FOSTERING THE PRACTICAL IMPLEMENTATION OF OPEN SCIENCE IN HORIZON 2020 AND BEYOND – 741839

D3.2 – Recommendations on Open Science Training

WP3 – Open Science Training

EIFL

20/07/2018

DOCUMENT DESCRIPTION

Deliverable number:	D3.2
Deliverable title:	Recommendations on Open Science Training
Actual Date of Delivery:	20/07/2018
Author:	Iryna Kuchma, EIFL
Reviewers:	Helene Brinken, University of Göttingen; José Carvalho, Antónia Correia and Eloy Rodrigues, Minho University; and Anna Schwickerath, GESIS
Workpackage:	3 – Open Science Training
Distribution:	Public
Version/Revision:	V3

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 741839

TABLE OF CONTENTS

SUMMARY

Building on Open Science Training Handbook, available as gitbook at https://book.fosteropenscience.eu/ and in the github repository at https://github.com/Open-Science-Training-Handbook, and on successes of over 40 online and face-to-face events that FOSTER organized in 2017-2018, this report provides good practice recommendations on open science training targeting researchers and multipliers – train-the-trainers approaches for research support staff and librarians. It includes the following:

- A selection of open science topics to include in your training activities;
- Useful tips on how to plan based on outcomes rather than objectives;
- Overview of types of training based on the audience size, funds available, duration of training and training levels;
- Organizational task checklist;
- Exercises and glossary;
- Overview of FOSTER training events for life science, social sciences and humanities and FOSTER open science clinic series of speed counselling for early career researchers, Tech Transfer and Grant Officers and National Contact Points for Horizon 2020;
- Recommendations on train-the-trainer approaches highlighting our experience from FOSTER open science trainer bootcamp and materials from two other train-the-trainer courses: ELIXIR EXCELERATE and Powering up your 2018 (data skills) from ANDS, Nectar and RDS.
- Roadmap for implementing open science training practices in research institutions suggesting six practical actions to be implemented by research institutions to support a cultural change towards open science.

RECOMMENDATIONS ON OPEN SCIENCE TRAINING

WHICH TOPICS TO COVER?

Open science is a broad area that includes many concepts and principles and the first step in planning your open science training event(s) is to identify the topics you want to cover.

To help you decide, FOSTER provides the Open Science taxonomy[1], further described in the paper "Fostering Open Science to Research Using a Taxonomy and an eLearning Portal"[2].

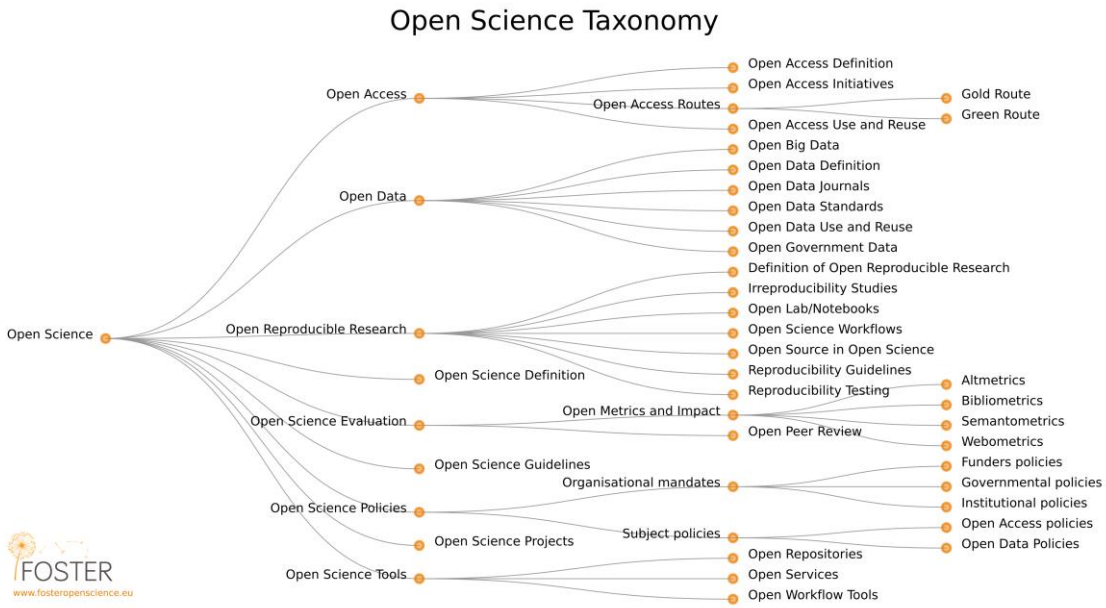


Figure 1 - Open Science Taxonomy

For more context and the key points to cover, check out "Open Science Basics" chapter of the Open Science Training Handbook that covers 12 open science topics:

- Open Concepts and Principles
- Open Research Data and Materials
- Open Research Software and Open Source
- Reproducible Research and Data Analysis
- Open Access to Published Research Results
- Open Licensing and File Formats

[1] https://www.fosteropenscience.eu/foster#taxonomy
[2] http://oro.open.ac.uk/44719/

- Collaborative Platforms
- Open Peer Review, Metrics, and Evaluation
- Open Science Policies
- Citizen Science
- Open Educational Resources
- Open Advocacy

Each topic description includes the following:

- What is it?
- Rationale
- Learning objectives
- Key components
- Knowledge & Skills
- Questions, obstacles, and common misconceptions
- Learning outcomes
- Further reading

Even if you are not planning to run training events on those exact topics, you will likely find them of use – there is a high degree of overlap between open science topics.

