was an opportunity to ask questions and mentor during the second session (coaching), which some groups utilised, but in general, the groups did not need mentoring.

Grading the HE students: there was no grading, as the activity was voluntary and did not count towards any course credit. All participants received certificates of participation at the end. However, the results produced by three groups were evaluated on the previously defined and announced criteria by the judges, whom speakers and mentors represented.

Please describe the difficulties in the crisis time to deliver your planned activity: It was challenging to bring the interactive part of the activity online because of COVID-19, but this was resolved by creative small groups and allowing the participants themselves to choose how and when they will meet to discuss ideas and prepare a project presentation.

Past history of the OKA: Totally new

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

• *creation of shared project ideas in which each stakeholder has an equal interest, in a participatory, bottom-up and user-driven way.* The participants expressed interest in bringing these projects to life with further consultation of the experts who presented during the activity.

• *broadening of 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

• *change in mindsets regarding knowledge accessibility, open innovation, social engagement,* and the HE role in society.

How long can the OKA outcomes be used: Long-term

How did you follow ethical, privacy requirements and copyright policies?

How did you follow ethical guidelines in recruiting participants? All participants were given information about the activity and its schedule, and they voluntarily signed up to participate. After submitting their presentations, all participants agreed to use their data for project reporting and gave vocal consent to publish their results.

How did you manage the data? (describe using FAIR principles) The data collected from participants during the registration process was collected through a google sheet and used exclusively for the purpose of registration, distribution of resources designed specifically for the participants and provision of access to the online platform, in which the OKA took place, and evaluation. Participants gave consent for this specific use of their data during the registration process. The data collection process followed the INOS Data Management Plan. The presentations designed for the participants by the speakers and all guidelines created for the event have been shared in Zenodo and are openly available for re-use.

How did you follow copyright policies? GDPR was closely followed during data collection, and proper attribution was given to re-used materials in the presentations.

2.3.2 Case 3-2 in Leuven University Library I

Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible: LIBER; Leuven University and Library (Belgium)

The topic of the activity: Open/Citizen Science

Domain area: social sciences/ humanities

The length of the activity (planned execution period): two sessions: session 1- two hours; session 2 – 1.5 hours

Activity duration: short-term

Who are participants in OKA: 29 HE students: bachelor/master/PhD; two HE educators, librarians

Mode of engagement: small groups

Delivery The delivery mode of the activity: online

Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide a short list or links):

- apps, software: Zoom meeting, MS Teams, e-mail
- learning resources: videos of lectures prepared specifically for the activity

Frequency of interaction: periodic interactions – three consecutive days, one session on day 1 and one session on day 3, with small group interaction on day 2 without facilitation and e-mail communication with the organizers

Activity approach: Please provide short information about how you planned and implemented the activity.

The online activity was designed to allow the Leuven University and Library participants and other LIBER member institutions time to interact, discuss ideas, and challenge outdated concepts in smaller international groups. The event focused on:

- what citizen science is,
- why it is important for the society as a whole and individual communities around the world,
- requirements to take into consideration when involving citizen scientists in research projects,
- examples of citizen science projects at Leuven University and practical challenges with the implementation of such projects,
- benefits of implementing citizen science at universities/libraries

During the first day, one keynote speaker presented what Citizen Science is, how universities and libraries are involved in it and the benefits associated with Citizen Science implementations. The lecture lasted for 20 minutes with a follow-up Q&A session. The keynote was followed by six lightning talks by the researchers from Leuven university who lead different Citizen Science projects. Each lighting talk was about five minutes long, followed by a joint Q&A session.

After the presentations, participants were split into four small groups, in which they discussed ideas for a citizen science project to develop and present during the debates in two days.

The culmination of the event was the debates, organized on the third day. Each group had seven minutes to present their ideas and ten minutes to answer questions from other groups and judges. While judges chose a winner based on the previously defined criteria, they noted that all four projects were innovative and topical and had a lot of potential for implementation. One of the projects focused on visualising a workplace of the future. Another was a course design of Co-designing an Inclusive City. The third one focused on researching the impact of pesticides on infant growth. The winning project was designed around the use of citizen science in cognitive psychology.

Preparation and implementation of the activity: LIBER was prepared and implemented in collaboration with one LIBER member – Leuven University and Library (Belgium).

HE students participation mode: Voluntary, informal learning opportunity they can do in their free time

HE participants' agency in the responsibility areas:

i. OKA idea generation: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity
ii. OKA co-planning and co-design: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity
iii. OKA team management: missing/low/high: Because of COVID-19 restrictions, students could not be engaged in the design of the activity

a. OKA execution: missing/low/high. COVID-19 restrictions, students could not be engaged in the design of the activity

iv. OKA evaluation: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity

v. OKA communication: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity

vi. using the results of OKA: missing/low/high. Participants, including HE students, mentioned that they would like to use the ideas generated during the activity, develop them, and implement them in their universities.

How were "citizens" accessed/involved and by whom: Citizens were not involved. The design of the OKAs delivered by LIBER mostly targets University staff (lecturers and librarians) as well as library students as multipliers of Open Science (OS) and Citizen Science (CS) in their universities. OKAs designed by LIBER train them in integrating OS and CS into their work.

What are educators', librarians', researchers', and HE students' preconditions for participation:

We had no preconditions for participation but collected prior knowledge on the subject to prepare accordingly.

Mentoring needs during the OKA: Based on the experience of the previously organised OKA, no mentoring was foreseen by the organisers (although mentors were on stand-by in case they were needed).

Grading the HE students: there was no grading, as the activity was voluntary and did not count towards any course credit. However, the results produced by four groups were evaluated on the previously defined and announced criteria by the judges, whom speakers and Citizen Science experts represented.

Please describe the difficulties in the crisis time to deliver your planned activity: It was challenging to bring the interactive part of the activity online because of COVID-19, but this was resolved by creative small groups and allowing the participants themselves to choose how and when they will meet to discuss ideas and prepare a project presentation.

Past history of the OKA: This is the second iteration of the OKA format.

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- creation of shared project ideas in which each stakeholder has an equal interest, in a participatory, bottom-up and user-driven way. The participants expressed interest in bringing these projects to life with further consultation of the experts presented during the activity.
- broadening of 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
- change in mindsets regarding knowledge accessibility, open innovation, social engagement and the HE role in society

How long can the OKA outcomes be used: long-term

How did you follow ethical, privacy requirements and copyright policies?

How did you follow ethical guidelines in recruiting participants? 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.

How did you manage the data? (describe using FAIR principles) The data collected from participants during the registration process was collected through zoom and used exclusively for registration, distribution of resources designed specifically for the participants, and provision of access to the online platform, in which the OKA took place evaluation. Participants gave consent for this specific use of their data during the registration process. The data collection process followed the INOS Data Management Plan. The presentations designed for the participants by the speakers and all guidelines created for the event will be shared Zenodo and made openly available for re-use.

How did you follow copyright policies? GDPR was closely followed during data collection, and proper attribution was given to re-used materials in the presentations.

2.3.3. Case 3-3 in Leuven University Library II

Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible: LIBER; Leuven University and Library (Belgium)

The topic of the activity: Open/Citizen Science

Domain area: (check all relevant): social sciences/ humanities

The length of the activity (planned execution period): Two sessions: session 1 - two hours; session 2 – 1.5 hours

Activity duration: short-term

Who are participants in OKA: 58 HE students: bachelor/master/PhD); two HE educators, librarians

Mode of engagement: small groups

The delivery mode of the activity: online

Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide a short list or links):

- apps, software: Zoom meeting, MS Teams, e-mail
- learning resources: videos of lectures prepared specifically for the activity

Frequency of interaction: periodic interactions – three consecutive days, one session on day 1 and one session on day 3, with small group interaction on day 2 without facilitation and e-mail communication with the organizers

Activity approach:

The online activity was designed to allow the Leuven University and Library participants and other LIBER member institutions time to interact, discuss ideas, and challenge outdated concepts in smaller international groups. The event focused on:

- what citizen science is,
- why it is important for the society as a whole and individual communities around the world,
- requirements to take into consideration when involving citizen scientists in research projects,
- examples of citizen science projects at Leuven University and practical challenges with the implementation of such projects,
- benefits of implementing citizen science at universities/libraries

During the first day, one keynote speaker presented what Citizen Science is, how universities and libraries are involved in it and the benefits associated with Citizen Science implementations. The lecture lasted for 20 minutes with a follow-up Q&A session. The keynote was followed by six lightning talks by the researchers from Leuven university who lead different Citizen Science projects. Each lighting talk was about five minutes, followed by a joint Q&A session.

After the presentations, participants were split into four small groups, in which they discussed ideas for a citizen science project to develop and present during the debates in two days.

The culmination of the event was the debates, organized on the third day. Each group had seven minutes to present their ideas and ten minutes to answer questions from other groups and judges. While judges chose a winner based on the previously defined criteria, they noted that all four projects were innovative and topical and had a lot of potential for implementation.

Preparation and implementation of the activity: LIBER was prepared and implemented in collaboration with one LIBER member – Leuven University and Library (Belgium).

HE students participation mode: Voluntary, informal learning opportunity they can do in their free time

HE participants' agency in the responsibility areas:

i. OKA idea generation: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity
ii. OKA co-planning and co-design: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity
iii. OKA team management: missing/low/high: Because of COVID-19 restrictions, students could not be engaged in the design of the activity
iv. OKA execution: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity
v. OKA evaluation: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity
vi. OKA communication: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity
vii. using the results of OKA: missing/low/high. Participants, including HE students, mentioned that they would like to use the ideas generated during the activity, further develop them, and implement them in their universities.

How were "citizens" accessed/involved and by whom: Citizens were not involved. The design of the OKAs

delivered by LIBER mostly targets University staff (lecturers and librarians) as well as library students as multipliers of Open Science (OS) and Citizen Science (CS) in their universities. OKAs designed by LIBER training them in integrating OS and CS in their work.

What are educators', librarians', researchers', and HE students' preconditions for participation:

We had no preconditions for participation but collected information about prior knowledge on the subject to prepare accordingly.

Mentoring needs during the OKA:

Based on the experience of the previously organised OKA, the organisers foresaw no mentoring (although mentors were on stand-by in case they were needed).

Grading the HE students: There was no grading, as the activity was voluntary and did not count towards any course credit. However, the results produced by four groups were evaluated on the previously defined and announced criteria by the judges, whom speakers and Citizen Science experts represented.

Please describe the difficulties in the crisis time to deliver your planned activity: It was challenging to bring the interactive part of the activity online because of COVID-19, but this was resolved by creative small groups and allowing the participants themselves to choose how and when they will meet to discuss ideas and prepare a project presentation.

Past history of the OKA: This is the second iteration of the OKA format.

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- creation of shared project ideas in which each stakeholder has an equal interest, in a participatory, bottom-up and user-driven way. The participants expressed interest in bringing these projects to life with further consultation of the experts presented during the activity.
- broadening of 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
- change in mindsets regarding knowledge accessibility, open innovation, social engagement, and the HE role in society.

How long can the OKA outcomes be used: long-term

How did you follow ethical, privacy requirements and copyright policies?

- **How did you follow ethical guidelines in recruiting participants**? 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.
- **How did you manage the data? (describe using FAIR principles)** The data collected from participants during the registration process was collected through zoom and used exclusively for registration, distribution of resources designed specifically for the participants, and provision of access to the online platform, in which the OKA took place evaluation. Participants gave consent for this specific use of their data during the registration process. The data collection process followed the INOS Data Management Plan. The presentations designed for the participants by the speakers and all guidelines created for the event will be shared by Zenodo and made openly available for re-use.
- **How did you follow copyright policies?** GDPR was closely followed during data collection, and proper attribution was given to re-used materials in the presentations.

2.4. Case 4. Why Universities and Libraries Should Get Involved in Citizen Science?

Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible: LIBER, University College Dublin Library

The topic of the activity: Open/Citizen Science

Domain area: social sciences/ humanities

The length of the activity (planned execution period): one session 1.5 hours long on 20 May 2021

Activity duration: short-term

Who are participants in OKA: 44 HE students: bachelor/master/PhD; two HE educators, librarians

Mode of engagement: in-group discussion

The delivery mode of the activity: online

Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide a short list or links):

- apps, software: Zoom, MS Teams
- learning resources: videos of lectures prepared specifically for the activity (delivered life, video recordings available shortly afterwards)

Frequency of interaction: once-off (during the activity)

Activity approach: Please provide short information about how you planned and implemented the activity.

This online activity was designed to introduce participants to Citizen Science and challenges associated with its implementation and discuss ideas and controversial aspects of Citizen Science.

The event focused on:

- what citizen science is,
- why it is important for the society as a whole and individual communities around the world,
- requirements to take into consideration when involving citizen scientists in research projects,
- controversial aspects of Citizen Science implementation

The activity started with an introductory presentation by Sabine Kunst, Head of Open Spaces, TU Delft Library, The Netherlands, Member of LIBER CS Working Group. The presentation focused on the basics of citizen science, challenges in its implementation, the role of libraries and the benefits citizen science brings. A presentation followed it by Críostóir Mac Cárthaigh, Head of National Folklore Collection, UCD Library, Ireland. Críostóir presented his institution, which came about because of a long-term citizen science project that started in the 1930s in Ireland and has turned into the National Folklore Collection institute, which initiated and coordinated several citizen science projects.

The session continued with a lengthy and engaging Q&A, which turned into a discussion. The activity that was initially planned to follow was “where do you stand” in which participants are given a controversial statement and need to choose whether they agree or disagree with it, then join the “agree” or “disagree” team, discuss it in a smaller group and then present to the other team. The Q&A session was so engaging

that the organizers decided to extend it and limit the planned follow-up activity to several statements discussed with a larger group to save time and continue with a very successful audience engagement momentum. Participants were happy about the change. In their evaluation of the event verbally right after the event and in the chat, all participants were either satisfied or extremely satisfied with it.

Preparation and implementation of the activity: LIBER was prepared and implemented, collaborating with one LIBER member: University College Dublin Library in Dublin, Ireland.

