



## D2.3 Community-endorsed quality assurance and certification framework for professional training and qualifications

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### Deliverable Abstract

This deliverable provides the first iteration of the Quality Assurance and certification Framework (QAF) for Open Science professional training and qualifications. It offers a reference framework (not a prescriptive requirement) to assure the quality of training materials and resources, based in four sections or sub-frameworks important in the context of Skills4EOSC project's principles and philosophy: Minimum Viable Skillset, FAIR-by-



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design and ELSI (Ethical, Legal and Social Issues), in conjunction with a comprehensive evaluation framework and learning resources catalogues. The document is a first approach to establish a set of attributes and useful questions for assessing the training materials created by Skills4EOSC. It also provides a useful reference for analysing the quality of any other Open Science course or educational resource. To come up with the initial QAF this first iteration of the deliverable defined a methodology of analysis for four sub-frameworks with essential elements, best practices and evaluation frameworks, in order to ignite a broader discussion with the stakeholders. This deliverable points out also some proposals for the community-endorsed version of the QAF and challenges for the future work and implementation.

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## Terminology: List of acronyms and glossary terms

### List of glossary terms

See also: <https://eosc-portal.eu/glossary>

**Controlled Vocabulary (CV):** An organised arrangement of words and phrases used to index content and/or to retrieve content through browsing or searching. In the context of FAIR data-controlled vocabularies started to be called "semantic artifacts".

**Copyright:** Type of intellectual property that protects original works of authorship as soon as an author fixes the work in a tangible form of expression.

**Essential indicator (Ess.):** One of the two kinds of indicators considered in the Quality Assurance Framework (QAF) to face different levels of learning object/resource's granularity. "Essential indicators" are those core indicators (properties) applicable to all learning objects, regardless of granularity. They are distinct from "non-essential indicators," representing a critical reference point to ensure the foundational quality of the learning materials, reinforcing the QAF's comprehensive approach.

**High-Value Dataset,** is a key provision included in the ODD and refers to a dataset documenting re-use associated with important benefits for society, the environment and the economy, in particular because of their suitability for the creation of value-added services, applications and new, high-quality and decent jobs, and of the number of potential beneficiaries of the value-added services and applications based on those datasets.

**Learning Object:** Any digital resource that supports learning developed around a single learning objective defined as a package of a lesson, activity and assessment with a concrete learning outcome. This is the minimum resource on which the FAIR principles are applied in the FAIR-by-design methodology. In this document, Learning Objects might also be called Learning Resources. Learning Material. See also: Open Science Learning Resource (OSLR).

**Non-essential indicator:** One of the two kinds of indicators considered in the Quality Assurance Framework (QAF) to face different levels of learning object/resource's granularity. Unlike "Essential indicators," these indicators are supplementary in nature and are specifically employed to evaluate learning objects/resources characterised by a higher degree of granularity.

**Open Data Directive (ODD):** is officially known as Directive (EU) 2019/1024, is a piece of legislation enacted by the European Union (EU) aimed at promoting the availability and reuse of public sector information and data across member states. The directive, which came into effect on July 16, 2019, seeks to enhance transparency, encourage innovation, and stimulate economic growth by facilitating access to and use of government-generated data.

**Open Protective:** Refer to a copyleft licence that includes additional clauses or provisions aimed at safeguarding the openness of the software or content covered by the licence. These clauses might go beyond the typical copyleft requirements and impose additional restrictions or conditions to prevent certain actions that could undermine the open nature of the project. "Open Protective" is not a recognized or standardised term in the world of open-source licensing, but it is used in ELSI-SF.

**Open Permissive:** Non-copyleft licence. Typically refers to a category of open-source licences that place few restrictions on how the software can be used, modified, and distributed. Permissive licences provide users with a higher degree of freedom in terms of how they can incorporate the open-source code into their own projects and software. Unlike online copyleft licence, these licences generally do not impose obligations to share modifications or derivative works under the same licence terms [ELSI-SF].

**Open Science Learning Resource (OSLR):** A learning resource/material, within the context of Open Science training and the Skills4EOSC project. It refers to any digital or tangible material, entity, or platform designed to facilitate the acquisition, understanding, and application of knowledge, skills, and competencies related to OS principles, practices, and methodologies. These resources encompass a diverse range of formats (online courses, interactive modules, instructional videos, articles, datasets, tools, software applications,

webinars, and other educational content). These resources serve as essential aids for learners, educators, trainers, researchers, and practitioners seeking to expand their proficiency and engagement in the field of Open Science.