FOSTER Open Science Toolkit[3] also offers in-depth information about ten open science topics:

1. What is open science?
2. Best practices in open research
3. Open peer review
4. Data protection and ethics
5. Licensing
6. Managing and sharing research data
7. Open source software and workflows
8. Open Science and innovation
9. Open access publishing
10. Sharing preprints

The toolkit is a set of free online courses, which does not aim to provide comprehensive coverage of all possible issues that may fall under a given course topic but rather to provide focused, practical and – where relevant – discipline specific examples to try and answer some of the burning questions researchers have about practicing open science.

[3] https://www.fosteropenscience.eu/toolkit

Open Science MOOC [4] also provides an overview of ten open science topics.

Figure 2 - Open Science MOOC

[4] https://opensciencemooc.github.io/site/

PLAN BASED ON OUTCOMES, RATHER THAN OBJECTIVES

"On Learning and Training" chapter[5] of the Open Science Training Handbook provides context on training strategies, practical guidance in designing a course as well as an overview of pedagogical theories. It focuses on three key concepts in teaching and training: preparation, execution and reflection.

For the preparation stage, planning based on outcomes rather than objectives is a good strategy.

The training community often uses learning objectives and outcomes interchangeably. Objectives, comprising aims or goals, and outcomes, comprising tangible results, may overlap, but are not genuinely the same.

When designing training, it is helpful to start with learning objectives and then list the outcomes for the training audience. Sometimes they may overlap, or in most cases, an objective encloses one or more outcomes. All practical exercises should be designed around specific outcomes.

LEARNING OBJECTIVES

- Learning objectives describe the intentions of the instructor by stating the purpose and goals of the course.
- Learning objectives focus on the content and skills important within the programme.
- They may describe what the instructors will do.
- Learning objectives should be specific and detailed.

LEARNING OUTCOMES

- Learning outcomes are statements that describe or list measurable and essential mastered content-knowledge — reflecting skills, competencies, and knowledge that trainees have achieved and can demonstrate upon successfully completing a course.
- Outcomes express higher-level thinking skills that integrate course content and activities and can be observed as a behavior, skill, or discrete usable knowledge upon completing the course.
- Outcomes are exactly what assessments are intended to show – specifically what the trainees will be able to do upon completing the course.

[5] https://open-science-training-handbook.gitbook.io/book/on-learning-and-training

- An assessable outcome can be displayed or observed and evaluated against criteria.
- Outcomes are clear and measurable criteria for guiding the teaching, learning, and assessment process in the course.

(Adapted from http://provost.rpi.edu/learning-assessment/learning-outcomes/objectives-vs-outcomes).

For Open Science Learning Objectives, see this FOSTER document: https://doi.org/10.5281/zenodo.15603 (see page 13 & 14).

ORGANIZATIONAL ASPECTS

Bigger workshops and events can require a lot of planning. Making your event a success will involve many decisions, from the small to the large, which are time-sensitive. "Organizational aspects" chapter[6] of the Open Science Training Handbook provides helpful information about training events basics such as format, audience, guest speakers and partners, venue, timing and budget. It also offers a useful checklist to aid in planning your training.

The four tables below provide initial guidance and recommendations on possible types of training and their characteristics based on the audience size, funds available, duration of training and training levels.

Audience Size	**Type of Training**			
	Live Workshop	**Course/ class**	**Lecture**	**Online Training**
less than 20	x	x	x	x
less than 40		x	x	x
more than 40			x	x

Funds	**Type of Training**			
	Live workshop	**Course/ class**	**Lecture**	**Online Training**

[6] https://open-science-training-handbook.gitbook.io/book/organizational-aspects

none			x	x
little	x	x	x	x
loaded	x	x		

Time	**Type of Training**			
	Live workshop	**Course/ class**	**Lecture**	**Online Training**
less than ½ day	x	x	x	x
½ - 1 day	x			
1- 4 days	x	x		
more than 4 days			x (series)	x (series)

Training level	**Type of Training**			
	Live workshop	**Course/ class**	**Lecture**	**Online Training**
Introductory			x	x
Aware of	x	x		x
Intermediate	x	x		x
Advanced	x	X	x	x

ORGANIZATIONAL TASKS CHECKLIST

"Organizational aspects" chapter[7] of the Open Science Training Handbook also covers organizational tasks such as equipment and media, marketing and advertising strategy, registration, communication, catering, signs, code of conduct, social media and notes, certification of attendance. We recommend this useful organizational tasks checklist.