HE students participation mode: Voluntary, informal learning opportunity they can do in their free time

HE participants' agency in the responsibility areas:

i. OKA idea generation: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the design of the activity
ii. OKA co-planning and co-design: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the activity's initial design. However, based on the immediate interests of the participants, the OKA format was slightly changed to fit their preferences.
iii. OKA team management: missing/low/high: Because of COVID-19 restrictions, students could not be engaged in the design of the activity
iv. OKA execution: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the activity's design but participated in its execution to a lesser extent by expressing their preferences for exercises.
v. OKA evaluation: missing/low/high. Participants expressed their opinion on activity evaluation through the evaluation form, chat and verbally right after the event.
vi. OKA communication: missing/low/high. Because of COVID-19 restrictions, students could not be engaged in the communication about the activity
vii. using the results of OKA: missing/low/high. Participants, including HE students, mentioned that they would like to use the ideas generated during the activity to further participate/initiate citizen science activities at their respective institutions.

How were "citizens" accessed/involved and by whom: Citizens were not involved. The design of the OKAs delivered by LIBER mostly targets University staff (lecturers and librarians) as well as library students as multipliers of Open Science (OS) and Citizen Science (CS) in their universities. OKAs designed by LIBER trains them in integrating OS and CS in their work.

What are educators', librarians', researchers', and HE students' preconditions for participation:

We had no preconditions for participation but collected information about prior knowledge on the subject to prepare accordingly.

Mentoring needs during the OKA:

Because of the format of the event, no mentoring was needed or foreseen by the organizers.

Grading the HE students: there was no grading, as the activity was voluntary and did not count towards any course credit.

Please describe the difficulties in the crisis time to deliver your planned activity: It was challenging to bring the interactive part of the activity online because of COVID-19, but this was resolved by the discussion exercise, which allowed participants to discuss and think critically.

Past history of the OKA: Totally new

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- broadening of 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
- change in mindsets regarding knowledge accessibility, open innovation, social engagement and the HE role in society.

How long can the OKA outcomes be used: long term

How did you follow ethical, privacy requirements and copyright policies?

- **How did you follow ethical guidelines in recruiting participants?**

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.

- **How did you manage the data? (describe using FAIR principles)**

The data collected from participants during the registration process was collected through zoom and used exclusively for registration, distribution of resources designed specifically for the participants, and provision of access to the online platform, in which the OKA took place evaluation. Participants gave consent for this specific use of their data during the registration process. The data collection process followed the INOS Data Management Plan. The speaker's presentation designed for the participants will be shared by Zenodo and made openly available for re-use.

- **How did you follow copyright policies?**

GDPR was closely followed during data collection, and proper attribution was given to re-used materials in the presentations.

2.5. Case 5 Edit-a-thon Wikipedia

Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible: University of Bordeaux (Library Department)

The topic of the activity: my thesis inside Wikipedia

Domain area: natural sciences/social sciences/arts/humanities/law/political science/economics

The length of the activity (planned execution period): one day - April 3rd

Activity duration: short-term/medium/long-term

Who are participants in OKA: 7 HE students (bachelor/master/PhD): PhD; "citizens" (children in school, museum/library visitors, youth centres, people accessed via digital channels or events, elderly centres) (15 PHD students did the training session, but seven attended the D-Day session (weekend of lockdown): five Wikipedians (regrouped in a civic association).

Mode of engagement: individual/small group(s)/large group

The delivery mode of the activity: face-to-face/blended/online; synchronous AND asynchronous (the edit-a-thon is prepared asynchronously with each participant and held synchronously face-to-face)

Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide a short list or links):

- collaboration facilities
- tools/equipment : computers, wi-fi, web browser
- apps, software (including open software and Citizen science project software): Wikipedia platform; Zoom for the animators
- learning resources (online/on paper, including OER, learning resource repositories): training on Wikipedia, its principles, organization, philosophy, and practical training on the editing tools
- data, knowledge, repositories

Frequency of interaction: one-time interactive event/periodic submissions or interactions

Activity approach:

Preparation of the activity:

Phase I: Outreach to students to take part in the edit-a-thon + research partners that could be interested in taking part in the editathon. Exchanges through email/one-on-one meetings to prepare candidate activities to be performed during the editathon. The aim was to design activities that are within reach of the editathon, related to the domain related to the PhD, and with several options (as some edits may have already been done by others in the meantime when the editathon occurs).

Phase II: "The" editathon event: a whole day. First half: introduction to Wikipedia, its principles and core philosophy, the relationship with science and research, focus on key common principles with Science and WP (source citation and plagiarism avoidance); second half: workshop: the participants performed their activities with help from Wikipedians/library staff. The editathon finished with an open exchange with the Wikipedians as an informal "audit" of Wikipedia in the students' area of knowledge: in my own field of work, which is the "big" enhancements in Wikipedia that would be of greater benefit? (article addition and/or modification)

HE students participation mode: Compulsory/optional formal learning activity for your HE students (as a course, course task or project they get graded)/Voluntary, informal learning opportunity they can do in their free time

HE students' agency in the responsibility areas:

i) OKA idea generation: missing/low/**high**; the activities during the editathon were be based on the participant's area of expertise/interest during an individual exchange with the librarian coordinator

ii) OKA co-planning and co-design: missing/**low**/high; the students had the opportunity to invite collaborators that are outside the HE sector

iii) OKA team management: **missing**/low/high.

iv) OKA execution: missing/low/**high**; the students produced edits during the editathon

v) OKA evaluation: missing/**low**/high; feedback was asked at the end of the editathon.

vi) OKA communication: **missing**/low/high.

vii) using the results of OKA: **missing**/low/high.

How were "citizens" accessed/involved and by whom: HE Students were reached directly by the organizers; they were invited to reach out to their collaborators in their PhD.

What are educators', librarians', researchers', and HE students' preconditions for participation:

Only preconditions:

- having registered to the editathon
- having created a Wikipedia account beforehand
- having exchanged with the organizers to identify editing activities

Mentoring needs during the OKA: The first half of the editathon was training on Wikipedia and Wikipedia edition tools.

Grading the HE students: The HE students were not graded on this activity.

Please describe the difficulties in the crisis time to deliver your planned activity: A face-to-face workshop was of great added value because fluid exchanges and a feeling of collective emulation are key success factors. However, this is complex and risky in the context: the editathon took place online through Zoom

videoconference and the design of sub-sessions in the afternoon. Participants were limited to allow for quality training and assistance, especially for the afternoon session.

Past history of the OKA: Conducted earlier/Conducted something similar/Totally new
A past Wikipedia Editathon initiative occurred on digitised heritage at the other Bordeaux universities. In this university, it was totally new.

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- the creation of shared open data, knowledge, and resources in which each stakeholder has an equal interest (widely known as "commons creation"), in a participatory, bottom-up and user-driven way.
- the development of technical and digital skills or the mastering of new tools among the participants.
- change in mindsets regarding knowledge accessibility

How long can the OKA outcomes be used:

Long-term: whatever improvements to Wikipedia have been made will be long-term.

Short-term: advocacy to be an actor of Wikipedia: some participants may become active Wikipedians in the long run.

How did you follow ethical, privacy requirements and copyright policies?

- How did you follow ethical guidelines in recruiting participants? (e.g., consents, information sheets)

We used traditional information about the initiative with an online survey. The one-on-one preparatory meeting was instrumental in explaining what was expected from the participant during (and before) the editathon.

- How did you manage the data? (describe using FAIR principles)

The data produced was published on Wikipedia. It is Findbable and Freely Accessible, Reusable as Wikipedia follows a copyleft paradigm.
As this is editorial data, the "Interoperable" part of FAIR principles does not really apply here.
The same applies to documenting the project and guidelines as available as a project page on Wikipedia.

- How did you follow copyright policies?

Most of the copyright aspects were GDPR-related.

We asked participants for their consent to use and disseminate screenshots of the zoom meeting.

The online survey had a GDPR disclaimer, and personal information was limited to name, surname, and email address. All the data collected from the survey was deleted after the editathon.

The participants were made aware of the public nature of everything they did on Wikipedia; they were recommended (but not forced) to use a pseudonym as a Wikipedia account.

2.6. Case 6. SPINE

Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible: University of Bordeaux (labex TRAIL) and Centre for neurological imaging (Brigham and Women's Hospital)

The topic of the activity: An open, participatory experiment (crowdsourcing) on biomedical image analysis

Domain area: Health/neurosciences

The length of the activity (planned execution period): two days: 25th and 26th of May. General introduction on the first day and then, workshops and feedback session on the second day

Activity duration: short-term/medium/long-term

Participants in OKA: 49 participants (all sessions combined) + four academics + four mentors (on technical support during the group sessions). HE students (bachelor/master/PhD): medicine students; "citizens" (children in school, museum/library visitors, youth centres, people accessed via digital channels or events, elderly centres): the general public; researchers, HE educators, librarians: researchers as mentors

Mode of engagement: individual/small group(s)/large group

Delivery mode of the activity: face-to-face/blended/online; synchronous/asynchronous

Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes

Apps, software (including open software and Citizen science project software): SPINE platform

Frequency of interaction: one-time interactive event/periodic submissions or interactions

Activity approach:

Preparation of the activity:

Phase I: Researchers gave introductions about the context of the experiment, questions, hypothesis, etc.

Phase II: The participants went on the SPINE platform and studied the lessons to learn a skill (or multiple skills). These lessons were composed of slides, videos, and interactive activities (image annotation). At the end of the lesson, the participant got a score and, depending on the score, was certified or not for the skill. The user could try again if he did not get the certification

Phase III: When certified, the user-contributed to the real experiment by annotating real cases.

Phase IV: The user could explore the data he produced, the data produced by others and clinical data to try to answer the question of the experiment

Phase V: Discussions between participants and researchers. Feedback

Phase VI: At home, participants could still contribute to experiments, use the platform, and get feedback on the experiment if new results were computed. The platform allows the participants to create their own experiments and explore open data to the public. The INOS questionnaire was used to evaluate the activity

HE students participation mode: Compulsory/optional formal learning activity for your HE students (as a course, course task or project they get graded)/Voluntary, informal learning opportunity they can do in their free time

HE students' agency in the responsibility areas:

i) OKA idea generation: missing/low/high.

ii) OKA co-planning and co-design: missing/low/high.

iii) OKA team management: missing/low/high.

iv) OKA execution: missing/low/high.

v) OKA evaluation: missing/low/high.

vi) OKA communication: missing/low/high.

vii) using the results of OKA: missing/low/high.

How were "citizens" accessed/involved and by whom: Involved by researchers

What are educators', librarians', researchers', and HE students' preconditions for participation:

Researchers: Know about medical imaging and neuroscience

Students: No conditions

Mentoring needs during the OKA: provide a short paragraph about mentoring needs during OKA design, implementation, evaluation with students

Grading the HE students: **explain what way grading was organised for OKA**

The platform integrates a mechanism to teach and evaluate the skills needed for the experiments

Please describe the difficulties in the crisis time to deliver your planned activity:

Past history of the OKA: Conducted earlier/Conducted something similar/Totally new

This was conducted multiple times in the past two years

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- *the creation of shared open data, knowledge, and resources in which each stakeholder has an equal interest (widely known as "commons creation"), in a participatory, bottom-up and user-driven way.* Researchers have to find a cohort of patients and their associated images and clinical data that are open to public
- *the development of technical and digital skills or the mastering of new tools among the participants.* Development of annotation tools and tutorials for these tools that anyone could use. Make simple tasks usually done by researchers access to the participants

How long can the OKA outcomes be used: short-term/long-term

How did you follow ethical, privacy requirements and copyright policies?

- How did you follow ethical guidelines in recruiting participants?: Sign a consent
- How did you manage the data? (describe using FAIR principles) The SPINE platform was designed to help scientists better organise the datasets thanks to metadata, easily sharing data using APIs

and replicating experiments. It was designed to easily use data as scientific workflow inputs to produce results. These results are easy to explore, and we can track the provenance of these results.

2.7. Case 7. CATCH UP!@LET

Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible: the University of Oulu, LET Masters' Program, Ridwan Whitehead, Ha Pham, Hansika Ambahelagedara, Tara Goodwin, Niina Impiö, Eetu Hataja, Karoliina Hautala, Bhavna Rawat

The topic of the activity: LET master's degree programme´s 15th anniversary celebration; Job opportunities and career paths: stories about opportunities and challenges after graduation, advice for current and future students; Networking

Domain area: (check all relevant): Social Sciences (Faculty of Education)
The length of the activity (planned execution period): three-hour online activity
Activity duration: Short-term
Who are participants in OKA: 4 academic staff + 23 participants (in total 27); HE students: LET- master´s programme students (former, current, and becoming); PHD students; LET research group members (academic staff); People interested in learning, education, and technology; researchers, HE educators.
Mode of engagement: Large group
The delivery mode of the activity: Online; synchronous
Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide short list or links):

- collaboration facilities (online platforms): Zoom, Microsoft Teams, Wonder.me, Google Forms, Flinga, Jamboard
- tools/equipment: Laptops, Personal digital devices
- apps, software (including open software and Citizen science project software): Zoom, Microsoft Teams, Wonder.me, Google Forms, Flinga, Jamboard
- learning resources (online/on paper, including OER, learning resource repositories)
- data, knowledge, repositories

Frequency of interaction: one-time interactive event including pre-event and post-event

Activity approach: Please provide short information about how you planned and implemented the activity.

The organizing team planned the activity online through Zoom, Microsoft teams and Wonder.me platforms. The actual OKA was implemented on Zoom and Wonder.me. The activity was planned and implemented in collaboration with the LET masters' programme students and academic staff. The event was completely orchestrated/hosted by the student organizing group.

The objective/purpose of the event was that participants would network and collaborate to cocreate knowledge about diversity in Education.