**Resource:** we have adopted the definition at [RoLECT](#) (EOSC Rules of Participation Legal & Ethics Compliance) that understands “resource” as any digital object or process such as data and metadata, publications, software, workflows, services, and training materials. In the context of this deliverable “resource” might be training materials, learning objects/resources.

**Sui Generis Database Rights (SGDR):** It refers to a unique form of protection granted to the creators of databases in certain jurisdictions. The SGDR grants the creator of a database the exclusive right to prevent others from extracting or reusing substantial portions of the database's contents. This right has its unique nature of rights protection in relation to other forms of intellectual property rights [ELSI-SF].

**Training catalogue:** Provides a description of the training services and materials offered along with the related policies and procedures in regard to such training

## List of acronyms and abbreviations

<b>Acronym</b>	<b>Definition</b>
<b>CC</b>	Creative Commons
<b>CESSDA</b>	Consortium of European Social Science Data Archives
<b>CV</b>	Controlled Vocabulary
<b>DOI</b>	Digital Object Identifier
<b>ELSI</b>	Ethical, Legal and Social Issues
<b>ELSI-SF</b>	ELSI QA Sub-framework (section of the QAF)
<b>EOSC</b>	European Open Science Cloud (Commons)
<b>Ess.</b>	Essential indicator
<b>ETHRD</b>	Education and Training on Handling of Research Data
<b>EU</b>	European Union
<b>FAIR</b>	Findable, Accessible, Interoperable, Reusable
<b>FAIR-SF</b>	FAIR QA Sub-Framework (section of the QAF)
<b>FsF</b>	Free software Foundation
<b>G-SF</b>	Generic QA Sub-framework (section of the QAF)
<b>GDPR</b>	General Data Protection Regulation
<b>ID</b>	IDentifier
<b>IEEE</b>	Institute of Electrical and Electronics Engineers
<b>Indic.</b>	Indicator
<b>IP</b>	Intellectual Property
<b>IPR</b>	Intellectual Property Rights
<b>JSON</b>	JavaScript Object Notation
<b>LR</b>	Learning Resource
<b>LMS</b>	Learning Management System
<b>LOM</b>	Learning Object Metadata
<b>MOOC</b>	Massive Open Online Course
<b>MVS-SF</b>	Minimum Viable Skillset QA Sub-Framework (section of the QAF)
<b>ODD</b>	Open Data Directive
<b>OER</b>	Open Educational Resource/s
<b>OS</b>	Open Science
<b>OSLR</b>	Open Science Learning Resource/s
<b>PDF</b>	Portable Document Format
<b>PSI</b>	Public Sector Information
<b>QA</b>	Quality Assurance
<b>QAF</b>	Quality Assurance and Certification Framework Quality Assurance Framework
<b>RDA</b>	Research Data Alliance
<b>RoLECT</b>	EOSC RoP Legal & Ethics Compliance
<b>RoP</b>	Rules of Participation
<b>SGDR</b>	Sui Generis Database Rights

<b>SMART</b>	Specific, Measurable, Achievable, Realistic/Relevant, Time-Based
<b>SSHOC</b>	Social Sciences & Humanities Open Cloud
<b>ToS</b>	Terms of Service
<b>TtT</b>	Train the Trainers
<b>UDL</b>	Universal Design for Learning Guidelines
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>URL</b>	Uniform Resource Locator
<b>W3C</b>	World Wide Web Consortium
<b>WG</b>	Working Group
<b>WIPO</b>	World Intellectual Property Organization
<b>XML</b>	eXtensible Markup Language
<b>YAML</b>	YAML Ain't Markup Language



## Content

Terminology: List of acronyms and glossary terms.....	4
List of glossary terms .....	4
List of acronyms and abbreviations.....	7
Executive summary.....	10
1. Introduction.....	11
2. Methodology.....	14
3. Quality Assurance and certification framework.....	17
3.1. The generic sub-framework (G-SF) .....	17
3.1.1. Evaluation.....	17
3.1.2 Indicators and best practices .....	18
3.2. Minimum Viable Skillset sub-framework (MVS-SF).....	23
3.2.1. Evaluation.....	23
3.2.2. Indicators and best practices .....	23
3.3. The FAIR-by-design sub-framework (FAIR-SF).....	26
3.3.1. Evaluation.....	26
3.3.2. Indicators and best practices .....	26
3.4. The ELSI sub-framework (ELSI-SF) .....	33
3.4.1. Evaluation.....	34
3.4.2. Indicators and best practices .....	34
4. Challenges and future work.....	41
References .....	43
Appendix .....	44