What	When and who?	Done?
Equipment/media		
Determine what technical equipment is needed		
Check if enough power outlets are available		
Order wifi for participants		
Organize video recording and taking pictures		
Test equipment a few days before the training. Find a colleague for technical support during the event		
Print out handouts, feedback forms and material for exercises or publish them online		
Prepare flip charts and pinboards		
Venue		
Check elevator access, accessible entrances, ramps		

[7] https://open-science-training-handbook.gitbook.io/book/organizational-aspects

Check public transport and parking availability		
Locate maternity room, prayer room and gender neutral washrooms		
Clear, legible signs		
Brief your helpers before the event		
What	**When and who?**	**Done?**
Marketing/advertising		
Identify communication channels		
Set up online presence		
Send event information to mailing lists		
Inform about your event in social media		
What	**When and who?**	**Done?**
Registration		
Set up registration module		
Collect information on dietary needs and allergies		
Ask for childcare needs		
Provide hotel information for events over several days		

Send confirmations/invitations to attendees and provide clear text and image instructions to the venue		
Send a reminder 1 or 2 days before the event		
Prepare name tags and print participants list		
Prepare a registration desk		
Organize a wardrobe checkroom for larger events		
What	**When and who?**	**Done?**
Catering		
Identify catering options and needs		
Order catering		
Check if meals are clearly labeled (especially regarding dietary needs and allergies)		
What	**When and who?**	**Done?**
Communication during event		
Inform the participants where to find emergency exits, food/beverages and restrooms etc.		
Hand out consent forms for video recordings, live streaming and/or photos		

What	When and who?	Done?
Post event dissemination		
Make photos of flip charts and other non-digital material or results		
Hand out or send certificates of attendance		
Provide or send training material (slides, notes, video recordings) to the attendees		
Provide a report for your funder or institution		
What	**When and who?**	**Done?**
Evaluation		
Hand out or provide an online or printed form for feedback		

EXAMPLE EXCERCISES AND PRACTICAL GUIDANCE

Lively and interactive training events need engaging activities. "Examples and Practical Guidance" chapter[8] of the Open Science Training Handbook provides suggestions on how to engage your audience, gives practical insight about theoretical topics and on gathering feedback from your participants. It offers a range of tested and approved training structures such as open science meet-ups, study groups, reproducible analysis and research transparency workshops, carpentry workshops, open science summer schools and many more; as well as exercises and resources from open science training experts. Feel free to test, reuse, and adapt them.

Example exercises, detailed descriptions are here: https://open-science-training-handbook.gitbook.io/book/examples-and-practical-guidance

Title	Topic and materials	Type	Duration
Line up!	general	whole group	5-10 min
Prioritization of training needs	Open Concepts and Principles, printout of research cycle with activities	whole group	10 min
Selection of Open Science practices	Open Concepts and Principles, printed cards with open science practices (also available as editable powerpoint slides or in a Google spreadsheet)	whole group	1-1.5 hour
Open Science discussion topics	Open Concepts and Principles	small groups	20-30 min

[8] https://open-science-training-handbook.gitbook.io/book/examples-and-practical-guidance

LIBER Open Science café	Open Concepts and Principles, LIBER Science Café card deck	small groups	1.5 hour
What is research data for me?	Open Research Data and Materials	individual / pairs	15 min
Why not share data?	Open Research Data and Materials	small groups	20 min
"Open Data Excuse" Bingo	Open Research Data and Materials, printed sheets of "Open Data Excuse" Bingo	whole group	20-30 min
Me and my data - Datagramms	Open Research Data and Materials	whole group	1-4 hours
Find your data publisher	Open Research Data and Materials	individual / pairs	10-15 min
What do you need for a data publication?	Open Research Data and Materials	whole group	10 min
Creating metadata	Open Research Data and Materials	individual / pairs	5 min
Get started with sharing software openly	Open Research Software / Open Source	individual / pairs	20-30 min

Establishing a Reproducible Data Analysis Workflow	Reproducible Research and Data Analysis	individual / pairs	4-8 hours
Choose the right version for the repository	Open Access to Published Research Results	individual / pairs	15-20 min
Open file formats	Open Licensing and File Formats	whole group	10-15 min
Creative Commons License matching	Open Licensing and File Formats	whole group	5-10 min
OER Remix	Open Licensing and File Formats Open Educational Resources, online version http://www.opencontent.org/game/ and a printed version http://www.opencontent.org/game/print/	whole group	10-15 min
Open peer review - participants openly review each others' texts	Open Peer Review, Metrics, and Evaluation	small groups	90 min
Open peer review - your 2 cents	Open Peer Review, Metrics, and Evaluation, large printout of dimensions of peer review: one for each participant and	whole group	1.5 hour