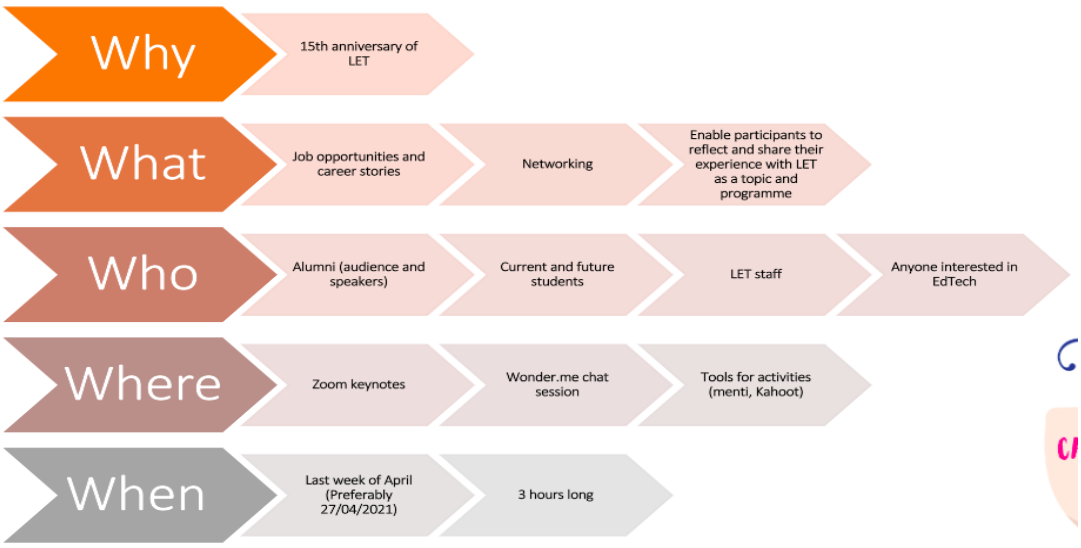

Figure 7.1. Planning roster

Preparation of the activity: Link to the Webdoc https://docs.google.com/document/d/1tzpOmc26tjx_a7JGusoFzzAbACxMdsLQV9gC3NV3x9k/edit?usp=sharing

HE students participation mode: Planning the activity was a compulsory part of the Education Technology Projects-course for LET master´s programme students. Participating in the event was optional.

HE students' agency in the responsibility areas:

i) OKA idea generation: high; **(jointly done between academic teachers and students)**

ii) OKA co-planning and co-design: high; (students independently planned and implemented the event)

iii) OKA team management: high; (students worked collaboratively and monitored their group processes while working on OKA plan/execution/evaluation)

iv) OKA execution: high; (students hosted and orchestrated the online event)

v) OKA evaluation: high; (students used a self-designed rubric and feedback surveys to evaluate the OKA. The following picture shows the evaluation results.)

Criteria	Under expectation	Nearly meet expectation	Meet expectation	Exceed expectation
Planning	Little to no plan Not completing on time	Submit a plan but there are still points that need to be more specific and realistic	The plan is submitted on time and it is realistic and detailed	Planning the project before the deadline and getting feedback
Content collecting quality	Little to no regard for the content produced for the project in terms of relevancy to the scope	Collect some contents but not adequate or there are still contents that are not relevant to the scope of the project	Collect enough, exact and relevant contents that answer all the questions given	Collect enough and very comprehensive and interesting contents.
Audiences interaction	Little or no increase, or decrease in the amount of likes, shares, and comments.	0 - 20% increase in likes, shares, and comm Ents - Relative increase in live viewer count	20 - 50% increase in likes, shares, and comments - Relative increase in live viewer count	50%+ increase in likes, shares, and comments -relative increase in live viewer count
Event participants	•Less amount of participants than expected •Not able to reach out to all target participant groups •Activities are not inclusive to all participants	- The amount of participants is sufficient, however, less than targeted - Some of the targeted participant groups were reached - Activities are partially inclusive	-Meet the targeted numbers of participant - All targeted participant groups were reached - Activities are inclusive (shorturl.at/aciF5)	•Exceeding the expected number of participants •Achieved participation from outside targeted participant groups •Inclusive activities are mentioned in feedback
Audiences satisfaction after events (via form)	0% - 60% satisfaction achieved	50% - 70 % satisfaction achieved	70% - 90% satisfaction achieved	90% - 100% satisfaction achieved

Figure 7.2. OKA evaluation criteria were developed for HEI students.

vi) OKA communication: high; (The student planned a social media and marketing campaign for the event, along with the academic staff)
vii) using the results of OKA: high; (the idea wall that was created in the event will be shared in social media)

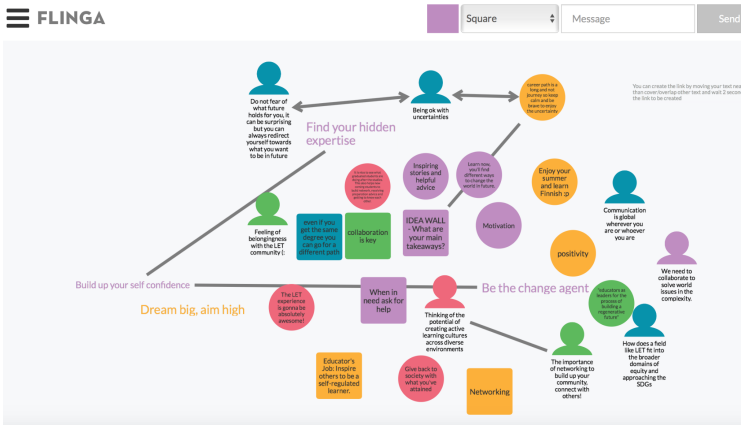

Figure 7.3. Idea Wall screenshot from planning Link Idea Wall: https://flinga.fi/s/FXH9FP5

How were "citizens" accessed/involved and by whom: Students as event organizers used social media to market the event for anyone interested in learning, education, and technology
What are educators', librarians', researchers', and HE students' preconditions for participation:
The event was targeted at LET students, alumni, incoming students, collaborators, and all interested in learning, education, and technology

Mentoring needs during the OKA: Students and academic staff collaborated intensely in 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 OKA as part of the course (Educational Technology Projects) and guided in different stages of the planning. The students did the event implementation on their own. After the event, they gave a final presentation about their major insights illustrating the entire process of planning and implementing the OKA. The presentation also included the evaluation results based on the evaluation rubric developed by the students. The academic staff provided feedback on the final presentation and the overall development process for the OKA.

Grading the HE students: Students organised the OKA as part of the Educational Technology Projects course spanning three main stages: project planning, implementation, and evaluation. And hence the OKA was graded/evaluated as part of the course.
The course evaluation was based on a "competence-based assessment" framework using Digital Open Badges (badge constellation shown in the picture below). The assessment framework evaluated the project plan, implementation, and evaluation at the team and individual level. The Digital Open Badges criteria focused on elements related to project work, collaborative learning process, individual reflection, and participation in each phase of the course.
Please describe the difficulties in the crisis time to deliver your planned activity: It was evident from the beginning that the event will be held online because of the covid situation and involve interested participants worldwide. All the phases of the event (planning, implementation, evaluation) were done online. It was relatively easy to deliver the event with good technical skills and experiences from the past year.
Past history of the OKA: Totally new

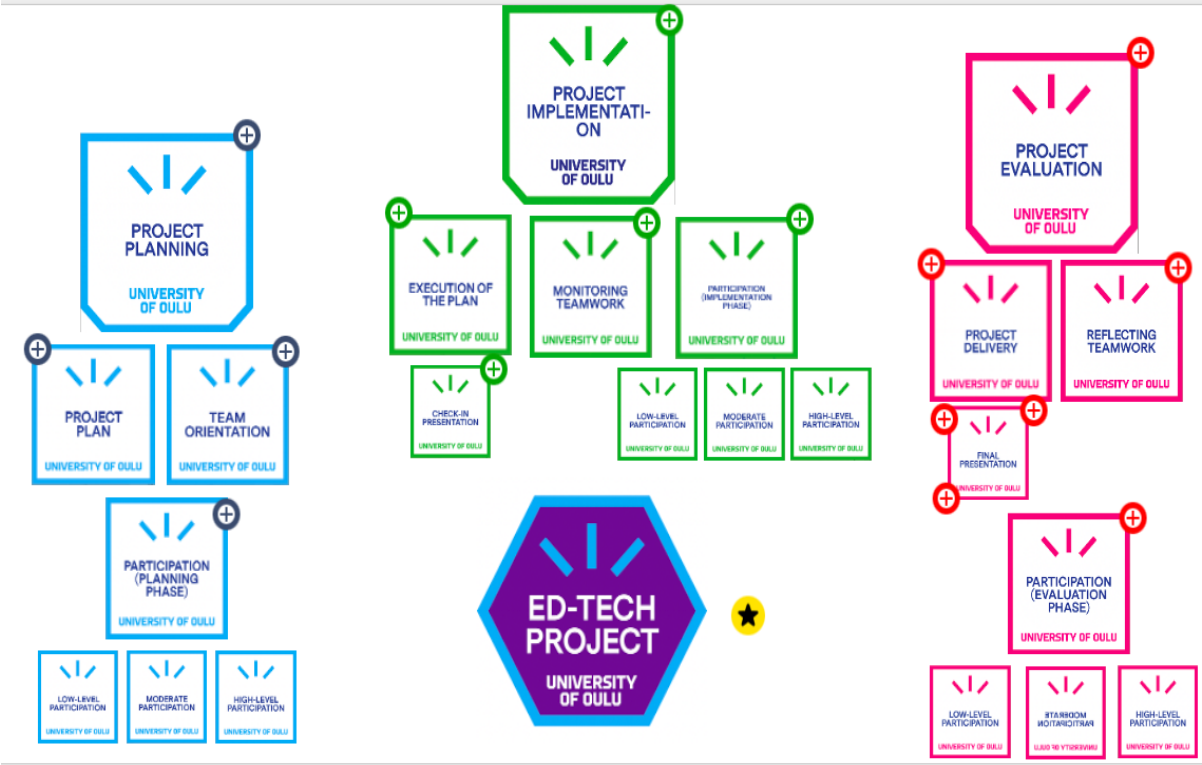

Figure 7.4. Overall badges' schema for evaluating the activity

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- Students as organisers gained insight into open and citizen science
- Organizers and participants of the OKA got the opportunity to access a wider/bigger community of learning sciences and ed-tech
- This OKA also strengthened the international and cross-border intercultural community of the LET network, which holds potential for future collaborative spaces
- Organizers and participants learnt to use different collaborative online tools while engaging in the OKA (Flinga, Jamboard, Zoom, Wonder.me)
- As a result of the event, an "Idea Wall" was created, which illustrates the participants' key take-aways and learning from the OKA
- The OKA design and implementation had an undercurrent of a pedagogical design based on the concepts/constructs related to the phenomenon of Collaborative Learning (CL). CL also forms one of the three major theoretical pillars of the LET Masters' program, which allowed for this translation of theory/research into practice

- Strengthening of active citizenship skills by strengthening their professional identity and the idea that they can impact addressing bigger problems in society.

How long can the OKA outcomes be used: long-term

How did you follow ethical, privacy requirements and copyright policies?

The event registration form had components related to participants' consent to use their names, pictures, or videos for promotional and dissemination purposes

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2.8. Case 8. "LIFE IN FARMS" A Minecraft-based Environmental Science Module

Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible: the University of Oulu, LET Master's Program, Bill Komansilan, Juan Castro, Samppa-Jaakoppi Maunumaa, Steponas Dabuzinskas, in collaboration with Essi Vuopala, Niina Impiö, Karoliina Hautala, Bhavna Rawat

The topic of the activity: "Life in Farm" gamified lesson plan/module for Grade 4 environmental science class

Domain area: Social Sciences (Faculty of Education)
The length of the activity (planned execution period): One or two meetings/week (45 min) during four weeks
Activity duration: long-term
Who are participants in OKA: Four academic staff + 4 facilitators + 22 participants (in total 30); HE students as the organizers:(Students in Educational Technology Project course), 4th-grade students in Rajakylä school, Classroom Teacher, Course teachers and coordinators (academic staff).
Mode of engagement: small group(s)
The delivery mode of the activity: face-to-face; synchronous
Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide short list or links):

- collaboration facilities (online platforms): Zoom, Microsoft Teams, SharePoint, One Note, Minecraft Education Ed. (for collaboration among OKA participants), Discord (https://discord.com/brand-new)
- tools/equipment: Laptops, Personal digital devices, Paper, cardboard, pens for the game in the orientation phase, Basic food products and ingredients (dairy, grain, and meat products) for the game in the culminating activity
- apps, software (including open software and Citizen science project software): Zoom, Microsoft Teams, Minecraft Education Ed. (for collaboration among OKA participants), Discord (https://discord.com/brand-new), SharePoint, One Note, Kahoot
- learning resources (online/on paper, including OER, learning resource repositories)

- Grade 4 Finnish core curriculum
- “Life in Farm” book chapter
- How to integrate Minecraft© in K-12 education
- Basic ideas and principles for game-based and gamified learning
- Detailed information about the routines and processes in various Finnish farms
- The appropriate game narrative for “Life in Farm.”

Frequency of interaction: periodic interactions (one or two meetings/week during four weeks)

Activity approach:
The organizing team planned the activity online through Zoom, Microsoft teams and Discord platforms. The actual OKA was implemented face-to-face in a school environment for grade 4 students. The pupils used Minecraft as a learning resource in their environmental science class. The activity was planned and implemented in collaboration with students and course coordinators/teachers of the LET masters’ programme. The event was completely orchestrated/hosted by the LET student organizing group.

The objective/purpose of the OKA was to learn the unit “Life in Farm” in environmental science subject through gamified / game-based experiences that should foster their engagement and collaboration while directing them to the learning objectives.