## Executive summary

Skills4EOSC aims to create and curate high-quality learning/training materials on Open Science, FAIR data, and related topics. Quality assurance (QA) is pivotal to ensuring these learning resources meet accuracy and relevance standards. However, QA criteria, such as accuracy and relevance, can be subjective and difficult to assess, furthermore, the absence of standardised frameworks adds complexity. This deliverable introduces a comprehensive Quality Assurance Framework (QAF). It focuses on assessing and certifying learning materials, involving key stakeholders. This first version of D2.3 targets Skills4EOSC partners and institutions, serving as a discussion starter. The QAF proposal incorporates principles like the Minimum Viable Skillset (MVS), FAIR-by-design methodology, and Ethical, Legal, and Social Issues (ELSI). It emphasises QA over Quality Control and promotes continuous improvement.

The QAF is designed considering four sections called: Generic, MVS, FAIR, and ELSI sub-frameworks. Each sub-framework consists of checklist questions assessing different elements. The concept of learning object granularity is addressed by essential and non-essential indicators. The QAF is based on existing frameworks and recommendations and it is intended to be community-endorsed, fostering collaboration and alignment.

This deliverable introduces a community-endorsed Quality Assurance Framework for Open Science training materials and learning resources (OSLR). It ensures high standards through an encompassing methodology, aligning with Skills4EOSC principles and governing mechanisms. The QAF aims to engage the community, achieve endorsement, and establish unified quality standards for OSLR, thus, this first iteration of the deliverable 2.3 serves as the catalyst for the discussion and community-endorsed qualification and certification of Open Science training materials. We also reflect on the challenges and future work and possible implementations of the QAF after the final version of D2.3.

## 1. Introduction

Within the realm of Open Science, a multitude of training resources exists and more are going to be created, catering to diverse facets of this domain, addressing different content and with different granularity and quality. Assessing the quality of learning resources (LR), in general, and in particular those addressing Open Science skills is a complex and multifaceted endeavour that entails significant challenges. Open Science (OS) is a dynamic field, and online education is in constant evolution driven by advancements in both, technology, and pedagogical approaches. As a result, the criteria for evaluating learning resources must be adaptable and context-sensitive, taking into account the diverse needs and learning styles. Additionally, the sheer abundance of resources available across various catalogues and platforms further compounds the difficulty of extracting assessment criteria.

Besides the already existing learning materials on Open Science (OSLR) (ex. FOSTER materials, MOOCs, etc.) Skills4EOSC will create and curate a distinct array of courses, materials, learning objects, etc. around Open Science, FAIR (open) data, data management, and related subjects encompassing research openness. Quality assurance of LR is a crucial process in ensuring that Skills4EOSC educational materials meet high standards of accuracy, relevance, and effectiveness. This process involves a series of steps and considerations to ensure that the learning resources are of the highest quality possible.

Quality indicators, such as accuracy, relevance, and engagement, can be subjective and may vary based on the learner's prior knowledge and goals. Furthermore, the rapidly changing nature of information makes it challenging to ascertain the timeliness and currency of resources. The absence of standardised frameworks for evaluating learning materials adds another layer of complexity to this task. In essence, the difficulty in assessing the quality of learning resources arises from the intricate interplay of subjectivity, contextual variability, and the ever-evolving digital education landscape.

So, the primary objective of this deliverable is to initiate a dialogue and propose an encompassing quality assurance framework (QAF). This framework is intended to be applied to the professional training material concerning OS, but we need

to point out the main aspects of this deliverable and the version of the framework developed here:

- a) D2.3 focuses on the formulation of a framework for ensuring the quality and certification of learning materials/resources (OSLR). The Quality Assurance Framework (QAF) developed within this context is set to be applied to the primary Skills4EOSC courses, curricula, and learning paths, tailored to distinct target groups. These learning materials will be crafted utilizing the FAIR-by-design methodology, aligning with the envisioned pilots and Train the Trainers (TTT) initiatives to be carried out in real-world scenarios within Competence Centres.
- b) It's important to clarify that this initial iteration of D2.3 is intended not for the ultimate end-users (trainers, course designers, or teachers), but rather for the Skills4EOSC partners and affiliated institutions. The goal is to initiate discussions, achieve alignment, and garner endorsement for the proposed framework. This is reflected in the inclusion of "community-endorsed" (in brackets) within the deliverable title, as this version serves as the basis for these discussions.
- c) It does not exist a dedicated qualification and certification framework for Open Science Learning Resources (OSLR), so D2.3 has crafted its own proposal for a QAF. This proposal draws from the overarching principles and philosophy of the Skills4EOSC project, encompassing the Minimum Viable Skillset (MVS), FAIR-by-design methodology, and considerations of Ethical, Legal, and Social Issues (ELSI). Additionally, it incorporates a comprehensive set of properties derived from more generalized learning resources/materials frameworks.
- d) It is also important to note that the primary focus of this document lies in Quality Assurance (QA) rather than Quality Control. QA adopts a proactive stance by establishing processes and standards to preclude errors or issues during instructional design. On the other hand, Quality Control operates reactively, pinpointing and addressing problems or mistakes in the final learning resource or course. Thus, our QAF should ideally be applied throughout the creation process of new learning resources, but it can also

be employed for certifying pre-existing courses or materials for the purpose of content reuse.

