

Skills for the European
Open Science
Commons

FAIR-by-Design Methodology: How to Develop FAIR Materials

Sonja Filiposka, UKIM
orcid.org/0000-0003-0034-2855

Supporting

1

Why FAIR Learning Materials?

Do	Practice what you preach
Show	Lead by example
Join	Build a community for co-creation
Persist	Be a reflection of what you'd like to see in others

2

FAIR for ALL

FAIR for Learners

Find training content that can be easily accessed using common applications. Come back and revisit whenever needed.

+

Instructors

Find existing training materials, access their **editable** versions, fully understand the context and reuse according to the licensing terms.

3

FAIR requires commitment

Time, Time, More Time
Additional work requires additional time. To provide full context and improve reusability, time is needed to make a record of all related information.

Fast **Easy**

Quick Fix

Devil is in the details
To be able to truly reuse the materials they need to be accompanied with an instructor kit.

Just-in-time

From the start
FAIR as an afterthought may require substantial rework, aim to think FAIR-by-Design.

New skills
The development process requires knowledge about metadata, PIDs, repos, licensing attribution, open file formats in addition to the typical learning materials design skill.

4

FAIR-by-Design Methodology

Backward Instructional Design Empowered with FAIR principles
focusing on both learners and peer instructors

- Prepare**: Do you understand FAIR and its implications?
- Discover**: Find existing resources, identify potential for reuse, attribution, tools & formats.
- Design**: Define syllabus and structure, facilitate materials, granularity, internal QA check, Decide on license.
- Produce**: Develop content, compatibility.
- Publish**: Release to public, for learners & instructors, ensure accessibility, define attribution, Enable feedback gathering.
- Verify**: Final QA check, Add to training catalogue, Use gathered feedback for continuous improvement.

Deliver

5

1 - Prepare

Learn FAIR

- Package of:
 - min 1 learning outcome
 - lesson plan
 - lesson content
 - min 1 activity
 - assessment
 - facilitation guide

Start Backward Instructional Design

- Define:
 - Target audience
 - Prerequisites
 - Scope

Formulate Learning Objectives

- Describe what new knowledge and skills will be obtained in a specific, measurable, attainable, relevant and time-bound (SMART) way.
- Use the Bloom's Taxonomy.

Define FAIR Learning Objects

- Know how to curate and share FAIR data
- Have legal IP/ repository, RSC (IR) metadata schema

Ideate

Focus on the learning outcomes that one wants to achieve. Work backward to the topics that need to be covered to achieve the learning objectives.

6

FAIR Principles Compliance

Learn FAIR

- Findability**
Resource and its metadata are easy to find by both humans and computer systems. Basic machine readable descriptive metadata allows the discovery of relevant data sets and services.
- Accessibility**
Resources and metadata are stored for the long term such that they can be easily accessed and downloaded or locally used by humans and easily discovered using standard communication protocols.
- Interoperability**
Metadata should be ready to be exchanged, interpreted and combined in a computational way with other data sets by humans as well as computer systems.
- Reusability**
Data and metadata are sufficiently well-documented to allow data to be reused in future research, allowing for integration with other complementary datasets. Provenance must be facilitated, and the conditions under which the data can be used should be clear to machines and humans.

- F1** Resource is uploaded to a [public repository](#).
- F2** Metadata are assigned [globally unique and persistent identifiers](#).
- A1** Resource is accessible for download or manipulation by [humans](#) and [software](#) ("machine-readable").
- A2** Publications and data repositories have contingency plans to assure that metadata remain accessible, even when the resource or the repository are no longer available.
- I1** Resource is uploaded to a repository that is interoperable with other platforms.
- I2** Repository uses data schema maps to or implements the [FAIR Data Catalog](#).
- I3** Metadata use standard vocabularies and/or ontologies.
- R1** Metadata are released with a [clear and accessible license](#).
- R2** Metadata about data and datasets are richly described with a plurality of accurate and relevant attributes.