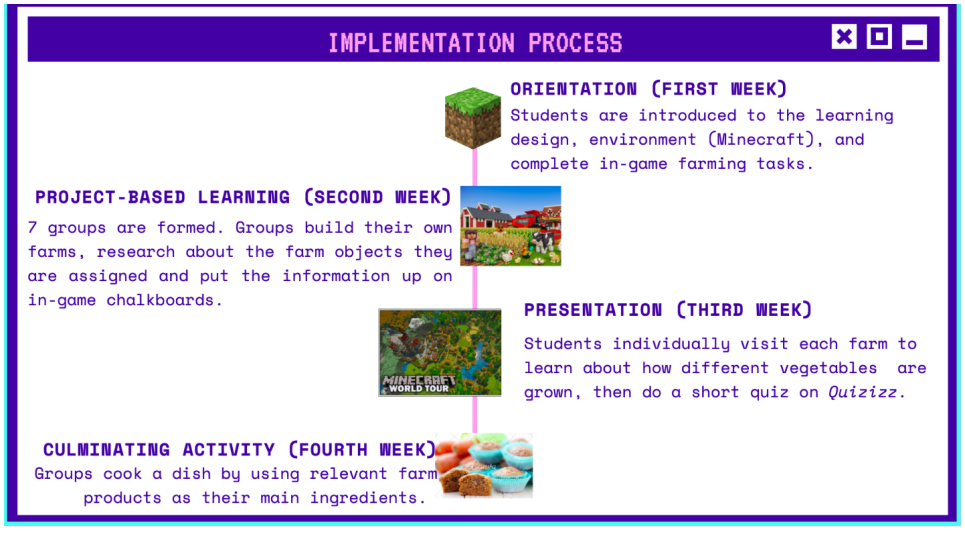

Figure 8.1. Outline of the implementation process in “Life in Farm.”

Preparation of the activity: Link to the Webdoc https://drive.google.com/file/d/1SXcKoeXrQsZ28WshxT18QBuO4_aDnfdn/view?usp=sharing

HE students participation mode: Planning the activity was a compulsory part of the Education Technology Projects-course for LET master´s programme students. Participating in the event was part of the pupils' curriculum.

HE students' agency in the responsibility areas:
i) OKA idea generation: high; (jointly done between Educational Technology Project course students, classroom teacher and academic teachers)
ii) OKA co-planning and co-design: high; jointly done between Educational Technology Project course students and the classroom teacher
iii) OKA team management: high; (students worked collaboratively and monitored their group processes while working on OKA plan/execution/evaluation)
iv) OKA execution: high; (students executed with the classroom teacher the event)
v) OKA evaluation: high; (students used a self-designed rubric and feedback surveys to evaluate the OKA. The following picture shows the evaluation results.)

FARMCRAFT'S PROJECT EVALUATION RESULTS

Aspects	Grade				
	5	4	3	2	1
Mastery *(measured from learners' quiz result in Week 3)*	The accuracy of the quiz is **>80%**	The accuracy of the quiz is **70%-80%**	The accuracy of the quiz is **60%-70%**	The accuracy of the quiz is **50%-60%**	The accuracy of the quiz is **<50%**
Curriculum connection *(measured form the client's feedback)*	**All** of the learning objectives are achieved through the module	**One** of the learning objectives is not achieved [journey of bread/milk], but optional objectives were created and achieved by most groups	**Two** of the learning objectives are not achieved	**Three** of the learning objectives are not achieved	**>3** of the learning objectives are not achieved
Collaboration *(measured form the client's feedback)*	**All** of the groups are able to collaborate well	**One** of the groups lacks collaboration	**Two** of the groups lack collaboration	**Three** of the groups lack collaboration	**>3** of the groups lack collaboration
Playfulness *(measured form learners' reflection)*	**All** students indicate how fun/ engaging (or similar description) the lesson is.	**Most** students indicate how fun/ engaging (or similar description) the lesson is. Not all students appreciated doing so many farming-related tasks Minecrafting.	**Some** students indicate how fun/ engaging (or similar description) the lesson is.	**Few** students indicate how fun/ engaging (or similar description) the lesson is.	**Almost no** student indicates how fun/ engaging (or similar description) the lesson is.

Figure 8.2. The evaluation criteria rubric for the participating primary school students

vi) OKA communication: low (students communicated the process as part of the EdTechProject course through check in- and final presentations)
vii) using the results of OKA: not applicable; the HE students shared a snapshot of the Minecraft screen, before and after the event (4 weeks of modules)

Figure 8.3 The screenshot of the Life in farms project in Minecraft

How were "citizens" accessed/involved and by whom: Citizens = pupils were accessed by EdTechProject course teachers who designed the course and established the initial project case.

What are educators', librarians', researchers', and HE students' preconditions for participation:
The students who organized the event were part of the EdTechProject course. The participants (pupils) did not have any preconditions.

Mentoring needs during the OKA: provide a short paragraph about mentoring needs during OKA design, implementation, evaluation with students
In the design/planning phase, the students, the classroom teacher and EdTech Project course teachers collaborated intensely. Regular check-in conversations were held between EdTech Project course teachers, classroom teachers and the students to share updates about the event plan and its development. Students were introduced to the idea of OKA as part of the course (Educational Technology Project) and guided in different stages of the planning. The students did the event implementation on their own, along with the classroom teacher's feedback, throughout the course plan's execution. After the event, they gave a final presentation about their major insights illustrating the entire process of planning and implementing the OKA. The presentation also included the evaluation results based on the evaluation rubric developed by the students. The academic staff provided feedback on the final presentation and the overall development process for the OKA.

Grading the HE students: Students organised the OKA as part of the Educational Technology Projects course spanning three main stages: project planning, implementation, and evaluation. And hence the OKA was graded/evaluated as part of the course.

The course evaluation was based on a "competence-based assessment" framework using Digital Open Badges (badge constellation shown in the picture below). The assessment framework evaluated the project plan, implementation, and evaluation at the team and individual level. The Digital Open Badges criteria focused on elements related to project work, collaborative learning process, individual reflection, and participation in each phase of the course.

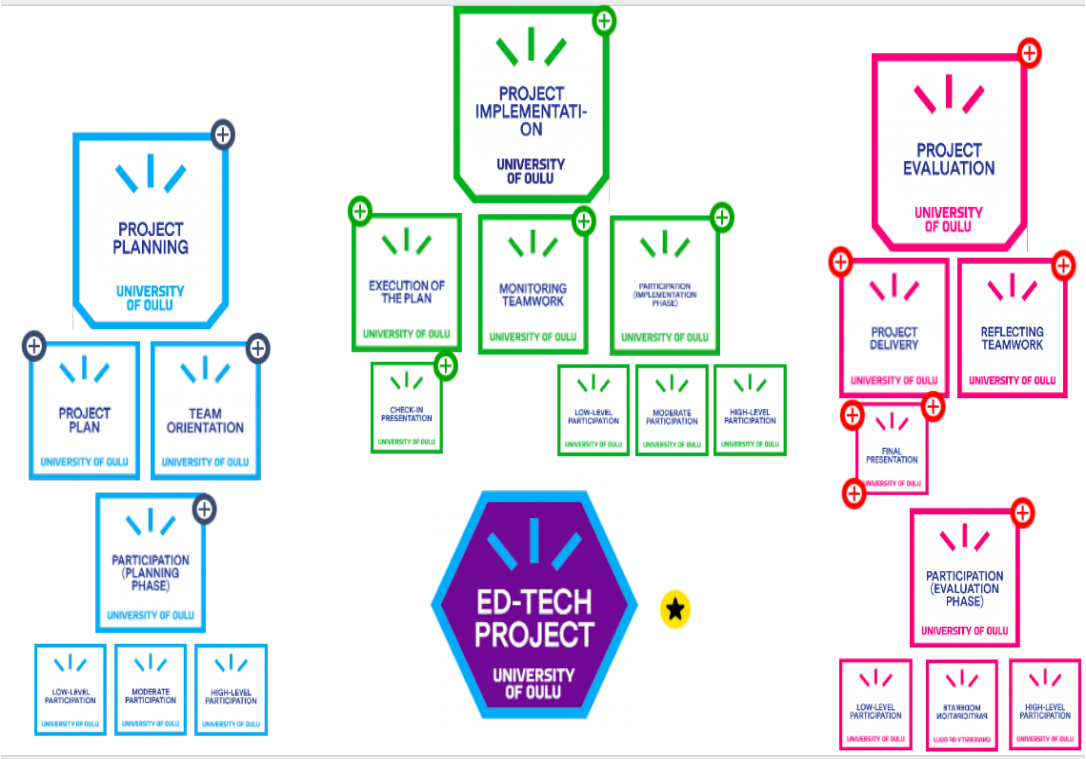

Figure 8.4. The framework of badges to assess the HEI students

Past history of the OKA: Totally new

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- Students as organisers gained insight into open science and citizen science
- Participants engaged in a learning experience where they inquired about farm life aspects such as growing plants, animal husbandry, and food products.
- The participants also gained experience in a gamified collaborative learning environment. The organizers of the OKA gained the experience of translating theories of learning

related to constructivist approaches, engagement and collaborative learning based pedagogies into practice.

- Organizers and participants learnt to use different Minecraft's education edition
- The OKA design and implementation had an undercurrent of a pedagogical design based on the concepts/constructs related to the phenomenon of Collaborative Learning (CL). CL also forms one of the three major theoretical pillars of the LET Masters' program, which allowed for this translation of theory/research into practice
- Strengthening of active citizenship skills by strengthening their abilities to use different tools and resources in order to collaborate through a long-term intervention

Please describe the difficulties in the crisis time to deliver your planned activity: Some issues highlighted by the OKA organizers have been displayed in the picture below

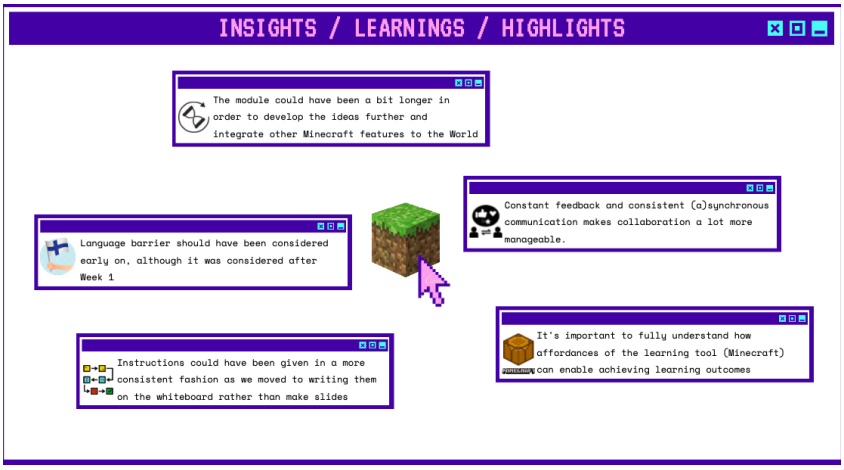

Figure 8.5. Evaluation of the HEI students' learning insights from the OKA activity.

How long can the OKA outcomes be used: long-term

How did you follow ethical, privacy requirements and copyright policies?

OKA organizers were actively communicating with the Vice-Principal of the school and the classroom teacher of the pupils.

2.9. Case 9. The Rover Adventure

Name of the OKA activity: Rover Adventure
Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible: the University of Oulu, LET Master's Program, Galina Zvereva, Eeli Antikainen, Filip Sever, Essi Vuopala, Niina Impiö, Bhavna Rawat & Karoliina Hautala

The topic of the activity: STEAM Pedagogy Learning Event using Maker-tools

Domain area: social sciences
The length of the activity (planned execution period):
Activity duration: short-term; one 3-hour long event
Who are participants in OKA: four academic staff + six facilitators +19 participants (in total 29)

- HE students are the organizers: (Students in Educational Technology Project course)
- 4th-grade students in Rajakylä school and their parents
- Classroom Teacher
- Course teachers and coordinators (academic staff)

Mode of engagement: small group(s)
The delivery mode of the activity: face-to-face; synchronous
Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide short list or links):

- collaboration facilities: Zoom, Microsoft Teams, Sharepoint
- tools/equipment: 3D printers (two items – anycubic), Vinyl cutter (one item – Cameo), Lego EV3 robotics, Sphero robot + application for Sphero
- apps, software (including open software and Citizen science project software): Osmo app, other apps related to maker tools
- learning resources (online/on paper, including OER, learning resource repositories): any materials from Fablearnlab: paper, wood, vinyl, plastic

Frequency of interaction: One-time interactive event
Activity approach:
The organizing team planned the activity online through Zoom, Microsoft teams and Sharepoint platforms. They also visited the school during the planning phase. The actual OKA was implemented face-to-face in a school environment for grade 4 students and their parents. The activity was planned and implemented in collaboration with students and course coordinators/teachers of the LET masters' programme. The event was completely orchestrated/hosted by the LET student organizing group.

HE students participation mode: Planning the activity was a compulsory part of the Education Technology Project-course for LET master´s programme students who designed the educational event in collaboration with the teacher in the local school. The event engaged both students and their parents in maker space activities.

HE students' agency in the responsibility areas:
i) OKA idea generation: high; (jointly done between Educational Technology Project course students (HE students), classroom teacher and academic teachers)
ii) OKA co-planning and co-design: high; jointly done between HE students and the classroom teacher
iii) OKA team management: high; (students worked collaboratively and monitored their group processes while working on OKA plan/execution/evaluation)
iv) OKA execution: high; (HE students executed the OKA with the pupils and their parents in collaboration with the classroom teacher and volunteer HE students)
v) OKA evaluation: high; (students used a self-designed feedback form to assess a rate of difficulty, fun, engagement of the pupils in the OKA. The following picture shows the evaluation results.)
vi) OKA communication: low (students communicated the process as part of the EdTechProject course through check in- and final presentations)
vii) using the results of OKA: not applicable; the HE students shared a result of the feedback questionnaire to assess the impact of the OKA.

How were "citizens" accessed/involved and by whom:
EdTechProject course teachers and university students designed the course and established the initial project case, accessing the local public school and its students.

What are educators', librarians', researchers', and HE students' preconditions for participation:
The students who organized the event were part of the EdTechProject course. The participants (pupils) did not have any preconditions.

