



ABSTRACT

The *Training Design and Implementation Framework* contains checklists and other methodological tools to guide and support CeOS_SE partners during the implementation of training activities.

Training Design and Implementation Framework. Final Draft V.1

Citizen-enhanced Open Science
Southeastern Europe



Erasmus+

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1. Introduction

Prior to coordination of PR3A1 activities is the setting of a *Training Design and Implementation Framework*, containing checklists and other methodological tools to guide and support CeOS_SE partners during implementation.

In the literature review performed to draft the framework, two particularly significant resources were found:

- Elisha Anne Teo. (2020). The INOS Learning Design Framework: Fostering the Educational Value of Open Science, Citizen Science and Open Innovation Activities (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.3932149>
- Sonja Bezjak, April Clyburne-Sherin, Philipp Conzett, Pedro Fernandes, Edit Görögh, Kerstin Helbig, Bianca Kramer, Ignasi Labastida, Kyle Niemeyer, Fotis Psomopoulos, Tony Ross-Hellauer, René Schneider, Jon Tennant, Ellen Verbakel, Helene Brinken, Lambert Heller, Open Science training handbook (2018), https://open-science-training-handbook.github.io/Open-Science-Training-Handbook_EN//

The INOS Learning Design framework is an excellent, comprehensive work including all the relevant topics in designing and delivering a training course. It also stems from the INOS project, whose acronym stands for (Integrating Open and Citizen Science into Active Learning Approaches in Higher Education) and perfectly resonates to the CEOS_SE project, which in turn is about Citizen-Enhanced Open Science in Southeastern Europe Higher Education Knowledge Hubs.

The FOSTER Open Science Training Handbook gives the complementary view on the wider concept of Open Science, and provides useful insights on delivering effective Open Science training.

In the perspective of reusing and capitalizing on previous projects outputs, we suggest therefore to adopt the INOS framework in the context of the CEOS-SE training activities, combined with suggestions from the FOSTER Handbook.

2. Practical guidance

2.1 The framework

At a glance, the INOS Framework is shown in Figure 1.

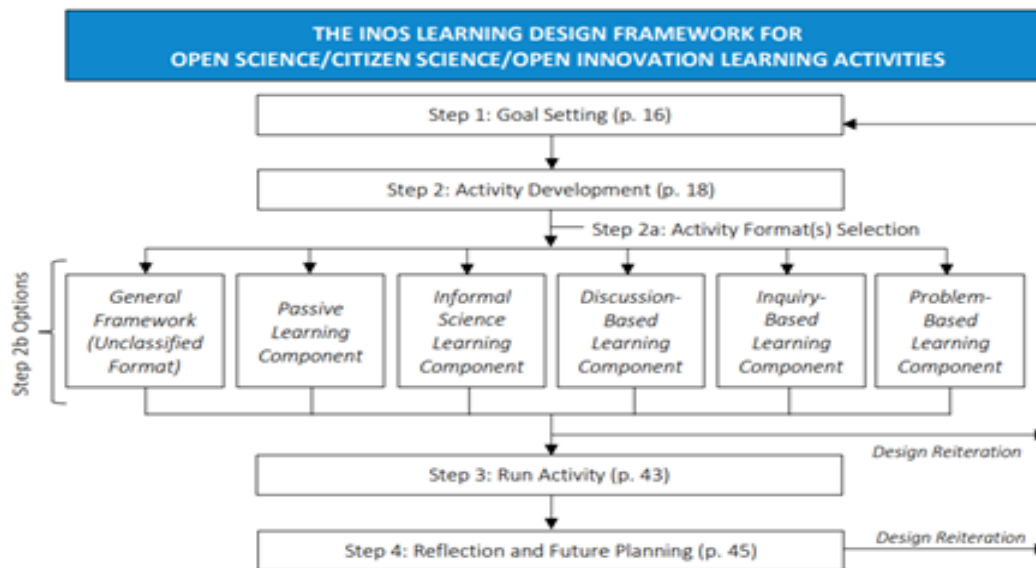


Figure 1: INOS learning framework

CeOS_SE partners are invited to go through the 4 steps of the INOS Framework when designing and delivering the training. These steps are outlined below:

Step 1. Goal setting

Specific training goals should be defined in order to inform further pedagogical decisions. Goals overarch all training activities. They should be developed considering participant backgrounds, knowledge, input and expectations.