- e) In the process of designing indicators and best practices, the approach adopted offers "recommendations and guidance" rather than a prescriptive stance. The aim is to measure and analyse, with an emphasis on aiding implementation and formative evaluation. Simultaneously, comprehensive guidance and indicators are provided to foster ongoing improvement across all criteria.

To summarize: This is the first iteration of a comprehensive quality assurance and certification framework (QAF) tailored to learning materials, aligned with Skills4EOSC endorsed principles, criteria and governance mechanisms. The final intention is to actively engage the community, fostering discussions and garnering endorsements for the outlined framework. This collaborative endeavour is geared towards culminating in a unified and endorsed framework by the end of the Skills4EOSC project (at M30), aligning with the collective vision for Open Science training materials evaluation and certification.

## 2. Methodology

The methodology undertaken in task 2.4 started with an exhaustive review of pre-existing learning materials QA and certification frameworks. Additionally, we performed an examination of five extant learning resource catalogues ([MERLOT Materials](#), [EOSC Marketplace Resources](#), [OpenPlato](#), [FOSTER OPENSCIENCE](#) and [ELIXIR TESS](#)) to evaluate the quality criteria currently employed by diverse learning communities, both within and beyond Europe, and encompassing both domain-specific and domain-agnostic perspectives. These QA frameworks and learning resource catalogues served as the foundation for devising a generic section of indicators and properties. The supplementary information detailing the development of this work and mapping process is available in [Appendix A](#).

In the design of the QA and certification framework, a distinct analysis was performed for the four principal sections:

1. The **Generic QA section (G-SF)**: This segment was fashioned using three prominent QA and certification frameworks related to learning materials—the [EOSC Synergy Online Training Handbook](#), the [NHS - NHS Shared Learning Quality Assurance Checklists for Evaluating Learning Objects](#) and the [Online and the QLT - Quality Learning & Teaching Rubric 3rd Edition \(2022\) Self-Review](#). Additionally, select quality criteria from the previously mentioned learning resource catalogue mapping were incorporated. This section serves as the foundational basis for introducing the remaining facets of the QAF, with the indicators of the other three sub-frameworks.
2. The **Minimum Viable Skillsets (MVS) QA section (MVS-SF)**: Anchored in the [Catalogue of Open Science Career Profiles - Minimum Viable Skillsets](#), developed in Skills4EOSC, this section involves the formulation of checklist questions and indicators to gauge the requisite quality assurance criteria aligning with the compliance between the learning resource and the MVS profile/s.
3. The **FAIR-by-design Methodology QA section (FAIR-SF)**: This was designed considering the [Draft Methodology for FAIR-by-Design Learning Materials](#), as elaborated also in Skills4EOSC.

4. The **ELSI QA section**: Drawing upon the EOSC RoP Legal & Ethics Compliance ([RoLECT](#)) web application, devised by the NI4OS project, indicators were jointly constructed with Skills4EOOSC ELSI work. These indicators relate to integration of pertinent Open Science regulations, policies, and legislative interventions impacting the development of Open Science competencies, QA, and certification mechanisms and frameworks. The RoLECT tool facilitates the self-assessment of digital objects' compliance with the legal and ethical parameters of the EOSC Ecosystem.

Each section or sub-framework is designed around checklist questions that assess performance across the principal elements/sections of the respective section. A mixed-indicator approach, encompassing quantitative and qualitative elements, is employed to assess performance for each checklist question, with the qualitative component describing the degree of compliance. Moreover, recommendations for best practices are provided to enhance performance within each indicator.

Concerning the concept of learning objects, following the IEEE Standard for Learning Object Metadata (IEEE LOM), four levels of granularity are distinguished:

- L1: Indivisible learning units, such as image files.
- L2: Collections of L1 objects, akin to lessons encompassing multiple elements.
- L3: Assemblages of L2 objects, representing courses composed of multiple lessons.
- L4: The highest level of granularity, encompassing study programs or learning paths amalgamating L3 and/or L4 objects.