Image taken from [Climate Change, Agriculture and Food Security website](#) licensed under the [CC BY-NC 4.0 license](#).

7



8

FAIR Learning Objects ...

- Contain learning content and information on tools and implementation resources
- Have an explicit learning objective
- Tend to be, but are not necessarily, small or granular in nature
- Tend to be, but are not necessarily, disassociated from context
- Are stored in a repository
- Are described using a metadata specification
- Are findable by searching a catalogue
- Are interoperable in that they can be used in multiple learning environments
- Are reusable by both other instructors and learners
- Can be repurposed for different learning contexts
- Are composable into aggregates

9

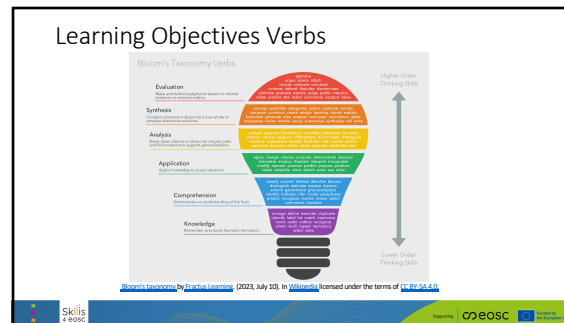
Backward Instructional Design

"Teaching for Understanding"

- Determine Learning Goals & Objectives**
To Establish:
 - What learners should know & be able to do by the end of the course
 - Transfer of knowledge to other challenges
 Add To:
 - Distill "Need to Know" from "Nice to Know"
 - Clarify for students the purpose of the course content
- Plan Assessments**
That Are:
 - High & low stakes
 - Aligned with learning goals/objectives
 - Of varying types
 Add:
 - Problem or case analysis
 - Align and monitor course progress
 - Synthesizing information through feedback/discussions
 - Quizzes & tests
- Plan Learning Activities**
That:
 - Are medium- & hands-on
 - Encourage motivation
 - Align with learning goals/objectives
 Add:
 - Use test bank as reference, not syllabus

"Backward design model" from [M. Learning Online](#) licensed under the [CC BY-NC 4.0](#)

10

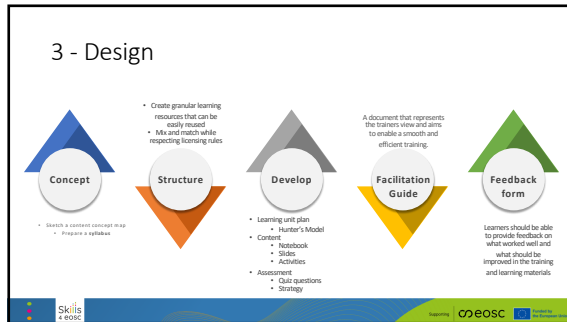


11

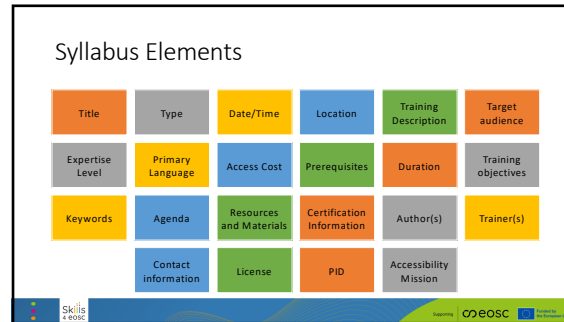
2 - Discover

- Get Inspired!**
 - There is no one key to rule them all
 - Discovery is a lengthy, windy process
 - Closed learning resources have value too
- OER**
 - Openly Available
 - Openly Licensed
 - Openly Reusable
 - Openly Accessible
 - Openly Distributed
- EOSC**
 - Low-barrier
 - Available on the Internet
 - Most EOSC projects have their own learning catalogues and/or platforms
- General**
 - Creative Commons
 - Content provided under a CC license
 - Always a multi-disciplinary open repository
 - Can be a free, open platform
- Multimedia**
 - Provides for all learning modalities:
 - Read/write
 - Auditory
 - Visual
 - Kinesthetic