Goals overlap with objectives but are broader in their scope.¹

Step 2. Activity development

To develop training activities a format should be defined. Depending on the format are the tools and the resources to adopt and the learning evaluation method.

2.a Activity format(s) selection

To determine the appropriate format(s) the INOS Framework considers:

- 1) Learning goals, available resources, and other details established in Step 1: Goal Setting.
- 2) The descriptions of each activity format.

¹ For more information about writing learning goals and learning objectives:

The Derek Bok Center for Teaching and Learning. (2020). *On Learning Goals and Learning Objectives*. The Derek Bok Center for Teaching and Learning. <https://bokcenter.harvard.edu/learning-goals-and-learning-objectives>

To identify which type of activity most closely resembles the activity to organise refer to the examples given in table 1.1 of the INOS Framework (p. 11). The 6 activity formats proposed by the INOS Framework, and the reference :

- The General Framework (unclassified format) (p. 20-23);
- The Passive Learning component (p. 24-26);
- Informal Science Learning component (p. 27-30);
- Discussion- based learning component (p. 31-33);
- Inquired-based learning component (p. 34-38);
- Problem based learning component (p. 39-42).

Step 3: Run activity

Trainers shall create checklists to be used in running training activity and engaging with participants. See table 4.9 of the INOS framework (p. 43-44).

Step 4: Reflection and future planning

After running of the activity trainers should reflect and make future planning. This Step encourages organisers to collate and share their pedagogical findings to improve training. See table 4.11 of the INOS framework (p. 45-47).

2.2 Practical suggestions

In this section you will find some highlights taken and adapted from the FOSTER Open Science Training Handbook to ease the CEOS_SE partners task. All content in the below table has been taken and adapted (to fit the specific CeOS_SE context) from the FOSTER OS Training Handbook, credited.

Expectations about a trainer

Everyone attending a training has got expectations, conscious and unconscious, about teaching methodology and content. Learners also have specific expectations about the trainer.

The FOSTER Open Science Training Handbook suggests trainers should:

- be enthusiastic;
- recognise the values the openness as an intrinsic core element of scientific and humanistic values;
- understand the importance of research transparency and reproducibility;
- show familiarity and knowledge with the research process and research outputs that can be shared, including data, code and software, papers, communication, workflows, grant applications, and data management plans;
- be aware of the policies, regulations and laws that could affect researchers when performing Open Science (and Citizen Science!)
- be able to teach and have a profound knowledge in Open Science (and Citizen Science);
- figure out the expectations raised in society about the use of resources and outcomes of scientific research, such as its impacts in citizen science, the public understanding of science, the influence in the education providers, etc.

Target audiences

To get started with Open Science and Citizen Science training the FOSTER Open Science Training Handbook suggests trainers should address audiences that are interested in the topic.

Training a motivated audience has several advantages:

- Trainer can feel more comfortable diving into the training area/topic.
- To assess audience motivation is highly recommended to run a survey in advance.
- A motivated audience will contribute to discussion and provide the trainer with useful input on how to further develop next training curriculum.
- Motivated audiences become trainers in their turn;

To make training successful, trainers need also gather information about their audience, i.e:

1. To take into consideration the diverse backgrounds of attendees.
2. To learn if learners/attendees know one another or not in advance.
3. Learners motivation (participation is voluntary or not?);
4. The knowledge level of the audience regarding Open Science and Citizen Science topics;
5. Whether the audience is accustomed to a specific learning method;
6. To set in advance a target audience size based on the available space/capacity and available time for practical work. The size of the audience will impact on how well learners engage together and interact. For larger audience trainer should consider break-out groups;
7. To consider using video-lectures to reach a broader audience. Though with a small group of people attending on-site it is often easier to maintain learners' attention, and to create the feeling of an authentic connection.
8. To consider the best way to approach different target audiences (meeting, face to face workshops, webinar, newsletter, social media, etc.)
9. With a heterogeneous audience, keep in mind the different stakeholders involved in order to address their different needs, knowledge and/or responsibilities:
 - i. funder, institution/employer, researcher (student, PhD student, researcher, project lead),
 - ii. support (research office, library, IT)
 - iii. commercial partners in a project