Mentoring needs during the OKA:
In the design/planning phase, the students, the classroom teacher and EdTech Project course teachers collaborated intensely.
Regular check-in conversations were held between EdTech Project course teachers, a classroom teacher and the HE students to share updates about the event plan and its development. HE students were introduced to the idea of OKA as part of their course (Educational Technology Project) and guided in different stages of the planning. The students did the event implementation on their own, along with the classroom teacher's feedback, throughout the course plan's execution. After the event, they gave a final presentation about their major insights illustrating the entire process of planning and implementing the OKA. The presentation also included the evaluation results based on the feedback questionnaire/survey

developed by the HE students for the pupils. The academic staff provided feedback on the final presentation and the overall development process for the OKA.

Grading the HE students:

Students organised the OKA as part of the Educational Technology Projects course spanning three main stages: project planning, implementation, and evaluation. And hence the OKA was graded/evaluated as part of the course.

The course evaluation was based on a "competence-based assessment" framework using Digital Open Badges (badge constellation shown in the picture below). The assessment framework evaluated the project plan, implementation, and evaluation at the team and individual level. The Digital Open Badges criteria focused on elements related to project work, collaborative learning process, individual reflection, and participation in each phase of the course.

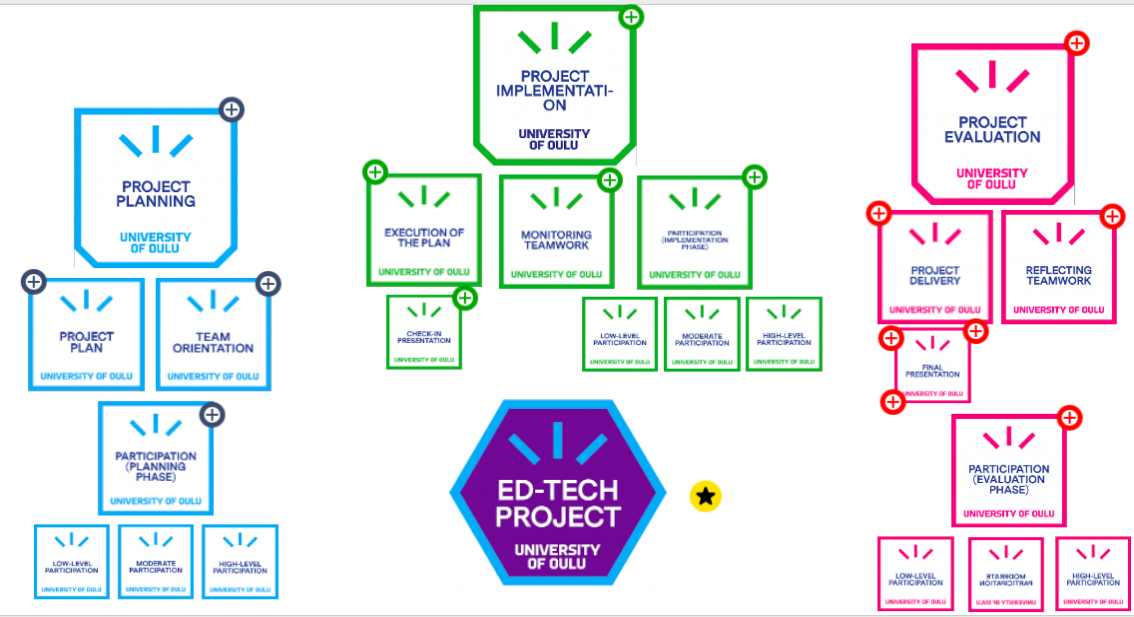

Figure 8.1. The framework of badges to evaluate HEI students' work at OKA

Past history of the OKA: Totally new

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- HE students as organizers gained insight into open science and citizen science.
- Pupils engaged in a learning experience where they participated in maker space activities with their parents.

- The participants also gained experience in a gamified collaborative learning environment through aspects of storytelling. The organizers of the OKA gained the experience of translating theories of learning related to constructivist approaches, engagement and collaborative learning based pedagogies into practice.
- Organizers and participants learnt to use different tools, machines and the corresponding software related to the Fablearnlab maker space.
- The OKA design and implementation had an undercurrent of a pedagogical design based on the concepts/constructs related to the phenomenon of Collaborative Learning (CL). CL also forms one of the three major theoretical pillars of the LET Masters' program, which allowed for this translation of theory/research into practice
- Strengthening of active citizenship skills by strengthening their abilities to use different tools and resources in order to collaborate

How long can the OKA outcomes be used: long-term

How did you follow ethical, privacy requirements and copyright policies?
OKA organizers were actively communicating with the Vice-Principal of the school and the classroom teacher of the pupils.

2.10. Case 10. Data workshop for "Technological and organizational trends in service design."

Name of the OKA activity: Data Workshop for "Technological and Organizational Trends in Service Design."

Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible: Service Systems Design Lab, Aalborg University

The topic of the activity: Creative use of data in the design process. How can we make experiences of cities as cultural districts legible by using data visualization to map social media data enriched by vision AI algorithms?

Domain area: natural sciences/social sciences/humanities

The length of the activity (planned execution period): Three days, 3-5. March 2021

Activity duration: short-term

Who are participants in OKA: Part of curriculum of university module "Technological and Organizational Trends in Service Design", 46 First-year masters Service System Designs students, One PhD student as a mentor, two HEI educators.

Mode of engagement: small group(s) for groupwork/large group for lectures and discussions

The delivery mode of the activity: online; asynchronous, synchronous self-organized groupwork

Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes:

Pre-prepared dataset, pre-recorded lectures, pre-selected research papers

Microsoft Teams, Miro, Google Drive, Instaloder (open source), OpenRefine (open source), RawGraphs (open source), Tableau (licensed), QGIS (open source), Table 2 Net (open source), Gephi (open source)

Frequency of interaction: periodic submissions or interactions

Activity approach:

Preparation of the activity: PhD students prepared a cleaned dataset, pre-recorded lectures, tutorial videos were prepared for online tools, journal articles were selected.

Phase I: Principles for design inquiry through data

Introduction (15 mins)

Basic principles, tools/software for data exploration and visualization (one hour lecture)

Student presentations & Q&A (45 minutes)

Design Inquiry through Data (one hour lecture)

Student feedback session (15 mins)

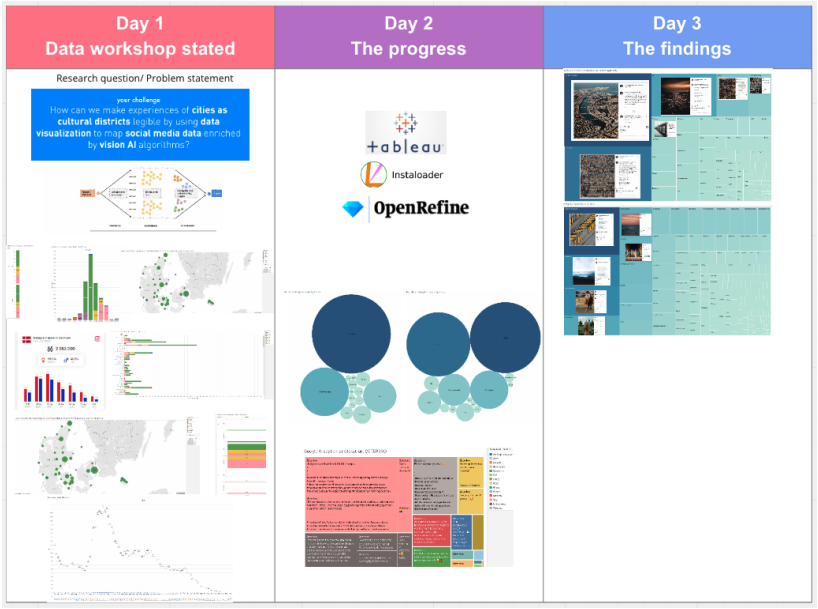

Figure 10.2. Data scraping canvases in Data workshop

Phase II: Scraping the data

Scraping Instagram data (one hour lecture)

Student group work (two hours)

Student feedback session (15 mins)

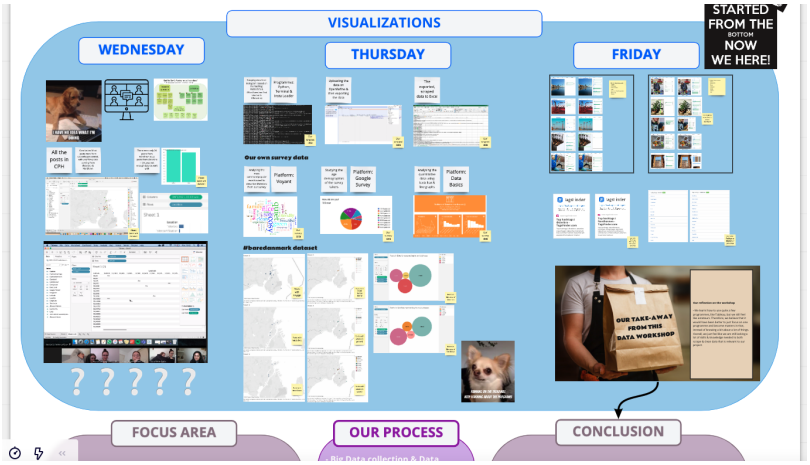

Figure 10.3. Data visualization canvases in Data workshop

Phase III. Visualizing the data
Student group work (three hours)
Student group presentations. Final presentations (15 mins for each group) on Day 3. (two hours)

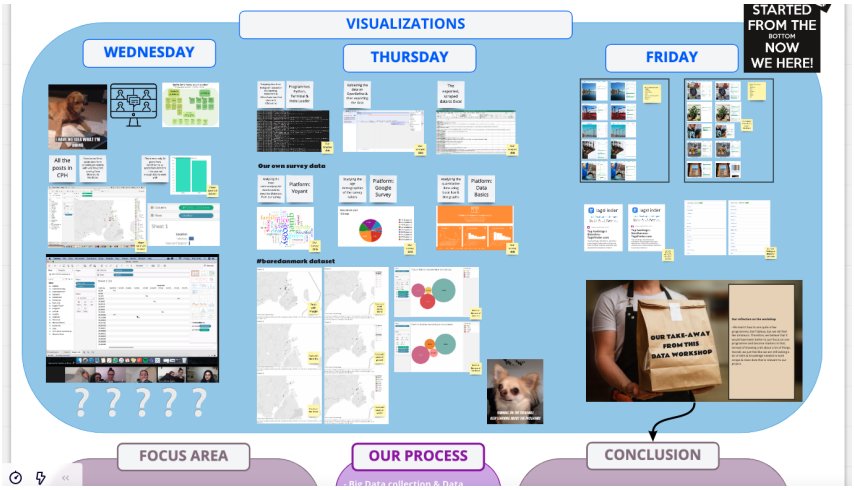

Figure 10.3. Evaluation of data-based inquiry canvas

HE students participation mode: Compulsory course task or project they get graded
HE students' agency in the responsibility areas:
i) OKA idea generation: missing
ii) OKA co-planning and co-design: low, one PhD student was involved
iii) OKA team management:/high; low, students participated as part of OKA group work

iv) OKA execution: low, students participated as active learners
v) OKA evaluation: low, participated in peer evaluation
vi) OKA communication: missing
vii) using the results of OKA: missing
How were "citizens" accessed/involved and by whom: no citizens were accessed
What are educators', librarians', researchers', and HE students' preconditions for participation:

Mentoring needs during the OKA: Students worked in their established student groups.
Grading the HE students: Students pitched their works
Please describe the difficulties in the crisis time to deliver your planned activity:
Past history of the OKA: Conducted something similar
What did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:
Ability to scrape and visualize data with several tools.
Understanding of digital methods.
Ability to creatively use data in the discovery phase of the design process.

How long can the OKA outcomes be used: short?
How did you follow ethical, privacy requirements and copyright policies? The data are managed as an open resource

3. Synthesis of the practices and critical issues across the case studies

3.1. What characterizes open knowledge activities in the INOS case studies

All the OKAs in INOS case studies were designed as interdisciplinary open-ended problems based on challenges with societal value.

OKAs were conducted as curricular (five cases) or extracurricular activities (seven cases). Four of the curricular activities focused on codesigning the open knowledge-building activities for external stakeholders (students at schools).

The age group of OKA participants ranged from primary education students, secondary education students, higher education students at master and PhD level, alumni, library visitors, wide public and elderly interest groups, as well as academics, experts and educators from the university who had not experienced open knowledge-building activities before. We managed to access 404 participants (reaching 420 was expected in the proposal phase).

The inclusion of participants to OKAs was based on existing channels - practice places, networks, libraries. Another good approach was engaging in the informal courses and project initiatives of which the universities were part. There were no pre-requirements to participants. It was widely possible to participate in the extracurricular events of seven case studies. In five case studies, access was defined through the course activities and their educational partners in schools.

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 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 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).