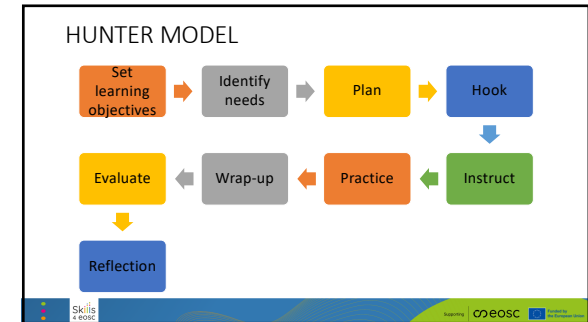
12



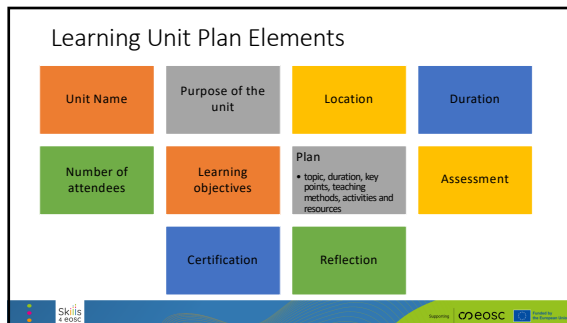
13



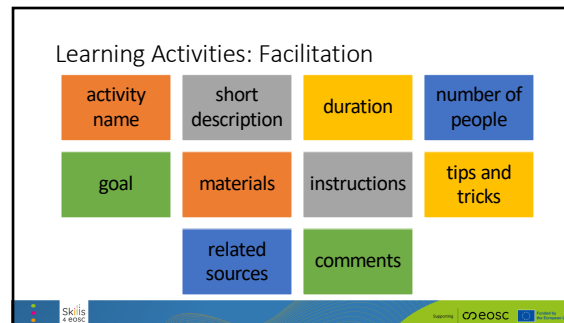
14



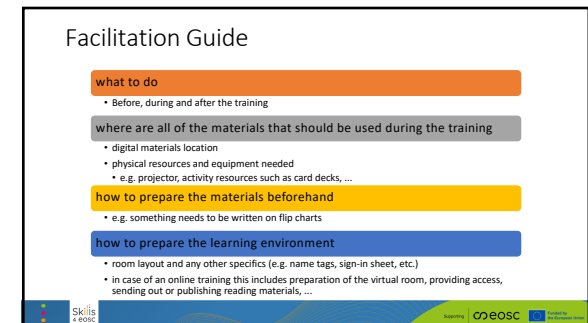
15



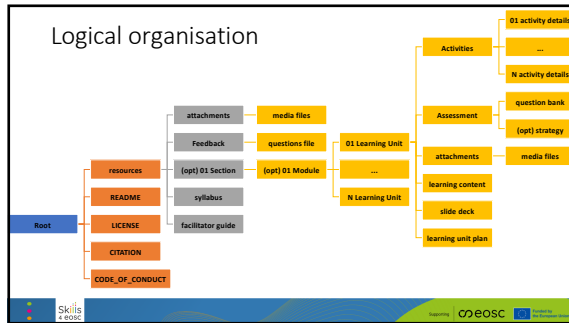
16



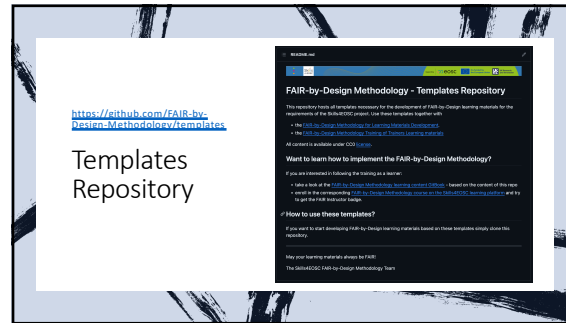
17



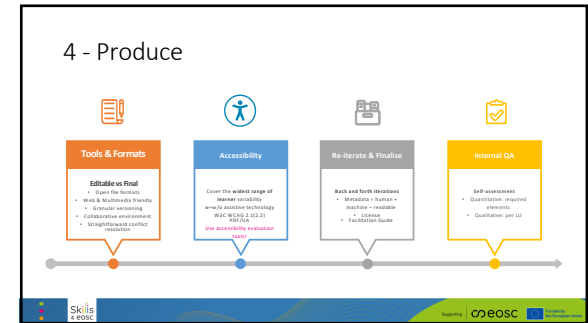
18



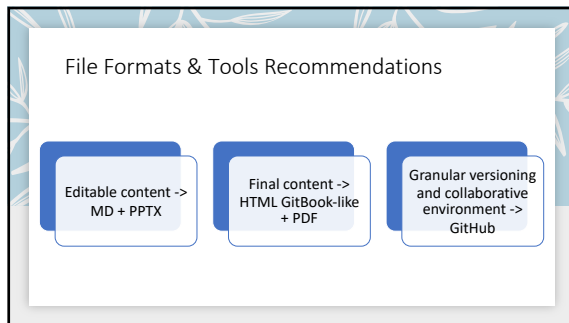
19



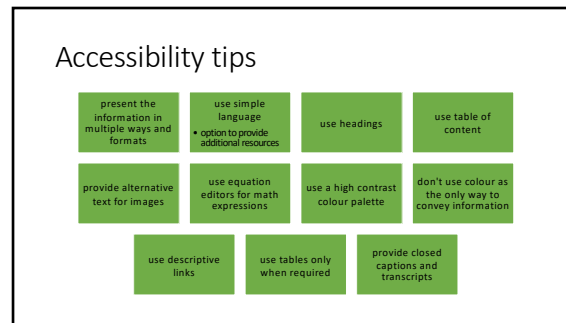
20



21



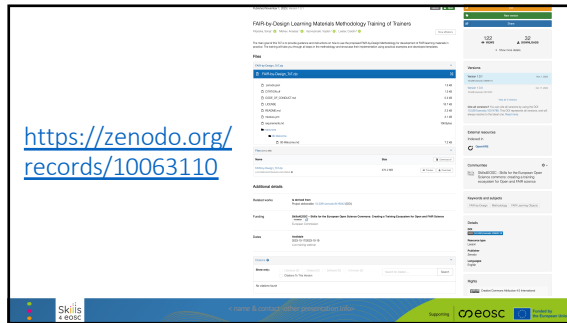
22



23



24



25



26

FAIR-by-Design QA Checklist 1/2

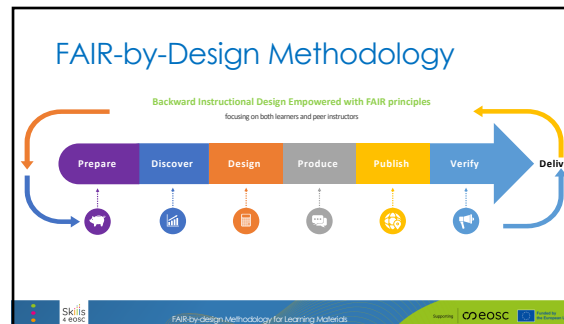
Essential	Stage	FAIR aspect	CHECKLIST QUESTION
	Prepare	I	Did you follow the stages of the backward instructional design process while developing the learning resource?
YES	Prepare	I	Is the RDA minimal (or domain specific) metadata schema used for the learning material description?
	Prepare	I	Are controlled vocabularies (CVs) used for describing the resource characteristics aligned with the chosen metadata schema?
YES	Design	R	If applicable, is there clear attribution for all reused resources with compatible licenses?
YES	Design	R	Has the learning resource been made available for use by defining a permissible license or policy information that allows derivation?
	Design	R	Does the learning resource represent a complete learning object or aggregation consisting of content, tools and implementation resources defined around min 1 learning objective?
	Design	R	Does the resource incorporate an instructor kit that aids in facilitating the process of others reusing learning material by offering helpful how-to guides?
YES	Produce	I	Is your resource available in open file formats which are tool agnostic and compatible with a wide variety of existing software?
YES	Produce	F	Is metadata for the resource provided in both human- and machine-readable format (e.g. JSON, XML or YAML)?