The CeOS_SE outcomes of the training should be that the trainees:

- 1) have a practical understanding of the key concepts of Open Science and Citizen Science;
- 2) have a knowledge of the corresponding applications of OS/CS;
- 3) have a knowledge of libraries best practices in OS/CS in Europe;
- 4) confidently use what was learned during the training, thus increasing their impact in their professional environment;
- 5) become trainers in their turn;
- 6) become able to network with advocates from multiple disciplines and act in a global Open Science initiative.

Designing a course

The FOSTER Open Science Handbook suggests two methods to plan a course:

1. Planning based on objectives, rather than outcomes

By planning a course on objectives rather than outcomes goals /objectives should be presented at the beginning of the lesson.

An interesting technique for specifying goals/objectives of the course is: SMART. SMART is an acronym that stands for five criteria: Simple – Measurable – Ambitious – Realistic – Timed.

- **Simple**, as the course should be understandable by persons not familiar with the topic;
- **Measurable**, if it is possible to determine whether the goal of the course has been reached. The FOSTER Open Science Handbook refers to the [Bloom's taxonomy of cognitive domains](#) which has categorized verbs good for teaching. Trainers should use verbs that are actionable: identify, draw, name, explain, calculate etc;
- **Ambitious**, if the training challenges the students. Being ambitious means having an answer to the question: What will students learn that they could not by other means?
- **Realistic**, if trainer defines real learning goals that can be reached in the given timeframe. Being realistic involves background knowledge of the students. Do they have the necessary knowledge? What practical abilities do they need? What technical prerequisites are there?
- **Timed**, if there is a concrete timeframe which the goal is to be reached. It is always good to set a detailed schedule or lesson plan.

Adapted from SMART Goals, How to create objective, measurable project goals, by Kristian Rother.

2. Planning based on outcomes, rather than objectives

The second planning suggested method to design a training course is the reverse instructional design, known as Backward design, a technique for planning lessons that emphasizes outcomes. Backward design challenges "traditional" methods of curriculum planning. In traditional curriculum planning, a list of content that will be taught is created and/or selected. In backward design, the educator starts with goals, creates or plans out assessments and finally makes lesson plans.

The idea in backward design is to teach toward the "end point" or learning goals, which typically ensures that content taught remains focused and organized

To start with the training Backward design trainer should:

1. Start from learning objectives;
2. Decide what constitutes evidence that these objectives have been met;
3. Choose the best format and design content to prepare the audience for what they will have to do during the summative assessment;
4. Sort the content in order of increasing complexity and then provide the content and motivation they need to close the gap between what they know and what they need to know to complete the summative assessment.

Content

Content collection and content reduction

Before starting to teach, trainer will have to collect and prepare content. Crucial, all, the content must be appropriate and align to the needs and capabilities of the target audience.

Another big challenge in designing training courses is the reduction of content to the training format. Try to reduce the content to the most important key points. What is really necessary to know and what are only details or marginal topics? Trainer should set thematic priorities, be transparent about omissions and inform participants/learners about these.

Enough time for open questions, discussions, sharing experience among participants should always be kept.

Starting the training

The FOSTER Open Science Training Handbook **suggests both trainers and participants should introduce themselves briefly** (although this is probably not recommended if the group is larger than 15-20 participants), at the beginning.

Trainers should also give a general presentation of objectives, content, and outcomes for the training event - what participants will learn, and why. Projecting confidence as a figure is key here in order to establish trust.

It is also extremely useful to collect thoughts from participants on their own expectations and levels of experience (trainers might use an online-questionnaire), and to gauge to what extent these match the intended outcomes and your overview of the intended or target audience for the training. If there is a large mismatch, now would be the time to trainers should consider ways to adapt the programme.