Table 1. The comparison of OKAs

Cases	Type	Participants	Length, mode	Topics, challenges	Outcomes, impact

Noise pollution at Reidi Road	Crowdsourcing data	Course activity combined with informal, 25 in-service teacher education students, one mentor, 12 students from 9th grade (15-16 years old), one mentor	2 x 3 hours, self-organized and group activities	Evaluating the health and wellbeing in the city space	The tangible open knowledge asset outcome was datasets and the geolocative reusable scenarios in Avastusrada; the impact was on teachers' and students' knowledge and competencies about citizen science activities organization, but the low impact was achieved on the actual communities and locations since the crowdsourced data were not used. The whole activity did not engage city planners and decision-makers.
Service design for Elderly	Knowledge building with a design approach	Extracurricular, ten elderly + three HEI educators	2 x 8 x 45 min full group and small groups	The potential of elderly people for the society; challenges of gender-related ageing and equal opportunities; raising the digital potential of elderly people; removing the discrimination of elderly at work and society; developing the professionals	The impact on the elderly was on their experiences, knowledge, and open innovation competencies. The elderly stakeholders created design thinking canvases for iterating and advancing service designs accessible in Trello.com publicly but not widely

				with mentors from the elderly workforce.	discoverable. The future services will be public resources for the elderly. They will implement their ideas as solutions in the future. There is a high impact on the communities. The elderly are supposed in the future to engage in similar codesign processes other seniors and stakeholders.
Dotmocracy workshop	Knowledge building workshop	Extracurricular, 18 library visitors (students, experts), two library staff	3x1 hour; 45 min; 1 hour (Iteration 1) full group and small groups 2 x 2x 2 h, 1.5 hours (Iterations 2 and 3) full group and small groups	What citizen science is, why the society as a whole and individual communities around the world, requirements need to take into consideration when involving citizen scientists in research projects, examples of how citizen science is integrated into education programmes and benefits such integration produces, speakers, presented Citizen Science, Copyright and its relevance to Citizen Science projects; and Datamining	The online activity was designed to allow the participants from different universities time to interact, discuss citizen science ideas and challenge outdated concepts in smaller international groups. The impact was on participants' co-constructed and widened knowledge and competencies about organizing citizen science activities. Participants, including HE students, mentioned that they would like to use the ideas generated during the activity, further develop them, and implement them

					in their universities.
Knowledge building jam	Knowledge building workshop	Extracurricular, in total six educators and 131 library visitors (students, experts)	2 x 2x 2 hours, 1.5 hours (Iterations 2 and 3) full group and small groups	Why Universities and Libraries Should Get Involved in Citizen Based on controversial dilemma situations as challenges: what citizen science is, why the society as a whole and individual communities around the world, requirements need to take into consideration when involving citizen scientists in research projects, and controversial aspects of Citizen Science implementation.	The impact was the co-constructed development of common understanding and shared knowledge about how to use citizen science in academic and library settings
Edit-a-Thon	Crowdsourcing knowledge	Extracurricular, 15 PhD students did the training session, but seven attended five Wikipedians	One day, self-organized	Wikipedia as creative commons	The participants learnt how to crowdsource digitally on open Wikipedia, improving the collective knowledge. The OKA results are publicly available in Wikipedia.

Spine	Data workshop	Extracurricular activity for students and other participants external from university 49 + 4 educators + 4 mentors	One day, self-organised	An open, participatory experiment (crowdsourcing) on biomedical image analysis	The participants learnt how to crowdsource digitally on medical data, improving the data by categorizations. The results are semi-accessible to those in the SPINE platform.
CATCH UP!@LET	Knowledge building with OKA design approach	Part of formal HEi course, four educators + 23 HEI students and alumni	One day, three-hour, one-time interactive event including a pre-event and post-event, large group	Job opportunities and career paths: stories about opportunities and challenges after graduation, advice for current and future students, networking	The is networking created among current students and alumni, and the information about alumni's experiences. The main impact was on students who learnt how to codesign an open knowledge-building event.
Life in Farms	Knowledge building with OKA design	Formal classwork, Four	One or two meetings/ week (45 min) during	Designing sustainability learning for schools as game-based experiences should foster their	Primary students learnt of the gamified collective knowledge-building approaches with design

	approach	educators + four facilitators, 22 HEI students and the primary education students	four weeks; small group(s), including a pre-event and post-even, large group	engagement and collaboration	features (Minecraft). The main impact was on HEI students who learnt how to codesign an open knowledge-building event.
Rover Adventure	Knowledge building with OKA design approach	Formal classwork, Four educators + six HEI students +19 participants from primary education	Short-term; one 3-hr long face-to-face event, including pre-event and post-even, large group	Designing STEM experiences for schools as game-based experiences should foster their engagement and collaboration	Primary students learnt collaborative STEM competencies. The main impact was on HEI students who learnt how to codesign an open knowledge-building event.
Data workshop	Data workshop	Formal classwork, 3 ac. staff, 46 master	Three days, online, asynchronous, synchronous self-	How can we make experiences of cities as cultural districts legible by using data visualization to map social media data enriched by vision AI	Students learnt to scrape and visualize open data with several tools and creatively used data in the discovery phase of the design process to understand how AI-based

		students	organised groupwork	algorithms?	data visualization services may be implemented in the cities. The accessibility of results is public but not easily findable for wide audiences.

3.2. The codesign and students' agency development

All the INOS project educators developed the learning design framework (LDF) for open knowledge activities (see O2A2). This background describes the 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. The LDF was developed for practitioners in design guidelines that can be used with student groups (see O2A3).

The project partners developed the learning design scenarios for open knowledge activities (pilot cases) in the next stage. Our pilots showed that in the planning phase, the educators did not systematically use LDF design guidelines by themselves. However, the main learning design elements 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 sheets among teachers and students. The project also developed the framework for implementing the open knowledge-building activities (O3A1) that followed the co-design stages and contained several learning sheets that aided the process using design thinking elements. However, we noticed that students did not follow these codesign framework principles in most of the INOS pilot cases. Several educators explained that they did not plan the activity with the students. Thus, introducing them to the implementation and learning design frameworks was of little purpose.

The INOS project aimed to engage higher education students in all the codesign and implementation phases of the open knowledge activities for engaging external stakeholders into open and citizen science practices. Several HEI educators and library network partners co-planned most activities from different domains and experts. Some revisions were made during the actual process reflections every day.

In several explored cases, the students and academic staff collaborated intensely during the design/planning phase (e.g., Noise pollution, CATCH UP!@LET, Rover adventure, Life in Farms). In the University of Oulu's cases, regular conversations were held between academic staff and the HE students to share updates about the event plan and its development. The students were introduced to the open knowledge activity and

guided in different planning stages as part of the course. The students were responsible for the event implementation on their own.

In explored case studies, our findings 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. Such cases enable self-organization as well as agency growth among students.

In some case studies, such as in the Sensor-based CS problem-solving activity Noise pollution on Reidi Road, the activity was planned to create the knowledge appropriation stages: from training the secondary education in-service teachers to letting the teachers in schools explore the same practice with their students.

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 codesign practices in teams (e.g., Service design for Elderly). Students' high agency in the discussion was considered to shift the activity in the run towards discussion groups (e.g., Knowledge building jams). Students' agency was grown in their own projects and presented and debated 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 preplanned 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 factor may depend on the experiences the participants have. For example, elderly participants requested mentoring help.

3.3. The learning outcomes from open knowledge activities

The creation of shared open data, knowledge, and resources in which each stakeholder has an equal interest (widely known as "Commons creation") in a participatory, bottom-up and user-driven way was one of the intended goals in OKAs. It was difficult for several OKAs to achieve equal interest to the Creative Commons among the participants and other relevant stakeholders such as community developers, city developers, public decision-makers etc. since they were not involved in the activity codesign (Cases 1, 3, 4, 10). In other cases, the common interest was achieved. Participants created well-designed services or learning events for themselves, such as for the elderly groups, for students and alumni, or primary schools (Cases 2, 7-9). In some cases, the OKA participants gained experiences with open data, but the data or knowledge were beneficial for specific interest groups (Wikipedia, SPINE data). In case 1, the teachers learnt to build innovative citizen science activities with digital and sensor-based tools outdoors that can be scaled up to many schools and public spaces (Case 1). The elderly stakeholders created service designs for the future

services (such as engagement garages for elderly men) that will be public resources for the elderly (Case 2). In the knowledge jams, the creation of shared project ideas in which each HEI student has an equal interest was achieved in a participatory, bottom-up, and user-driven way. The participants expressed interest in bringing these projects to life with further consultation of the experts who presented during the activity (Case 3).

The discussion about citizen science pros and cons elicited the participants' opinions and created shared knowledge (Case 4). The participants in Edit-a-thon achieved an open exchange with the Wikipedians as an informal "audit" of Wikipedia in the students' area of knowledge: in my own field of work, which is the "big" enhancements in Wikipedia. Would that be of greater benefit? (article addition and/or modification) (Case 5). As a result of the alumni event, an "Idea Wall" was created, illustrating the participants' key take-aways and learning from the OKA (Case 7). The participants of the data workshop learnt to use open data for solving design purposes for public space design. The resulting visualizations of the datasets may be used as an open knowledge outcome (Case 10).

The development of soft skills and creativity took place in several OKAs. For example, some OKAs used the design thinking process elements to develop creativity (Case 2). The collaborative and creative project work was pervasively used in several cases developing *collaboration and project work competencies* (Cases 2-4, 7-10). The design-related products mediated the development of soft skills and creativity, such as designing the geolocation tracks for citizen science (Case 1), designing elderly services (Case 3), designing open science ideas' application in education (Cases 7-9), designing the visualizations for using AI and open data in city space (Case 10). Few cases also focused on *self-organization competencies* with Creative Commons (Case 5 with Wikipedia; Case 6 with SPINE; case 10 self-organized group work)

The development of technical and digital skills or the mastering of new tools among the participants was particularly achieved because most activities were digitally mediated. Several cases taught how to digitally or with technical tools create, scratch, visualize, and annotate data with the geolocation or visual images dimension (Cases 1, 6,10). In most cases, some collaboration with digitally-mediated tools was conducted that supported digital collaboration skills, using shared co-creation tools such as brainstorming, developing and maturing knowledge (Wikipedia), opening up different perspectives of designs using the digital canvases (Case 2). Digital gamification elements were experienced in some cases (Cases 8, 9) where assessment with open educational badges provided novel digitally mediated assessment experiences.

The creation of evidence-based results to strengthen the evidence-building effort highlighted in EU policies (decisions, problem solutions) was one planned result in several case studies, but this was partially achieved because of the low involvement from policymakers and decision-makers. Secondly, it was difficult to do real engagements with specific decision-makers in the community as part of the activities because of Covid-isolation restrictions.

Some of the examples where no policymakers were involved are the following. Data were crowdsourced, but no decisions or discussions followed in the sensor-based activity (Case 1). Participants' created examples of how open data could be used in visualizations for AI-enhanced city design, but these were not shared with city designers (Case 10).

In the following examples, the ideas were developed but had little empirical testing to be mature enough for the common good. In Case 2, the elderly participants solved the problems for elderly groups. They were directed to end with working solutions. Ideas as problem solutions were developed further using the design

canvases and will be developed further by the groups after the training. Three ideas were developed: The Garage for elderly lonely men, The Community collaboration and inclusion projects and How to sustain a longer happy work-life for elderly +50 groups. The work with ideas will continue, and they will try to connect with the policymakers and other stakeholders to realize their ideas (Case 2). Participants developed several citizen science project ideas in the knowledge building jams and Dotmocracy workshops. One of the projects focused on creating accessible cultural routes for all in Sofia, Bulgaria.

Another was a course design introducing citizen science as an elective in a university. The winning project was designed around the idea of contesting pseudohistory through citizen science. In their feedback, participants noted that they particularly enjoyed the opportunity to learn from each other and to challenge their ideas through project development. In the second iteration, one of the projects focused on visualising a workplace of the future. Another was a course design of Co-designing an Inclusive City. The third one focused on researching the impact of pesticides on infant growth. The winning project was designed around the use of citizen science in cognitive psychology (Case 3). HEI students created, run, and evaluated learning design projects with external stakeholders - alumni (case 7) and students and teachers in schools (Cases 8, 9).

Change in mindsets regarding knowledge accessibility, open innovation, social engagement, and the HE role in society was developed in several cases. The elderly participants changed their understanding of how to co-create open innovation. They have developed a high inclination to social engagement between elderly groups and other age groups in society (Case 2). In the knowledge-building activities, the HEI students 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. There was a change in mindsets among HEI students regarding knowledge accessibility, open innovation, social engagement and the HE role in society (Cases 3,4). Students as organisers gained insight into open science and citizen science in the alumni event planning. Students were strengthening their active citizenship skills by strengthening their professional identity and the idea that they could impact addressing bigger problems in society (Case 7). Students working with the primary school in Cases 8 and 9 as OKA organizers gained insight into open science and citizen science. They strengthened active citizenship skills by using different tools and resources to collaborate through long-term intervention (Case 8). Participants in the data workshop learned to repurpose open data for service design in the public domain (Case 10).

Sustainable development goals were reached in several activities (Cases 1-4, Cases 8 and 10). Cases 1 and 10 related data with sustainable city monitoring: In Case 1, crowdsourcing for environmental data focused on using the sensors that taught how environmental monitoring with citizen science activities could be made. Participants in the data workshop learnt how to open dataset visualizations that could be used for nudging people in the city design (Case 10). Cases 2-4 and 8 discussed sustainable and sustainable communities' dilemmas. The discussed topics opened up the issues of quality education, reduced inequalities in decision making, sustainable cities and communities, partnerships for the goals, creating partnerships in the communities. The intercultural aspects were dealt with in Case 7. The OKA's organisers and participants got the opportunity to access a wider/bigger community of learning sciences and ed-tech. This OKA also strengthened the LET network's international and cross-border intercultural community, which holds potential for future collaborative spaces. Participants from primary schools engaged in a

learning experience where they inquired about farm life aspects such as growing plants, animal husbandry, and food products (Case 8).

3.4. What resources were needed to conduct open knowledge activities

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 common place 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.

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, email, Microsoft Teams, SharePoint, One Note, Discord https://discord.com/brand-new, Minecraft Education Ed.
- co-creation and teamwork platforms: Trello.com, Miro.com, Wonder.me, Flinga, Jamboard, Kahoot, Google Forms
- resource sharing LMS platforms: Google classroom, Google drive
- tools for data management - Instaloder (open source), OpenRefine (open source), RawGraphs (open source), Tableau (licensed), QGIS (open source), Table2Net (open source), Gephi (open source)

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

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.

Few activities were conducted in actual places, so the project cannot generalise the criteria further.

Digital work required Wi-Fi access and personal tools such as smartphones, computers, 3-D printers, robots, and sensors. The participants' digital skills were developed as part of the activities and did not constrain their access. However, this might have lessened the interest in participation.

3.5. Creative commons from open knowledge-building activities

Working with and producing open knowledge and open data as creative commons was one of the goals of open knowledge-building activities. The explored cases worked with actual data that were collected with the sensors from the environments (Case 1), as well as with the open data that is publicly available (Case 10), and the data that originate from scientifically led processes in medicine (Case 6). The participants were engaged in collecting, scraping, aggregating, visualizing, and enriching the data. Yet, what did not happen was decision-making and policy discussions around the datasets. The data crowdsourcing and workshop results were opened up publicly, but they are scattered in the platforms (Avastusrada, SPINE, Miro) and not easily findable for the wider public.