To face challenges arising from the varying granularity of the term "learning object," the framework introduces two categories of indicators (essential and non-essential). This approach establishes a foundational set of minimum QA and certification indicators applicable to all learning objects, regardless of granularity, in conjunction with an additional collection of indicators for assessing learning objects with greater granularity. By incorporating this separate set of criteria, the QAF ensures a comprehensive evaluation approach that addresses both

fundamental and nuanced aspects of learning materials, promoting a thorough understanding of their quality and effectiveness.

For certification purposes, each sub-framework culminates in a final score, differentiating between essential score (where only essential indicators' performance is considered) and total score (encompassing performance across both essential and non-essential indicators).



## 3. Quality Assurance and certification framework

The Skills4EOSC QA and certification framework is divided in four sections as described in the methodology of the QAF design:

1. The generic sub-framework (G-SF)
2. The Minimum Viable Skillset sub-framework (MVS-SF)
3. The FAIR-by-design sub-framework (FAIR-SF)
4. The ELSI sub-framework (ELSI-SF)

Each section includes “indicators” that are properties or attributes. These are not standardised as metadata elements, but are meant to help the creators in the process of assuring quality in Learning Resources (LR) design.

### 3.1. The generic sub-framework (G-SF)

This section or sub-framework considers indicators for learning resources quality assurance taking into account generic properties applicable to any kind of learning objects, including those focusing on Open Science (OSLR).

#### 3.1.1. Evaluation

The G-SF comprises 20 indicators, divided into essential and non-essential categories. 10 indicators are essential, forming the basis for evaluating the learning resource's QA certification. Meeting a minimum score of 1 for all essential indicators means successful compliance. Conversely, non-essential indicators (also 10) are applicable depending on the nature and the granularity level of the learning resource. Their relevance is contingent upon alignment with the resource's characteristics.

### 3.1.2 Indicators and best practices

#### Indicators: Title, Goal, Objectives & Outcomes, and Audience

Ess.	Checklist question	Indic.	Indic. value definition	Property	Source
YES	Does the resource title clearly describe what it offers?	0-1	YES (1) NO (0)	Title	EOSC-Synergy
NO	Does the resource include its goal?	0-1	YES (1) NO (0)	Goal	EOSC-Synergy
YES	Does the resource clearly state its target audience?	0-1	YES (1) NO (0)	Audience	EOSC-Synergy
<b>YES</b>	Does the resource state the expertise level required from its audience?	0-1	YES (1) NO (0)	Expertise level	EOSC-Synergy
<b>NO</b>	Are the learning objectives* and outcomes* specific, well-defined, and measurable?	0-1	YES (1) NO (0)	Objectives, Outcomes	EOSC-Synergy
<b>NO</b>	Does the resource clearly describe its program / outline?	0-1	YES (1) NO (0)	Program	EOSC-Synergy, QLT

*Note: "goals" represent the broad aspirations trainers have for their students. On the other hand, "learning objectives" are the specific steps trainers take to help students reach those goals. "Learning outcomes" are the actual knowledge, skills, or abilities that students should be able to show at the end of their training.*

#### Best practices

Certain important indicators, like the "title", "goals", "target audience", and "expertise level", are considered essential because they play a vital role in the basic quality of learning materials, no matter how detailed they are or its level of granularity. When it comes to the title, it is a good idea to make it engaging and even explain why people should use the learning material. The goals of the material can cover various aspects, such as the benefits, skills it teaches, or problems it helps solve. Describing the intended audience could mean mentioning who the material is meant for, like researchers or students. Also, indicating the expertise level, like beginner, intermediate, or advanced, is helpful.

On the other hand, indicators related to learning objectives, outcomes, and program details are considered "non-essential" because they mostly apply to more detailed learning materials. For example, a learning object with only images might not have this type of information.

Some interesting questions to consider as a trainer are: Why are you doing this training? What does success look like? These questions help you think about developing skills, gaining knowledge, and changing attitudes through the training. When writing learning outcomes, you can ask: What will learners get from this training? What skills will they show? Using phrases like "By the end of this training, participants will be able to..." is helpful. Also, choosing the right action words that match different levels of learning is important. Think about how learners can show they have learned the outcomes - this is connected to evaluation and assessment. Using the SMART (Specific, Measurable, Achievable, Realistic/Relevant, Time-Based) approach for objectives makes them clear and achievable.