Icebreaker

To get started with the course in order to create a warm and positive learning environment the FOSTER Open Science Training Handbook suggests to begin with an ice-breaker exercise. Creating a warm, welcoming, friendly and positive learning environment should enable attendees to better participate and learn, and help them to feel more comfortable.

As groups can differ in important ways, trainers should try to choose the best exercise for their audience: a poorly chosen icebreaker can do the opposite, making people feel nervous or uncomfortable!

During the training

During the training it is suggested to define the intended outcomes of the training and always give orientation to trainees, i.e.:

- Where are we?
- Where do we want to go?
- What will we cover?

A change of pure talks about the content to deliver (max. 20 minutes) and activity sessions to work with the content (Klaus Döring, 2008) should be balanced during the training.

Gamification

The FOSTER Open Science Training Handbook refers to the methodology in Active Learning (based on Constructivism and on some Connectivism) and adds learning engagement techniques (i.e. gamification) to break barriers and flatten as many obstacles as possible during the training. Gamification also helps quiet people to become active in the discussion.

Inclusive engagement

Trainers should always try to engage quiet people in the discussion.

As the FOSTER Open Science Training Handbook suggests aA good starting point might be to ask a question and wait at least 30 seconds for answers (Mary Budd Rowe, 1986).

Another suggested method of achieving inclusive engagement is *progressive stacking*. In this case a moderator might choose who speaks next from those participants who wish to speak and have not yet spoken, as usual.

Instant feedback

At the end of each module, instant feedback is required from participants in the form of a one-up/one-down (i.e. state one thing that was useful/good in the module and one thing that was unclear/could be improved).

Another suggested way for getting instant feedback, is through continuous polls. Trainers should always show feedback counts to the participants. Showing totals or graphs can act as an incentive. Online, cloud based tools generate more engagement,. Learners can use internet connected mobile devices and feel empowered. Examples of this are abundant

General recommendations

Here the final general recommendations of the FOSTER Open Science Training Handbook for trainers:

- Stay connected! Always try to keep the contact with the group, check your pace and those of the others.
- Be careful not to overload the participants with too much and/or too difficult content.
- Be open for feedback at any time but avoid or actively break-up never-ending discussions.
- Breaks: Always give enough space for breaks. The longer your course, the longer and more often your breaks.
- Prepare short, middle and long versions of your exercises to become flexible if the discussions are more or less intensive.
- Be prepared for difficult students and consult some troubleshooting guidance before the course.
- Wrap-Up / Meta View: At the end of the training it might be worth to tell your participants what you did and why you did it. This will also make the evaluation easier.

And finally - enjoy the session yourself!

2.3 Other useful suggestions on training design and delivery

You might also find useful guidance and suggestions in

- MIT Training Delivery Guide <https://web.mit.edu/training/trainers/guide/index.html>

This is an online resource providing insights on the whole training designing process, as per Figure 2.

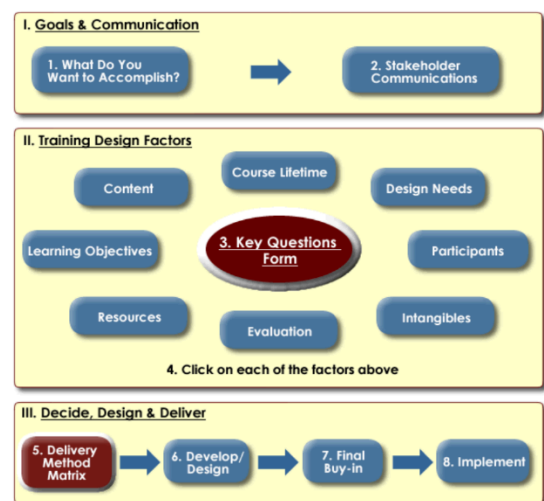


Figure : MIT design framework

Particularly relevant are the

- Delivery Method matrix <https://web.mit.edu/training/trainers/guide/deliver/train-guide-matrix.pdf>
- Course lifetime <https://web.mit.edu/training/trainers/guide/design/lifetime.html>
- Key Questions Form <https://web.mit.edu/training/trainers/guide/design/questions.html>