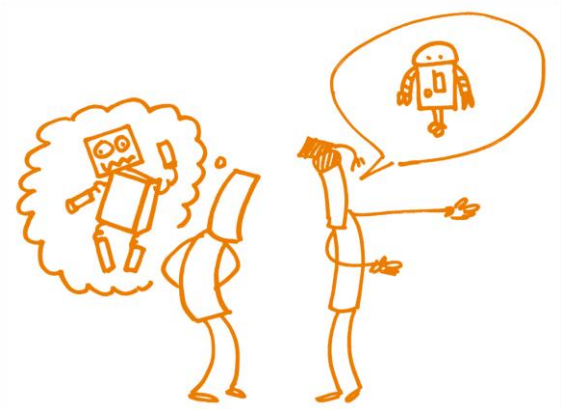
	a communal one (presentation with animated slides also available)		
Taking a stance	Open Science Policies	whole group	10 min
Plain language explanations	Citizen Scientists and Science Communication Collaborative Platforms	small groups	2-3 hours
Devil's advocate - convincing the skeptics	Open Advocacy	small groups	30 min
Writing a lay summary	Citizen Scientists and Science Communication	individually or in pairs	60 minutes

GLOSSARY

Like any other emerging field, open science uses quite a lot of difficult terminology. The "Glossary [9] " of the Open Science Training Handbook explains most of the less familiar terms and concepts.

ILLUSTRATIONS, ICONS AND CARTOONS

Icons, cartoons and images can help to attract the training participant's attention and to illustrate complex issues in a low-threshold and maybe even fun way. FOSTER initiated the creation of more than 100 icons and cartoons by Patrick Hochstenbach (University of Gent, Belgium). They are now available for you to re-use under Creative Commons Public Domain Dedication (CC0 1.0 Universal).



- Download the large set of small icons such as a book, coffee, researcher, megaphone etc. here: Large ZIP archive of PNG graphics (1.5Mb)
- Download the 16 cartoons, e.g. fundamental rules of open science here: ZIP archive of 16 PNG illustrations (15Mb)

[9] https://open-science-training-handbook.gitbook.io/book/glossary

ELEARNING

Online courses provide a great opportunity to offer training for a high number of participants who might not able to travel to face-to-face events because of time, distance or money. If you are creating online courses about open science, you can re-use our 18 online courses available at https://www.fosteropenscience.eu/courses when designing your own. You can export them into SCORM and integrate them in any learning management system.

CHECK LIST FOR TRAINERS

At FOSTER's open science trainer bootcamp, Pedro Fernandes provided useful tips on connecting with audiences, establishing house rules, team building, engaging participation, gathering feedback and planning sessions and courses:

Connecting with audiences

- Plan an icebreaker and use it to establish a team where you belong.
- Begin training by ensuring that people know each other.
- Establish what the goals or learning objectives are.
- Focus the team on the need to reach specific learning outcomes.
- Connect!

Engaging participation

- Ensure sufficient amounts of time for Q&A, discussion / opinion making, feedback (instant responses), relaxation, food and drink.
- If your training is long, stop the delivery when logical (end of a module) and insert a wrap-up.
- Call for participation in short intervals. Use it to connect with your audiences.
- Collect instant feedback, e.g. using Yes/No method with post-it stickers or USB lamp or quantifying method - Fist or Five (six categories) and with software like Socrative[10].

Planning a session

- Pick each concrete outcome (and define it clearly).
- Design an exercise that a learner can perform, alone or in a group in a reasonable amount of time. The exercise should carry the method that you want to train people in.
- Check the need for a short presentation and prepare to deliver it if adequate.
- Create a way to prove that the outcome has been achieved. Can be a wrap-up, a demonstration, a learner presentation, etc.

[10] https://socrative.com

Risk management tips

- Have a plan B for absolutely everything.
- When providing training to a group, remember that each participant will judge your training in a variety of aspects.
- Some participants will expect individual attention at times. Find ways of providing that level of comfort (by smartly juggling with attention).
- Aim at thoughtful ways of judging the delivery yourself, as it flows, anticipate critical moments and be prompt at correcting what may go wrong (it will, at times).

More general references

- Online Learning: https://onlinelearninginsights.wordpress.com

FEATURED FOSTER TRAINING EVENTS

Below are the three examples of FOSTER training courses for researchers on life sciences, social sciences and humanities as well as for multipliers (Horizon 2020 National Contact Points – NCPs). These examples could help you plan your engaging open science events.

LIFE SCIENCES: REPRODUCIBLE IN SILICO GENOMICS TRAINING

Reproducibility of in-silico pipelines analysis has become one of biology's most pressing issues. The exponential growth of biological datasets, increasingly complex data analysis methods and the lack of community standards all present major challenges. These obstacles are exacerbated when considering the installation, deployment and maintenance of bioinformatics pipelines across the diverse range of computational platforms and configurations on which these applications are expected to be applied (workstations, clusters, HPC, clouds, etc.).

The training unit at the Centre for Genomic Regulation (CRG), in collaboration with Foster plus, organized the Nextflow: reproducible in silico genomics workshop in Barcelona on 14 and 15 September, 2017. Nextflow[11] is an open source software enabling the reproducibility of complex computational data analysis workflows. It addresses the problem of scientific reproducibility by making code easily re-usable and deployable across very different platforms. The team behind Nextflow have created a powerful tool integrated with other popular technologies and industry standards such as Git, GitHub[12] and Docker[13]. "Nextflow enables researchers to easily use software containers technology, wrapping up all the software of an analysis and ensures the

[11] https://www.nextflow.io/index.html
[12] https://github.com
[13] https://www.docker.com

results can be replicated by anyone, anywhere" explains CRG group leader Cedric Notredame.