Additionally, although it is not a requirement, the recommended [Research Data Alliance \(RDA\) minimal metadata schema](#) suggests adding information about any needed prerequisites for understanding or using the learning material or its topic. These prerequisites might include basic knowledge levels, specific tasks, technical skills, or familiarity with certain technologies, tools, software, or systems.

### Indicators: Date, Duration, Author, Trainer and Language

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic.</i>	<i>Indic. value definition</i>	<i>Property</i>	<i>Source</i>
YES	Does the resource state the <b>date</b> when it was published and/or the date of the newest version?	0-1	YES (1) NO (0)	timescale, publication	Extant catalogues
NO	<i>If needed, does the resource state the <b>dates</b> the training takes place?</i>	0-1	YES (1) NO (0)	<i>timescale</i>	EOSC-Synergy
NO	If applicable, does the resource state the expected <b>duration</b> of the training?	0-1	YES (1) NO (0)	timescale	Extant catalogues, QLT
YES	Does the resource specify the <b>developer/author</b> of the resource?	0-1	YES (1) NO (0)	Author	EOSC-Synergy
NO	Does the resource specify the <b>trainer/s</b> of the resource?	0-2	0- The trainer/s is not specified 1- The trainer/s is specified 2- Trainer's bio or	Trainer	EOSC-Synergy

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic.</i>	<i>Indic. value definition</i>	<i>Property</i>	<i>Source</i>
			relevant info is provided (or a URL to it).		
YES	Does the resource state the <b>language</b> used?	0-1	YES (1) NO (0)	Language	Extant catalogues

### Best practices

If we want to follow the RDA minimal metadata schema, we need to include specific attributes within the learning resource. These attributes are the date when the material was published, information about who made it, and the main language it's in. Other attributes like dates for the training sessions, how long the training is, and who the trainer is, are optional. Especially for lower levels of granularity or simpler learning resources, we might not need to include these details. We should only add these properties when they make sense for the learning material.

### Indicators: Assessment, Grading, Micro-credentials and Costs

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic.</i>	<i>Indic. value definition</i>	<i>Property</i>	<i>Source</i>
NO	If applicable, does each content or instructional unit end with an activity/ <b>assignment</b> that allows for student feedback? Are <b>assessment strategies</b> consistent with course objectives and are clearly stated?	0-2	0- No assignment 1- Assignment included 2- Assignment included and aligned with course objectives	Assessment	NHS
NO	If applicable, is <b>grading</b> policy provided in a manner that clearly defines expectations for the course and respective assignments?	0-1	YES (1) NO (0)	Grading	QLT
NO	If applicable, does the course consist of <b>micro-credentials</b> that can be aligned to create a larger milestone credential?	0-1	YES (1) NO (0)	Micro-credentials	QLT

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic.</i>	<i>Indic. value definition</i>	<i>Property</i>	<i>Source</i>
YES	Does the resource include information regarding whether the access to it implies <b>costs</b> or not?	0-1	"YES (1) NO (0)"	Costs	Extant catalogues

### Best practices

While not all learning resources have costs, it is important to share whether accessing the resource is free or if there are any costs involved. The indicators about assignments, tests, grading, and micro-credentials only apply to more detailed learning materials with higher level of granularity (like a lesson instead of just a small piece). For example, very basic learning materials might not have this information. (e.g., a minimum learning object that consist of an indivisible learning unit, L1 in the IEEE LOM).

### Indicators: Learning style, Delivery, Technology, Trainer and keywords

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic.</i>	<i>Indic. value definition</i>	<i>Property</i>	<i>Source</i>
NO	Does the resource cover different <b>learning styles</b> that lead to more student engagement, while not overly relying on one learning style such as reading/writing?	0-1	YES (1) NO (0)	Learning style	QLT
YES	Does the resource state its <b>delivery method</b> ? (live sessions, self-learning, hybrid, face-to-face...)	0-1	YES (1) NO (0)	Delivery	EOSC-Synergy
NO	If applicable, does the resource explain the required <b>tools/software/infrastructure</b> as well as the instructions for acceptable assignment submission types (e.g., MS Word, MS Excel, MS PowerPoint, PDF, .mp4, mov.)?	0-1	YES (1) NO (0)	Technology	EOSC-Synergy
YES	Does the resource include relevant <b>keywords</b> related to the content and structure?	0-1	YES (1) NO (0)	Keywords, Metadata	Extant catalogues

### Best practices

It is really important to decide how we are going to deliver the training using the learning materials. This means figuring out if people will learn in real-time, on their own online (self-paced), face-to-face, or a mix of these ways. Also, we need to think about whether the material is simple, like text or images, or has a higher level of complexity or granularity. The way people will use the material might limit what types of tools and formats we can use.