27

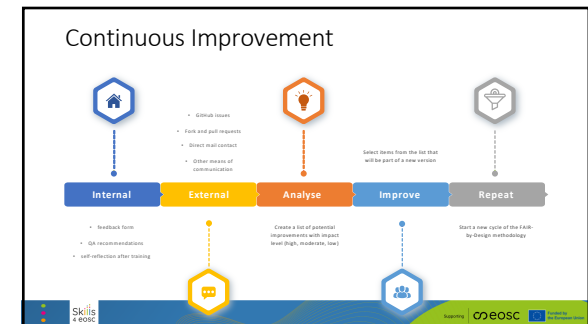
FAIR-by-Design QA Checklist 2/2

Essential	Stage	FAIR aspect	CHECKLIST QUESTION
YES	Produce	A	Has an accessibility checker tool been utilised to improve the accessibility of all learning resource files (PDF, HTML, video, etc.)?
	Publish	R	Have you employed a versioning system to track and control changes in your materials?
YES	Publish	F	Is the complete learning resource (including instructors info) registered or indexed in at least one searchable repository? Is it in a FAIR repository?
	Publish	A	Are the resource access rules (how to access, e.g. registration procedure) explicitly communicated to learners?
YES	Publish	A	Are access rules (authentication & authorisation) implemented for the learning resource?
	Publish	A	Is the learning resource searchable in at least one relevant catalogue? Is it FAIR (can be searched based on metadata)?
	Verify	A	Does the course include the possibility to provide feedback or comments from users and/or trainers/designers? If so, do you regularly gather and analyse that feedback?
	Verify	R	Does the resource adopt an open community approach regarding its quality and reachability?
	Verify	A	Has the learning resource been checked by a third party regarding its learning experience quality?
	FAIR		Does the resource align with the FAIR-by-design methodology principles?

28





29



30

FAIR-by-Design Methodology Details

- Up-to-Date Methodology**
 - https://fair-by-design-methodology.github.io/FAIR-by-Design_Book/
- ToT course on Skills4EOSC LMS**
 - <https://learning.skills4eosc.eu/course/view.php?id=19>
- Training GitBook**
 - https://fair-by-design-methodology.github.io/FAIR-by-Design_ToT/latest/
 - GitHub
 - https://github.com/FAIR-by-Design-Methodology/FAIR-by-Design_ToT


31

Help us improve



- We are very interested in your thoughts and ideas
- Let us co-create and make a new, improved, version of the FAIR-by-Design materials together



32



- Skills for the European
- Open Science
- Commons

Funded by the European Union

Skill4EOSC has received funding from the European Union's Horizon Europe research and innovation Programme under Grant Agreement No. 101058827


Thank you! Questions?

Credit: Some of the slides in this presentation were created by [SlideEgo](#)

Sonja Filiposka - sonja.filiposka@fnisj.ukim.mk

FAIR Implementation Workshop @ FAIR-IMPACT, 4 December 2023

This presentation is released under a [CC-BY 4.0 license](#). To cite this presentation, please copy and paste:
 Filiposka, Sonja. 2023. December 4). FAIR by Design Methodology: How to Develop FAIR Materials. FAIR Implementation Workshop, FAIR-IMPACT Webinar. Zenodo. 10.5281/zenodo.10256852.



33