The training was organised across two days and structured in two main sessions. It combined talks, demos, a tutorial/workshop for beginners as well as two hackathon sessions for more advanced users.

In the first session there were selected talks focused on the problem of reproducibility in bioinformatics pipelines. Speakers from leading institutions and organizations, such as Pasteur Institute, King's College London, Synthetic Genomics, Roche Sequencing and Amazon among the others, introduced their use cases, best practices and how they have applied Nextflow to enable reuse, collaboration and transparent results of their computational genomics data analyses.

The second session included an introductory course on the Nextflow programming environment for novice users and a parallel hackathon for expert users that provided the possibility to share and collaborate together on selected projects.

Nextflow project lead, Paolo Di Tommaso (CRG), said that "getting together in the same room helped foster new collaborations and strengthen existing ties with users and developers".

During the hackathon, coordinated by Evan Floden (CRG), several contribution proposals emerged and in the end, five diverse ideas were chosen for communal development ranging from new pipelines through to the addition of new features in Nextflow. "The hackathon format allows for productive, constructive work to occur in an open and informal environment" Di Tommaso noted.

Participants: 45 researchers, EC project managers and companies (bioinformaticians).

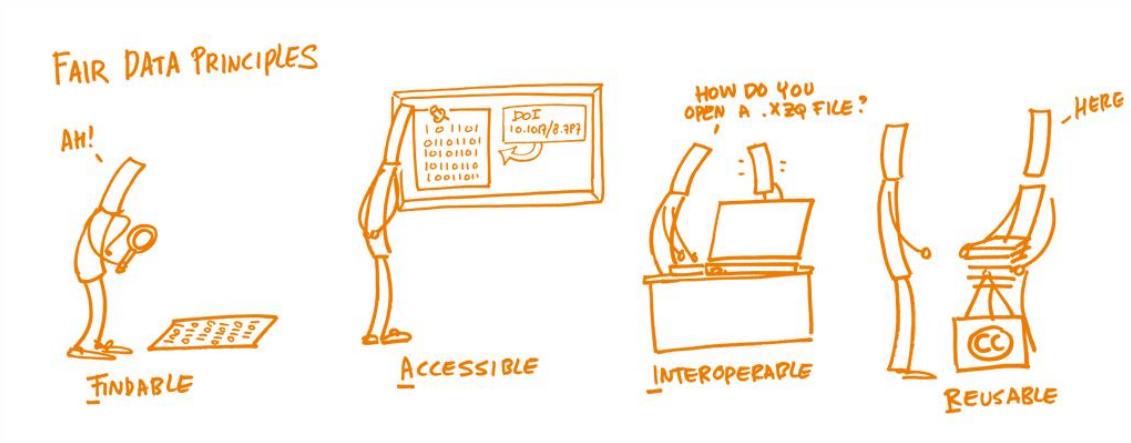
All materials, course content, assignments and the hackathon projects are available at the GitHub repository[14].
Nextflow blog: Nexflow Hackathon 2017[15]

A short movie[16] from the event.

[14] https://github.com/nextflow-io/hack17
[15] https://www.nextflow.io/blog/2017/nextflow-hack17.html
[16] https://www.youtube.com/watch?v=s7SqYMRiY8w

SOCIAL SCIENCE AND HUMANITIES: TRAINING EARLY CAREER RESEARCHERS ON OPEN SCIENCE & RESEARCH DATA MANAGEMENT

The National Documentation Centre (EKT), OpenAIRE National Open Access Desk, in cooperation with FOSTER organized a seminar on Open Science and Research Data Management targeting early career researchers in social sciences and humanities (SSH) on June 5, 2018. Following an open call, 23 participants were selected to join the workshop.



The event was divided into three parts. In the first part, participants got introduced to the concepts of open science and open access. Open licenses discussion with a particular focus on Creative Commons licenses was very interactive. Then FOSTER and OpenAIRE support and training materials were presented that facilitate the practical implementation of open science.

Participants received the "Opening up the research workflow sheet" (designed by Bianca Kramer and Jeroen Bosman, see below) and were asked to mark one or two activities that they were practicing already and one or two that they would like to explore.