2.4 Delivery checklist

The Training Unit at the University of Turin (Sara Cantarutti and Jessica Schinasi) provided a checklist, which summarizes organizational aspects you have to consider when planning a training course:

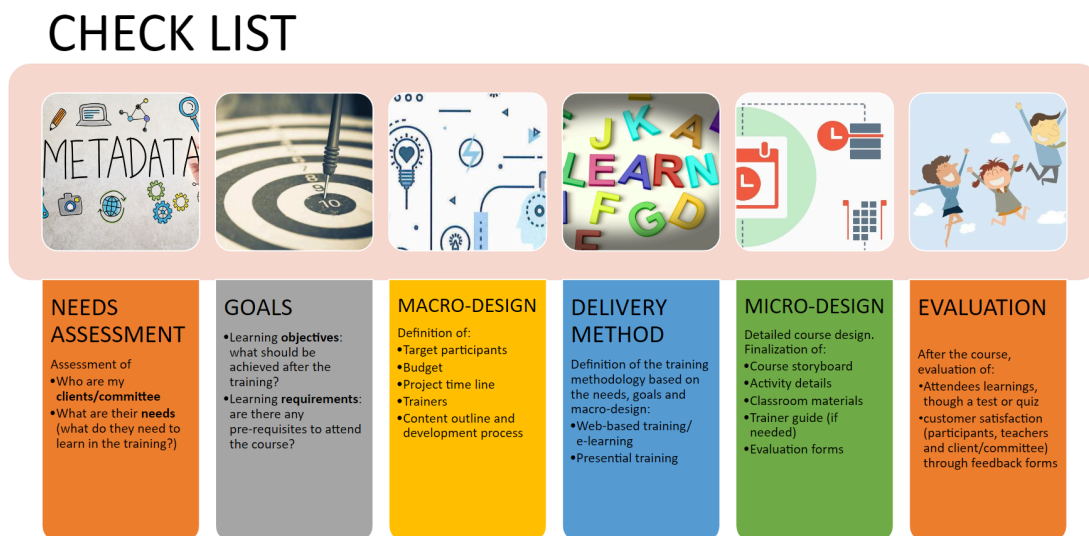


Figure 3: Cantarutti, S.- Schinasi, J. Training checklist, 2022

3. Training materials

There are several online resources where you can find training materials on Open Science and Citizen Science.

- **FOSTER project training material**, <https://www.fosteropenscience.eu/resources>
Starting from the FOSTER taxonomy (actionable) you will find training material on each component (including Citizen Science)
- **SSHOC training discovery tool** (mainly for Social Science and Humanities), https://training-toolkit.sshopencloud.eu/entities?search=&f%5B0%5D=content_type%3Asource
You can search training material by topic, intended audience, language...
- **UniTo training materials** (in English and Italian), <https://www.oa.unito.it/new/materiale-scaricabile/>
Courses on Open Science (including Citizen Science, Horizon Europe provisions...) of different duration, from 1 hour to 9 modules of 2 hours each

- **The Turing way**, <https://the-turing-way.netlify.app/welcome>
A comprehensive handbook on reproducible science and its components
- **EU citizen science training material**, https://eu-citizen.science/training_resources
Training on Citizen Science in different languages
- **Co-creation menu** (ORION project),
<https://www.orion-openscience.eu/activities/co-creation/201711/menu-co-creation-tools>
A rich collection of methods to engage different audiences with science and research

4. Conclusions

The ultimate objective of the framework is to support the integration of OS/CS training practices into the daily library routine and to engage different audiences in CS projects.

The CeOS_SE design and implementation framework is mainly built on the results and the deliverables of the 1) [FOSTER Project](#) and the 2) [INOS Learning Design Framework](#).

The CeOS_SE design and implementation framework aims to provide a practical guide to support the planning and the delivery of Open Science and Citizen Science successful training. It aims to enhance the impact of OS/CS training courses and to create a multiplier effect of the training activity. It refers to different audiences, but it is meant to be addressed mainly to librarians.

The CeOS_SE framework also provides trainers with a checklist to summarise the main organisational aspects in planning a training course, and videos and tools to support the delivery and the evaluation of OS/CS courses for librarians.