Using the right keywords is also very important. Keywords help organize the materials in a system so that people can find what they need easily. They can search for specific things like who made the material, how long it takes, and what area it is about.

When it comes to how people learn and use technology, we follow the [Universal Design for Learning Guidelines](#) (UDL). These guidelines say we should use

technology that helps people learn actively. This means using tools that let students interact with the material and talk with each other and teachers.

To make all of this better, we need to think about a few particular conditions of the learning experience. For example, trainers can think about using tools like GoogleDocs or Zoom for group work and presentations. They can also use discussion forums and tools for marking up text to help students talk and share ideas; or interactive videos and software for working together on projects. Moreover, if the learning materials need specific tools or software, it's a good idea to tell people about them. And if there are certain ways they should submit assignments, it's good to give them clear instructions for that, too. This makes the whole learning experience better and easier for everyone.

### **3.2. Minimum Viable Skillset sub-framework (MVS-SF)**

In this sub-framework we reflect the specific features that a learning material/resource or course should include in terms of minimum content already defined in task 2.1 in Skills4EOsc (D2.1 Catalogue of OS Career Profiles and MVS) as Minimum Viable Skillset.

#### **3.2.1. Evaluation**

The MVS-SF encompasses 8 QA indicators, within which a subset of 3 indicators are "essential". Building upon what we established in the previous sub-framework, the accomplishment of achieving a minimum score of 1 across all the essential indicators implies compliance with the standardised proposed indicators. Conversely, the non-essential indicators (5) are relevant or not based on the contextual attributes and characterising the learning resource according to its inherent nature and granularity level.

#### **3.2.2. Indicators and best practices**

**Indicators:**

<b>Ess.</b>	<b>Checklist question</b>	<b>Indic.</b>	<b>Indic. value definition</b>	<b>Property</b>
YES	Is the <b>goal/description</b> of the resource in line with the mission of the MVS profile for the stated target audience?	0-1	YES (1) NO (0)	Goal
NO	Are the <b>learning objectives</b> and <b>outcomes</b> of the resource relevant to any of the outcome of the MVS profile for the stated target audience? (Section: "Contributes to which Open Science outcomes?")	0-1	YES (1) NO (0)	Objectives, Outcomes
NO	Do the <b>activities and assignments</b> of the resource help the stated target audience to perform any of the 'Main activities' in the MVS"?	0-1	YES (1) NO (0)	Activities
NO	Does the resource help the target audience acquire knowledge and skills that would help them to demonstrate any of the ' <b>essential skills and competences</b> ' in an MVS relevant to their role?"	0-1	YES (1) NO (0)	Prerequisites
NO	If applicable, are the <b>technological prerequisites</b> (tools, software and infrastructure requirements and skills) stated aligned with the essential skills and competences listed in the correspondent MVS profile of the stated target audience?	0-1	YES (1) NO (0)	Prerequisites
NO	If applicable, are the <b>domain prerequisites</b> stated aligned with the essential skills and competences listed in the correspondent MVS profile of the stated target audience?	0-1	YES (1) NO (0)	Prerequisites
YES	If applicable, does the resource introduce the MVS elements and concepts from an Open Science taxonomy or controlled vocabulary in its <b>keywords</b> ?	0-2		Keywords
YES	If applicable, does the resource have coherently structured content for all elements of the MVS in its <b>metadata</b> ?	0-2		Metadata



## Best practices

The subset of indicators considered “essential” within the G-SF are also “essential” within the MVS-SF (keywords, metadata, and goal/description). In the Catalogue of Open Science Career Profiles - Minimum Viable Skillsets, we recognise a comprehensive array of MVS profiles:

- Civil Servant
- Data Stewards - Coordinator, Embedded
- Early Career Researcher
- Ethics Advisor
- Knowledge Broker
- Legal Expert
- Masters student
- Policymakers - Research policy, Evidence-based policymaker
- Research Infrastructure Professional
- Senior Researcher
- Undergraduate student

Therefore, regarding role, the target audience stated in the learning resource should be consistent with the correspondent role/s in this list. We must remember here that the MVS is meant to be used by anyone involved in developing the skills of whichever role is described by that MVS (e.g. including people who are in the same role, and want to plan their own training needs).

In the MVS Catalogue, each MVS Profile is explained separately. In these profiles, we will find different sections like "Open Science Mission," "Open Science outcomes," and "Activities."

When it comes to the section about prerequisites, there is not a direct connection between the possible requirements for a learning resource (like technical skills or knowledge in a certain area) and a specific section in the MVS profile. So, it will be up to the user to check this. This means looking at the skills and abilities explained in the profile that matches the learning resource to see if they match with what is needed for the resource.