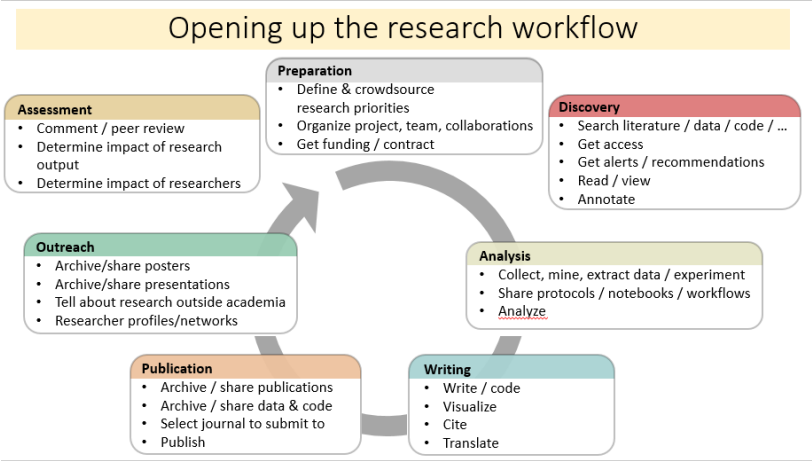


Figure 3 - Opening up the Research Workflow diagram

The second part of the seminar included a presentation "The What, Why and How of Data Management Planning[17]" and an interactive session where participants had the opportunity to share their practices and ask questions about data management based on their experiences with handling the data of their projects. The variety of disciplines and types of data led to a productive discussion and exchange of ideas regarding data management practices, highlighting the importance and benefits of data management planning from the very early stages of the research process. It also confirmed the necessity of considering issues related to data storage and preservation after the completion of the project.

POSTGRADUATE DATA MANAGEMENT PLAN

As a hands-on activity participants developed their Postgraduate Data Management Plans, using a template below adapted from the University of Bath Postgraduate Data Management Plan template.

Overview

Postgraduate Researcher:
Project title:
Project start and end dates:
Project context:

Defining your data

Describe your data (e.g. type, format, volume)

Looking after your data

Explain how you will manage your data, noting particular concerns or issues (e.g. storage and backup, data structuring, versioning, documentation etc.)

[17] https://www.fosteropenscience.eu/node/2281

Sharing your data

Explain which data will be shared and how (e.g. via repository, under what license)

During the third part of the seminar, participants had the opportunity to learn about funding and networking opportunities available for researchers in SSH. Horizon 2020 National Contact Point presented funding opportunities under the Societal Challenge 6 “Europe in a changing world: inclusive, innovative and reflective societies”, Science with and for Society (SwafS), Marie Sklodowska Curie Actions (MSCA), and the European Research Council (ERC). Networking opportunities of “Knowledge Bridges” initiative were also presented.

In the end, there was a discussion how similar training events could be organized in universities and participants gave good feedback about the usefulness of this seminar.

Find the blog posts about this event online: https://blogs.openaire.eu/?p=3301 and http://www.ekt.gr/en/news/22008.

OPEN SCIENCE CLINIC SERIES OF SPEED-COUNCELLING FOR EARLY CAREER RESEARCHERS, TECH TRANSFER & GRANTS OFFICERS AND NCPS

Open Science Clinic is a short (usually one hour long) interactive face-to-face or online session that provides a practical advice on implementing certain aspects of open science in certain contexts.

Examples of Open Science Clinic of speed-counselling for early career researchers (face-to-face sessions):

- In support of UN Sustainable Development Goal 14 "Life below water" in collaboration with CIIMAR on May 24, 2017 in Matosinhos, Portugal.

- Open Science Clinic in Barcelona, Spain, on April 16, 2018.

Examples of Open Science Clinic of speed-counselling for Tech Transfer & Grants Office professionals (face-to-face sessions):

- For Research Support & Tech Transfer Officers on October 12, 2017 in Malta; target group: Tech Transfer & Grants Office professionals.
- For Joint Programming Initiatives JPI-OCEANS on October 26, 2017 in Lisbon (Portugal); target group: researchers and students, research administration.

Examples of Open Science Clinic series of speed-counselling for early career researchers (online sessions):

- Open Science Clinic of Speed-Counselling for Young Researchers in support of UN Sustainable Development Goal 14 ("Life below water") in collaboration with SeaCHANGE, COLUMBUS and Marie Curie Alumni Association on July 28 - September 1, 2017.

- Open Science Clinic: Winning Marie Curie with Open Science on May 14, 2018.

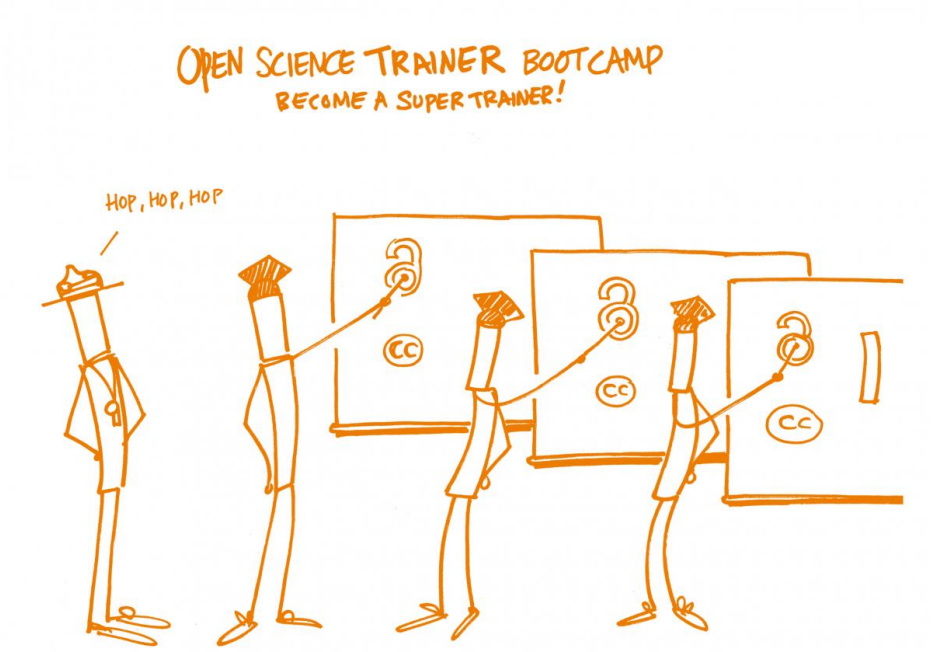
Examples of Open Science Clinic series for Horizon 2020 National Contact Points (online sessions):