Working with open knowledge was experienced in the self-organized crowdsourcing mode (Case 5), in the discursive (Cases 3, 4) and in design practices (Cases 2, 7-9). Working with open knowledge took the dialogical and trialogical modes - leading to the formation of shared common knowledge among the participants in the discussions, as well as to the shared common ground development for the common design purposes (dialogical mode); and the formation of shared knowledge objects (trialogical mode) (Cases 2, 3-4, 7-9). The dialogical processes were mediated by the discussion environments that preserved the recordings, and these became open knowledge objects the non-participants could reuse. The knowledge building was mediated by shared tools such as Wikipedia, Minecraft, google documents and slides, and different collaboration boards and design canvas boards. The groups who developed the ideas and shared them widely using social media channels can open these products up. Yet, the results developed in knowledge building around ideas (cases 2-4) or planning activities (such as cases 7-9) are too much contextualised and kind of mid-products, which wider audiences would not easily grasp unless such results are developed further as cases. This knowledge maturing stage was not taken by the participants of the INOS case studies, except that we used the evaluation guidelines to summarise the cases for this report. Secondly, there are no common portals where such cases could be easily and openly shared across educational and practice communities to achieve the real value of creative commons.

The presentations designed for the participants and all guidelines created for the event have been shared by Zenodo and are openly available for re-use (Cases 3,4).

The organizers communicated the INOS case studies in several channels when they planned the activities and achieved the results. However, this communication is brief and does not sufficiently popularize the participation in open science and citizen science activities among the wider public.

3.6. Assessment and evaluation in open knowledge activities

Three types of assessment and evaluation practices could be highlighted regarding the open knowledge-building activities in higher education for introducing the open science and citizen science approaches. The first practice is formative, which was provided as part of the discussions, group work pitches, both by mentors (usually experts, or educators or higher education students) and the participants of the activity (Cases 2,3,4,5,6). A formative evaluation was considered suitable for extracurricular activities. In several cases, some structural elements predefined guided this formative feedback provision. For example, students developed a feedback form to assess participants' rate of difficulty, fun, engagement of the pupils in the OKA (Case 9).

In the case studies of INOS, few specific assessment grids were developed that focused on participation and the quality of the creative commons and design products or events from the participants' and experts' and educators' viewpoints (Case 9).

The assessment was considered more important in the curricular cases (Case 10). Then it stemmed from the learning outcomes introduced to the students at the beginning of the activity. Particularly in the University of Oulu, an interesting gamification approach was developed to provide badges to the participants related to specific competencies they achieved as learning outcomes (Cases 7-9). The open badge-based assessment framework evaluated the project plan, implementation, and evaluation at the team and individual level. The Digital Open Badges criteria focused on elements related to project work, collaborative learning process, individual reflection, and participation in each phase of the course.

In several cases, a competitive element was embedded (Case 3) that motivated the participants to pursue the extracurricular activities. However, some participants disliked the competition (see the qualitative survey results). The extracurricular activities were awarded certificates in some cases.

It is also important to monitor open knowledge-building activities while codesigning and running them. In the INOS project, some of the monitoring was done qualitatively by educators (partners of INOS). They monthly reflected among the partners how the planning and running of their OKAS proceeded, which helped to make some corrections. Secondly, while running the OKAs, they systematically collected evidence from their OKAs using the evaluation templates. This template enabled directing attention to specific aspects of codesign, learning outcome types, and ethical principles that the OKAs were ought to follow. The active participatory citizenship surveys were handed digitally to the participants at the end of the activity. This approach allowed us to collect summative feedback with open questions and, as indicated, the level of participants' competencies. In some case studies, the surveys were not given to the participants because of their age (Cases 8-9), or other reasons (elderly service design case handed the survey related to open innovation, in knowledge building jams the organisers believed that the questions were not relevant and related to what participants experienced). Because of digital access for the participants, it was difficult to motivate them after the OKAs to fill in the surveys, so the response rate remained lower than expected. In cases 4, 5 specific feedback surveys were developed that provided feedback for the organisers on how to change the activities for the next iterations.

3.7. Ethics and privacy management in open knowledge-building activities

Ethics and privacy management and following GDPR in case studies were aligned at the universities to specific ethical regulations that each partner followed. The participants were asked for permission to collect evidence from the case studies (images, examples from the online collaboration results). The event registration form had components related to participants' consent to use their names, pictures, or videos for promotional and dissemination purposes. Participants gave consent for this specific use of their data in the INOS videos during the registration process.
The participants were introduced to FAIR principles and acknowledged that their work is publicly available as creative commons. All participants were given information about the activity and its schedule, and they voluntarily signed up to participate. All participants agreed to use their data for project reporting and gave vocal consent to publish their results after submitting their presentations. The data collection process followed the INOS Data Management Plan. The examples are provided in the Implementation framework (O3A1).
No private data were collected or handled in the OKAs. The survey was conducted anonymously.

4. Active participatory citizenship competencies in open knowledge-building activities

4. 1 The survey results

One goal of OKAs is to develop participants' active participatory citizenship competencies. Therefore, a survey instrument was developed (see Annex II). The following three dimensions of active citizenship were used: **socio-economic, socio-cultural and politico-legal.** The survey contained the following components: the survey started with asking respondents' background information and feedback about the OKA. Then items of the three dimensions (socio-economic (items 1-5), socio-cultural (items 6-10), politico-legal (items 11-15) were evaluated on a five-point scale (from "I certainly agree" to "I certainly disagree"). Each dimension includes five items that focus on either **gained knowledge** (items 1, 2, 6, 11, 12), intention and **agency to participate in future activities** (items 3, 7, 8, 13) or **values** (items 4, 5, 9, 10, 14, 15).

The survey was planned to be conducted in 12 OKA activities. Because of the Covid-19 crisis, many of the activities took place online, which created some difficulties in motivating the participants to fill in online surveys after lengthy online activities. Each partner translated the OKA survey into their national language. The survey was attributed to the participants anonymously. Thus, there was no possibility to remind the participants that it was to be filled in if they did not wish. We managed to collect back feedback from seven OKAs, which was less than planned originally. The number of respondents that provided back feedback to the OKAs was 90. The total number of participants in all 12 OKAs was 404. Thus, 22 % of participants responded less than we expected. The project proposal aimed for 65 %. However, among the seven OKAs from where we collected the results, the response rate was higher from 226 participants 39 % provided the answers - 23 respondents from the Noise Pollution at Reid Road (Case 1), seven respondents from Dotmocracy workshop (Case 3), 13 participants from Knowledge building jam (Case 4), seven participants from Edit-a-Thon (Case 5), 25 respondents from SPINE (Case 6), six respondents from Catch up LET (Case 7), 13 respondents from Data workshop (Case 10).

The quantitative results are provided in the following figures 4.1-4.4.

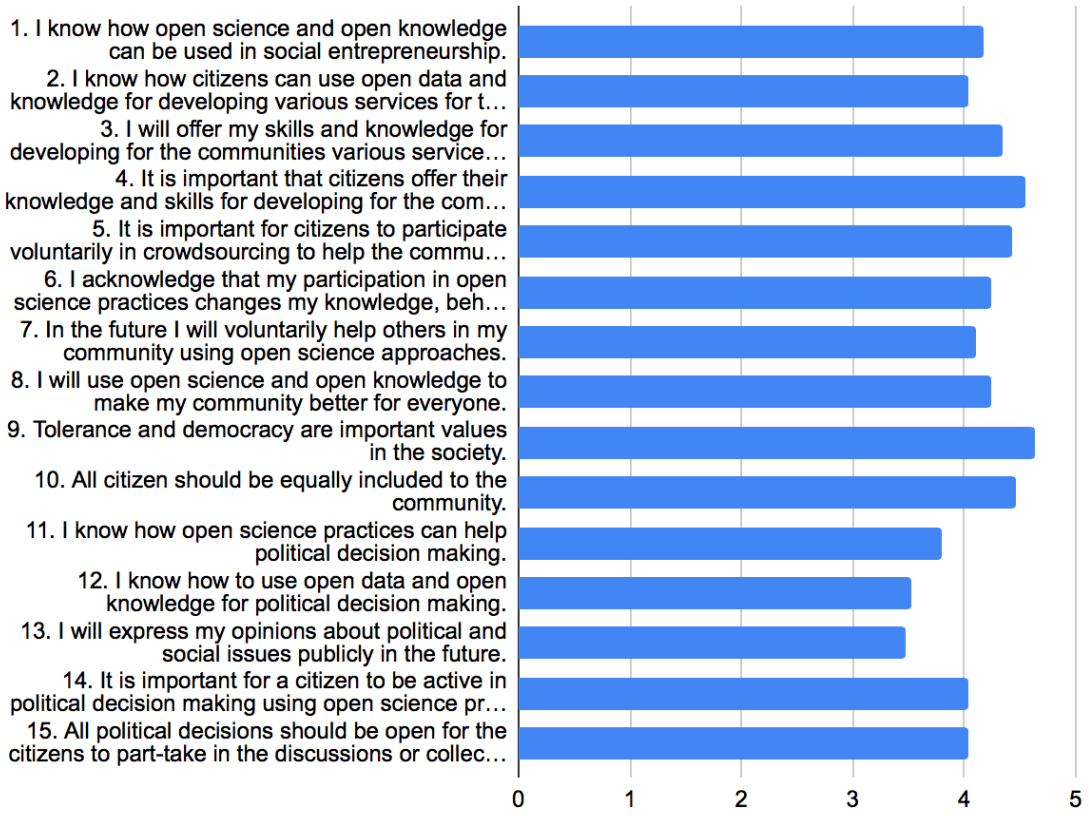

Figure 4.1. The overview of active citizenship competence levels among participants of open knowledge-building activities.

We discovered (see Figure 4.1) that after conducting the open knowledge-building activities, the participants rated more highly their values' dimension (average 4.43) (particularly approving equal inclusion to the community, tolerance and democracy as values), and their behavioural intentions and agency (average 4.12) (particularly voluntary participation in citizen science for the community sake, and offering their skills and knowledge for developing for communities data and knowledge-based services). The knowledge dimension was rated the lowest (average 4.02).

The socio-cultural dimension was rated the highest (average 4.50), next to the socio-economic dimension (average 4.38), and the lowest was the politico-legal dimension (average 3.76). None of the INOS open knowledge-building activities enabled experiencing active policy discussions with community stakeholders and using the collected knowledge and data for policy change purposes. We may argue that this could have influenced the responses. However, we cannot make direct inferences. The results indicate a clear need for bringing policy level discussions and decision-making into open science activities.

We also explored the dataset by types of open knowledge activities (see Figure 4.2). It could be found that the activity type might have influenced the participants' opinions. Four types of activity categories were

synthesized across OKAs - crowdsourcing data (Case 1), crowdsourcing knowledge (Case 5), data workshop (Case 10) and knowledge-building (Cases 3, 4, 6, 7). The average results of each type of activity indicate that participants' responses were at a lower level in the data crowdsourcing (average 3.94) and knowledge building OKA's, compared with the ratings of crowdsourcing knowledge (average 4.51) and data workshop (average 4.24). These results cannot be directly linked with the learning and experiences from the open knowledge-building activities.
We also studied the responses of different types of participants in open knowledge-building activities (Figure 4.3). The data comprise 19 educators, nine experts, 46 higher education students and 17 external (students and teachers from secondary schools).

We also discovered some notable differences in the profiles of high school educators compared to other participants - they had the lowest results in the policy-related survey items 12, 13 and 14 (Figure 4.3). This result may indicate the need to train high school educators about how and why to develop policy related open science activities in higher education courses. In comparison, the experts' policy-related values were found to be the highest (items 14, 15).

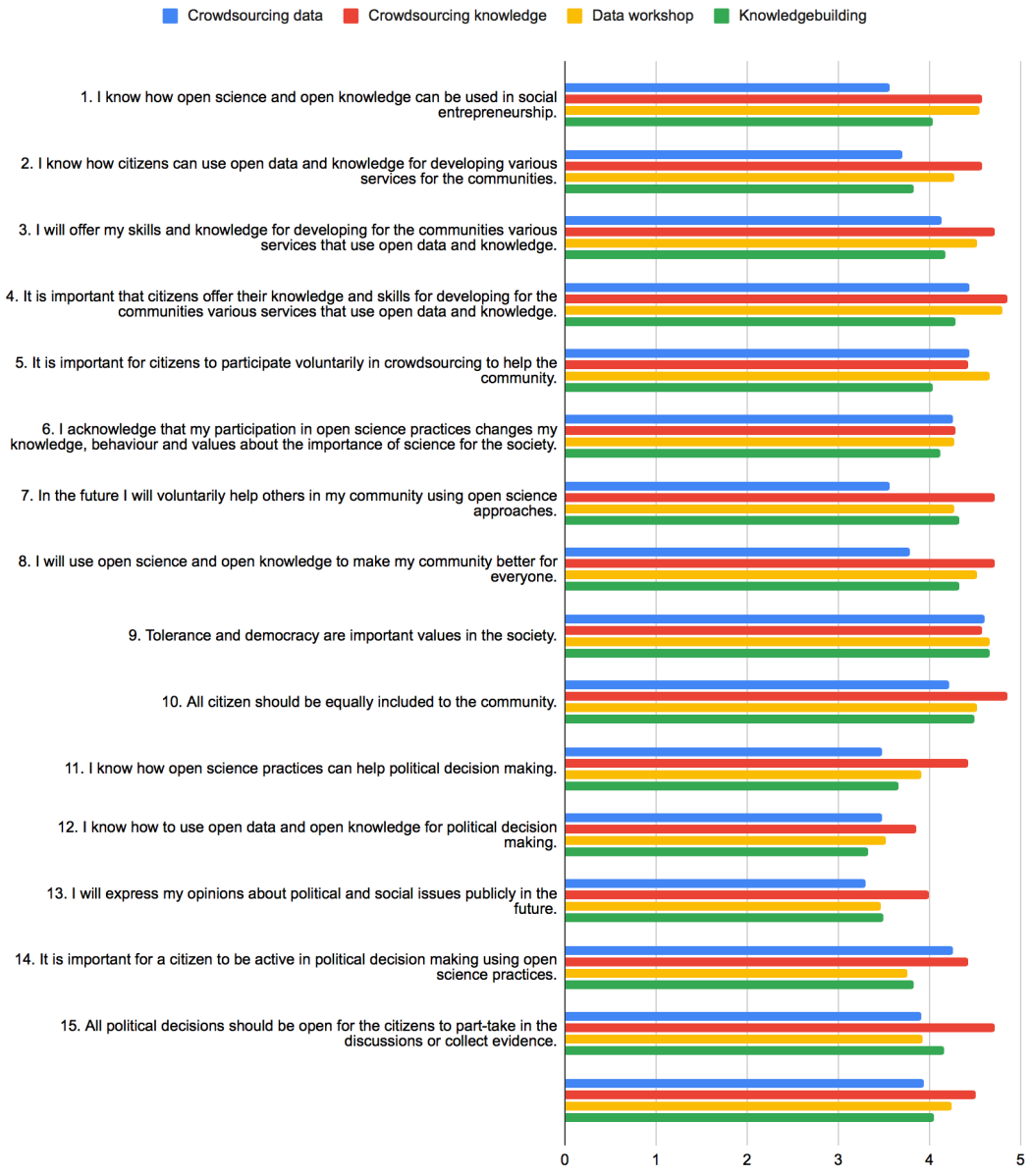

Figure 4.2. The comparison of active citizenship competencies across different types of open knowledge-building activities

Figure 4.3. The comparison of active citizenship competencies among the participants of open knowledge-building activities

The experts had higher opinions of their knowledge, agency, and values (see the questionnaire components above) than high school educators and high school students and external participants (most of these were students and teachers at schools). Figure 4.4 summarises the differences in participants' average knowledge, agency, and values.