- Open Science Clinic for H2020 NCP CaRE (Societal Challenge 2 Food) on April 19 and 26 and May 3, 2018

- Open Science Clinic for EUResearch (Switzerland) on May 24, 2018.

RECOMMENDATIONS ON TRAINING THE TRAINERS ON OPEN SCIENCE

In order to multiply open science training forces, FOSTER follows a train-the-trainer approach. The open science trainer bootcamp equipped future instructors with the skills they need to conduct training events in their own institutions.



The three-day workshop provided sufficient amount of time to address the content – the main aspects of open science such as open access to publications and data, open peer review, licenses, open innovation, open source software and workflows, Text and Data Mining and citizen science – and skills focusing on how to spread the word about open science principles most effectively.

If you plan a similar event, check out materials from Bianca Kramer's and Jeroen Bosman's interactive session[18] about how to give training and how to interact with your audience. In a role-play, they challenged the participants in their roles as trainers.

It is also important to let participants practice what they have learned, e.g. ask them to develop and conduct mini training workshops (15 minutes each) and outline a roadmap about their training plans for the upcoming months.

[18] https://figshare.com/articles/Aspects_of_Open_Science_Training_-_FOSTER_Open_Science_Trainer_Bootcamp_2018/6163790

An outline of the three-day train-the-trainer bootcamp

Day 1 revolves around the different aspects of open science, and the materials that can support training events. Make sure to start with an icebreaker exercise and draft your code of conduct. You could end the day with a case study on putting open science into context.

Day 2 – Start the second day with a warming-up exercise and train your participants on how to give training. In the afternoon, let them work on their own open science mini-training in small groups. Don't forget about a group picture.

Day 3 – On the third day, participants give mini-trainings they prepared the day before to other bootcamp participants. You might want to split people in two groups and allocate sufficient amount of time for individual feedback and evaluation. In the afternoon let them work on their own open science training roadmaps: plans of trainings they will give and how to get there. End your event with a wrap up, evaluation and certification.

With the launch of FOSTER Open Science Toolkit, the bootcamp programme can be shortened to a one-two day's event. In order to do so, participants should already arrive at the workshop with some amount of previous knowledge. You could ask your participants in advance to go through the ten courses covering the following topics:

1. What is open science?
2. Best practices in open research
3. Open peer review
4. Data protection and ethics
5. Licensing
6. Managing and sharing research data
7. Open source software and workflows
8. Open Science and innovation
9. Open access publishing
10. Sharing preprints

Find the outlines of the one and two-day bootcamps below.

One day event	**Two day event**
Begin with an icebreaker exercise and draft a code of conduct. Afterwards focus on how to give training. Let the participants get to know their teams for jointly designing training. In the last part of this one-day training ask the participants to design their own open science training in a group work.	**Day 1 –** Start with an icebreaker exercise and draft your code of conduct. Train your participants on how to give training. In the afternoon, let them work on their own open science mini-training in small groups. Don't forget about a group picture.

	Day 2 – Participants give their mini-trainings and receive individual feedback. In the afternoon, they work on their own open science training roadmaps. End your event with a wrap up, evaluation and certification.

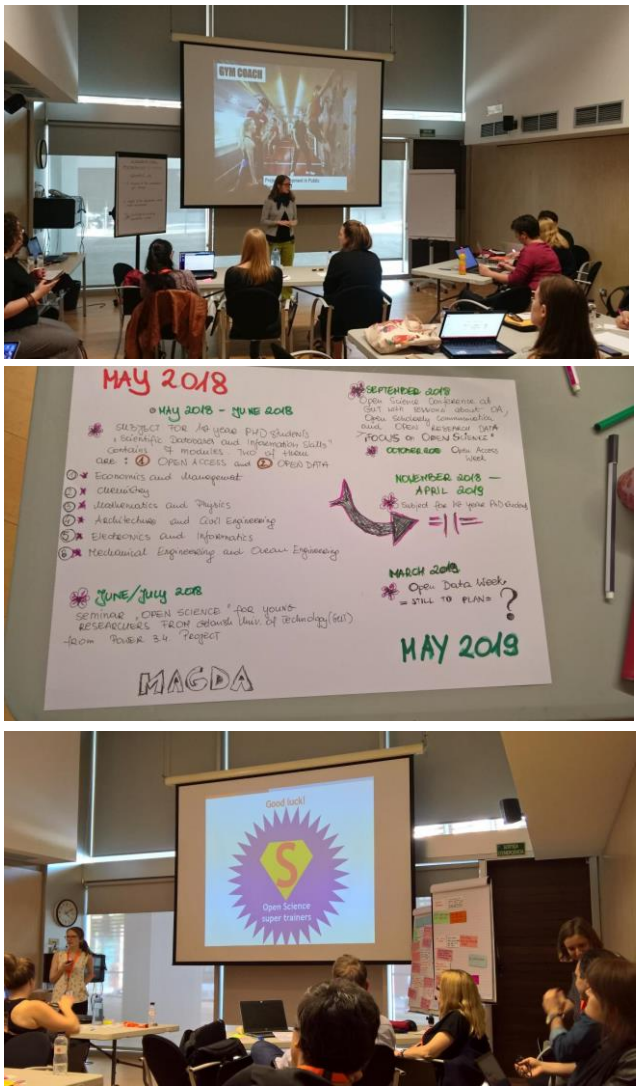


Figure 4 - FOSTER Plus Open Science Bootcamp Photos

The FOSTER bootcamp kicked off a community of open science trainers that exchanges experiences, learns from each other and shares materials. All bootcamp participants will conduct trainings in their own institutions during the following year.

For more information about train-the-trainer approaches, check out materials from **ELIXIR EXCELERATE Train the Trainer course**[19]. The course is made up of four sessions, covering:

- Learning principles and how they apply to training
- Training techniques that can be used to enhance learner engagement and participation
- Assessment and feedback in training
- Session, course, and materials design

ANDS, Nectar and RDS run training workshops for data trainers and also provide the training materials for reuse. Take a look at the **Powering up your 2018 (data skills) training course online workbook**[20] that includes the following sections:

- **Getting started:** Speed dating – what's your data training story? Who's who in the room?
- **What motivates Academically Contextualized Adults to learn new skills, new methods and new practices?** Adult learning theory and Knowles 6 principles of adult learning.
- **Developing end-to-end data skills and support programmes:** Designing end-to-end programmes, rather than focusing on individual activities, maximize the impact of individual activities within the programme.
- **Finding a place for your training and messages in the competitive research landscape:** How can we get the attention of our researchers, HDR students and their lecturers/supervisors? What methods do you, and could you, use to drive attention to your training activities – spectacular not spam? What methods do you, and could you, use to drive up attendance at your training activities – how can you turn REGISTRATION (i.e. interest) into ATTENDANCE (i.e. action)?
- **How do you know if you are making a difference?** How does your unit/department evaluate the efficacy and impact of training it provides to researchers and students?
- **Making your workshops sparkle:** Content and delivery. Tips and tricks that build successful training environments in workshops.
- **Theory and practice of good online eLearning design.**
- **Web design principles for research skills and data information web pages.**
- **Bringing it all together:** Discuss and share your newly designed awareness/training programmes using the whiteboard or some butchers' paper

[19] https://github.com/TrainTheTrainer/EXCELERATE-TtT

[20] https://docs.google.com/document/d/1ohUqqST7Q23styDUlU6t25W2q7rvYpvbr_ZlsJxOfjA/edit

– put together a poster (be creative) describing what your group has come up with. You have 1 minute to pitch it to the room.

ROADMAP FOR IMPLEMENTING OPEN SCIENCE TRAINING PRACTICES IN RESEARCH INSTITUTIONS

In order to achieve more transparency in research practices, research performing organizations should implement open science training practices. FOSTER policy briefing[21] outlines three key ways how stakeholders across the research lifecycle can influence and support the transition towards open science:

1. **Promote change by advocating open science skills acquisition and learning.**
2. **Support change through enabling access to open science training materials and courses.**
3. **Motivate change by providing recognition and reward for open science activities.**

The briefing suggests six practical actions to be implemented by research performing organizations to support a cultural change towards open science:

1. **Improve quality and capacity of open science training.**
2. **Integrate open science content in researcher training** by embedding training modules focused on practical skills into ongoing educational programmes on a regular and standardized basis from as early as possible.
3. **Tailor open science resources to research disciplines.**
4. **Support and promote open science skills acquisition.** The young generation of scientists and researchers is a major audience for training. Supervisors and researchers guide their mentees and are therefore an important target group to recognize the value of open science training, too.
5. **Lobby for change at all levels.**
6. **Recognize and reward open science skills.** Students and researchers are more likely to make an effort to gain skills if these are deemed relevant for their career progression. Stakeholders across the research lifecycle should reward early career researchers by including open science practices in evaluation processes and awarding efforts with the European Credit Transfer and Accumulation System or other formal certificates.

FOSTER offers materials for training and reuse, including discipline specific guidance (life sciences, social science and humanities) and online courses when institutions cannot provide trainings themselves.

[21] 10.5281/zenodo.1209174