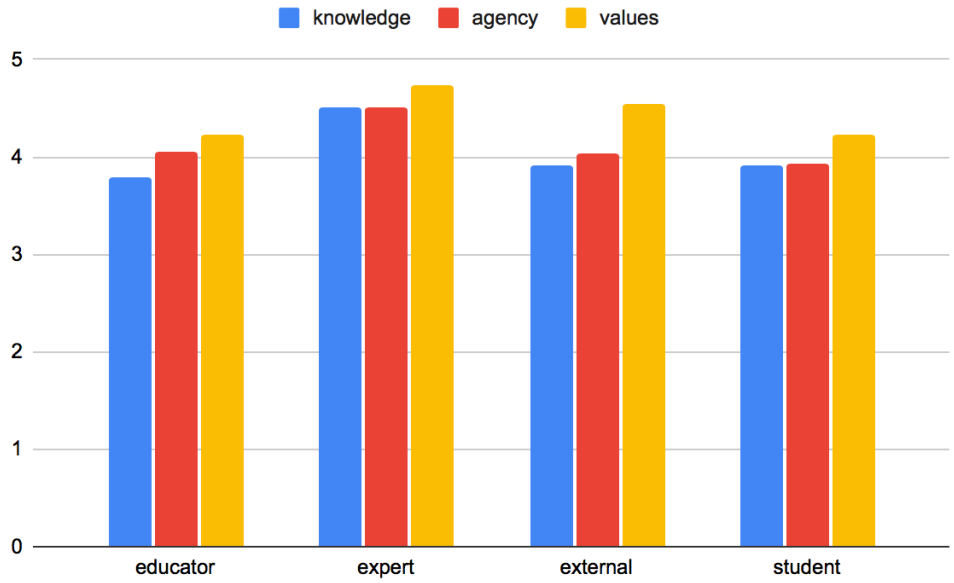

Figure 4.4. The differences in average knowledge, agency, and values among different participant types in the open knowledge-building activities.

The results of the active participatory citizenship competencies' survey provided an interesting insight into the different possible gains and needs among different participants' groups. Yet, the data are not causally related to the open knowledge-building activities since the development of knowledge, agency, and values are longer than the short activities we offered in INOS cases.

The qualitative feedback to the survey items highlights several positive aspects and what to improve in the knowledge-building activities.

The group interactions, the possibility of asking questions and the experts' explanations and involving the public in the reflection were highly esteemed.

Many participants praised the well-designed pedagogical sequences and interaction in the activities. They liked gamification aspects, the possibility to conduct learning and explorations outdoors, and learning how inquiries are made at locations.

Several participants also noted that the interesting open science platforms motivated them to participate and helped them to understand how data is studied. Students noted that they were intrigued by the shared datasets formed because of individually performed activities. Working with the data visualizations was also

found very engaging. For example, they highlighted: *I got very inspired to use data. Instead of just finding data to use, it has been really interesting to create it and consider every aspect of the data along the way.* One participant wrote: *This course really opened up my curiosity!*

The participants were proud that they were trusted and could contribute to scientific data, noting, for example, *I greatly appreciated the trust placed in us by the teacher-researchers.*

Particularly interesting are some responses that reveal the participants' active participatory citizenship intentions, such as *Democratization/popularization of scientific fields and processes in interaction with researchers. Feeling of participating in an experience for the benefit of all.*

From the negative side, several interesting aspects were brought up, such as:

- unpredictability in the activities
- the challenge in the task was perceived as difficult to perform at the beginning
- the lower number of participants than expected
- digital mode, some bugs in the platforms
- unclarity in some instructions on how to work with the data
- readability of the data processes needs to be enhanced
- allocation of time in the whole activity and particularly for group work
- the competitive elements were disliked
- the GDPR and ethical issues must be discussed more in-depth
- better considering the level of participants (beginners and experienced)
- having moderators and coaches in the groups was requested

Conclusion

The report summarised the lessons learnt from the INOS project open knowledge-building activities (OKA) conducted in 2020/2021 at the partner universities and research libraries. The in-depth descriptions of the OKA cases are presented using the structural elements that make it easy to understand what resources were needed, what actions were taken, how the participants were engaged in the process, and what was achieved. This collection does not present the best practice, as we explored several activities for the first time. The second part of the report synthesises the aspects of HEI's engagement with external stakeholders, the ways of achieving participants' agency, how the cases achieved the creation and sharing of open knowledge, and what the participants learned. The last part of the report contains the survey results of the 90 individual active citizenship competency levels estimated after the open knowledge activities. We believe that the examples and the generalizations from lessons learnt and the survey results may inspire the future good practices of integrating open knowledge activities in HEIs.

Overall, the exploration with integrating open knowledge-building activities to the higher education institution practice so that the educators and learners could also involve the external from the university participants highlighted some critical pinpoints. The university learning structures can be opened up to external people to participate in open science activities. It is particularly valuable to codesign such activities together with the students, experts and educators involving the external from the university stakeholders into the design process. This approach helps to grow the active participatory citizenship competencies among all involved counterparts. Yet this was also found challenging in the case studies to give students a

more active part in planning their own learning experiences. University and research library partnerships with schools and external networks provided a good opportunity to collaborate as part of short-term open knowledge activities. However, it must be noted that the longer knowledge-building activities on shared challenges would be more valuable as they would allow planning iterative test cycles and codesign to be practised, rather than just working with some data and knowledge in a short period and dropping those.

Most of the INOS open knowledge-building activities were conducted in the digital mode, which on the one hand, was difficult and less attractive for participants. On the other hand, it enabled us to develop new digital approaches to collaborative work with the knowledge and data and manage discussions and group work. We achieved many outcomes related to open society, citizen activism, shared open knowledge, and data. We also discovered that decision making, and policy actions were somewhat left without attention in OKAs, and the politico-legal dimensions were not esteemed highly enough among participants. These factors should be considered if we want to prompt the full cycle of open science in the universities and communities. Secondly, there are not enough common spaces for open data sharing in the society that both the universities, research institutions and the communities to feel ownership. More development is required to engage and share the results of open knowledge and data publicly for the communities' future benefit. The results of the short term open knowledge-building activities done by higher education, schools or other initiatives remain incremental, scattered, and not easily discovered.

Finally, we summarize some numerical indicators that the INOS project set for its actions: How many students, educators and external stakeholders could the INOS open knowledge activities engage? Conducting 12 OKAs were planned, and we managed to do 12 OKAs; we expected 420 individuals to take part in those, 404 individuals participated as part of informal, extracurricular, and curricular activities; we expected 65 % of results from the active participatory citizenship surveys but achieved only 22 % of responses.

The project was run at the challenging Covid-crisis time, which hindered the partners from meeting (except online). We had to revise our planned activities many times because of lockdown and strict regulations for public events. Yet, as we have achieved most of the planned goals, the open knowledge-building activities' report proves that many digitally mediated open science approaches are available for higher education institutions to engage with community stakeholders despite no face-to-face access.

References

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Pata, K. (20201)Guidelines for open knowledge activities with citizens in higher education institutions. INOS project report O3A4.

Annex I. Formative evaluation guideline for implementing OKAs

Name of the OKA activity:
Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible:

The topic of the activity:

Domain area:(check all relevant): natural sciences/social sciences/arts/humanities
The length of the activity (planned execution period):
Activity duration: short-term/medium/long-term
Who are participants in OKA:

- HE students (bachelor/master/PhD)
- "citizens" (children in school, museum/library visitors, youth centres, people accessed via digital channels or events, elderly centres)
- researchers, HE educators, librarians

Mode of engagement: individual/small group(s)/large group
Delivery mode of the activity: face-to-face/blended/online; synchronous/asynchronous
Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide a short list or links):

- collaboration facilities
- tools/equipment
- apps, software (including open software and Citizen science project software)
- learning resources (online/on paper, including OER, learning resource repositories)
- data, knowledge, repositories

Frequency of interaction: one-time interactive event/periodic submissions or interactions
Activity approach: Please provide short information about how you planned and implemented the activity. Phase: Where? (place, medium) Who? (HE educator, researcher, librarian, HE student, external from HE participant) What? (what they do) With what? (data, knowledge, resources) Why? (goals, outcomes, outputs, impacts)

Preparation of the activity:
Phase I:
Phase II:
…

HE students participation mode: Compulsory/optional formal learning activity for your HE students (as a course, course task or project they get graded)/Voluntary, informal learning opportunity they can do in their free time
Note. We assume that the OKAs engage HE students to participate and organize citizen science activities.
HE students' agency in the responsibility areas:

i) OKA idea generation: missing/low/high; **(please specify)**
ii) OKA co-planning and co-design: missing/low/high; **(please specify)**
iii) OKA team management: missing/low/high; **(please specify)**
iv) OKA execution: missing/low/high; **(please specify)**
v) OKA evaluation: missing/low/high; **(please specify)**

vi) OKA communication: missing/low/high; **(please specify)**
vii) using the results of OKA: missing/low/high; **(please specify)**

How were "citizens" accessed/involved and by whom:(e.g., by researchers/HE students/local stakeholders in organizations; what way you accessed, e.g., social media/event-related (workshop, meeting)/place-related contact (in school, library, centre etc)

What are educators', librarians', researchers', and HE students' preconditions for participation:
Note: here, we collect information supporting HEs in planning OKAs as open science learning activities.

Mentoring needs during the OKA: provide a short paragraph about mentoring needs during OKA design, implementation, evaluation with students

Grading the HE students: **explain what way grading was organised for OKA**

Please describe the difficulties in the crisis time to deliver your planned activity:

Past history of the OKA: Conducted earlier/Conducted something similar/Totally new
If available, provide here links to the activity resources.

Explain shortly what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- the creation of shared open data, knowledge, and resources in which each stakeholder has an equal interest (widely known as "commons creation"), in a participatory, bottom-up and user-driven way.
- the development of technical and digital skills or the mastering of new tools among the participants.
- the creation of evidence-based results to strengthen the evidence-building effort highlighted in EU policies (decisions, problem solutions)
- change in mindsets regarding knowledge accessibility, open innovation, social engagement, and the HE role in society.

How long can the OKA outcomes be used: short-term/long-term

How did you follow ethical, privacy requirements and copyright policies?

- How did you follow ethical guidelines in recruiting participants? (e.g., consents, information sheets)
- How did you manage the data? (describe using FAIR principles)
- How did you follow copyright policies?

Annexe II. The survey

This questionnaire measures active participatory citizenship competencies in open knowledge activities in the INOS project. The answers will be anonymous and used only for scientific research.

Background information
What is your role?
HE educator
librarian
researcher
HE student
other participants from outside the university
Gender: male / female
Age: ……

Feedback to the activity
How satisfied were you with the activity?
very satisfied
rather satisfied
rather not satisfied
not satisfied

What was positive about the activity? (e.g., benefits for you, for community etc.)
……
……...

What are your suggestions to the organizers?
……
……...

Active participatory citizenship
Evaluate the following statements through your experience in the activity.

Statement	I certainly agree	I rather agree	So and so	I rather disagree	I certainly disagree
1. I know how open science and open knowledge can be used in social entrepreneurship.	5	4	3	2	1

2. I know how citizens can use open data and knowledge to develop various community services.	5	4	3	2	1
3. I will offer my skills and knowledge for developing for the communities various services that use open data and knowledge.	5	4	3	2	1
4. It is important that citizens offer their knowledge and skills to develop various services that use open data and knowledge for the communities.	5	4	3	2	1
5. It is important for citizens to participate voluntarily in crowdsourcing to help the community.	5	4	3	2	1
6. I acknowledge that my participation in open science practices has changed my knowledge, behaviour, and values about the importance of science for society.	5	4	3	2	1

7. In the future, I will voluntarily help others in my community using open science approaches.	5	4	3	2	1
8. I will use open science and open knowledge to make my community better for everyone.	5	4	3	2	1
9. Tolerance and democracy are important values in society.	5	4	3	2	1
10. All citizens should be equally included in the community.	5	4	3	2	1
11. I know how open science practices can help political decision making.	5	4	3	2	1
12. I know how to use open data and open knowledge for political decision making.	5	4	3	2	1
13. I will express my opinions about political and social issues publicly in the future.	5	4	3	2	1

14. It is important for a citizen to be active in political decision making using open science practices.	5	4	3	2	1
15. All political decisions should be open for the citizens to part-take in the discussions or collect evidence.	5	4	3	2	1