### 3.3. The FAIR-by-design sub-framework (FAIR-SF)

Creating or transforming digital learning materials into FAIR-compliant ones is one of the objectives of Skills4EOsc and so a very important section to assure the quality of those resources. The FAIR-by-design process generates a new final learning package and ensures its availability on relevant platforms, and various steps (such as metadata definition, facilitator package inclusion, and cataloguing) are involved. To streamline this process and eliminate unnecessary duplication of efforts, we strongly encourage integrating the FAIR principles from the outset of the design process. This involves implementing FAIR principles throughout every phase of learning material development, from conception to release. Thus, the FAIR-by-design methodology is another key sub-framework to inspire indicators and best practices that guarantees the quality of the resources from this specific point of view.

#### 3.3.1. Evaluation

In the FAIR-SF, there are a total of 18 indicators. Among them, 8 are considered important (“essential”) and are equally spread across the FAIR principles of Findability, Accessibility, Interoperability, and Reusability (with 2 essential indicators for each FAIR principle). When evaluating the resource, having a score of at least 1 for all essential indicators means that the resource meets the basic requirements for being FAIR. On the other hand, if this minimum score is not achieved, additional actions are needed to make sure the learning resource/material follows the minimum requirements for FAIR compliance.

#### 3.3.2. Indicators and best practices

##### Indicators: Accessibility

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic.</i>	<i>Indic. value definition</i>	<i>FAIR principle</i>	<i>Property</i>
YES	Has an <b>accessibility checker</b> tool been utilised to improve the accessibility of all	0-1	YES (1) NO (0)	Accessible	Accessibility

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic.</i>	<i>Indic. value definition</i>	<i>FAIR principle</i>	<i>Property</i>
	learning resource files (PDF, HTML, video...)?				
NO	Are the resource <b>access rules</b> (how to access, e.g. registration procedure) explicitly communicated to learners?	0-1	YES (1) NO (0)	Accessible	Accessibility
YES	Are <b>access rules</b> (authentication & authorisation) implemented for the learning resource?	0-1	YES (1) NO (0)	Accessible	Accessibility

### Best practices

As one of the indicators for learning materials, we have included the “accessibility” principle of FAIR, going beyond the “availability” (usually understood as that) of the resource, to the real web accessibility.

To enhance the accessibility of the learning resource, it's a good idea to use a tool that checks how accessible they are. To make sure the materials are accessible and inclusive, you can use the [Self-Publishing Guide by BCcampus](#). This guide talks about challenges that need attention for accessibility. When you fix these challenges, you make sure that everyone, including people from different backgrounds and abilities, can use the learning materials. Even though the [W3C Accessibility Standards](#) were made for web content, they can help with all learning resources/materials that are online.

Access information is not just about costs in the Generic-SF. In the FAIR-SF, it means the rules for how people can actually access the resources. It is really important to make sure that everyone can easily get to the learning materials. This means having open access rules that let people use and reuse the materials. While it is not mandatory, it is a good idea to make sure the learning resources are accessible for different learning styles and for diverse learners, including people with disabilities.

## Indicators: Co-creation, Facilitator kit, Versioning and Instructional design

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>FAIR prin.</i>	<i>Property</i>
NO	Does the course include the possibility to provide <b>feedback</b> or comments from users and-or trainers/designers? If so, do you regularly gather and analyse that feedback?	0-4	0: No feedback options 1: feedback from users OR trainers/creators, but no analysing feedback 2: feedback from users AND trainers/creators, but no analysing feedback 3: feedback from users OR trainers/creators, and analysing feedback 4: feedback from users AND trainers/creators and analysing feedback	Accessible	Co-creation
NO	Does the resource adopt an <b>open community</b> approach regarding its quality and reachability?	0-5	One point per item used in the resource: -1: Open peer reviews -1: Open comments -1: Code of Conduct that supports an open collaborative environment available -1: Ability to gauge interest in instructors facing resources (e.g. Zenodo views/downloads, GitHub stars, etc.) -1: Ability to gauge interest in learners facing resources (e.g. number of participants enrolled, number of badges/certificates issued, etc.)	Reusable	Co-creation
NO	Does the resource incorporate an <b>instructor kit</b> that aids in facilitating the process of others reusing learning material by offering helpful how-to guides?	0-7	1 point per type of information provided: -1: Resource is structured in one or multiple units (depending on size) -1: Each unit has a study workbook -1: Each unit has an outlined assessment -1: Each unit has a unit lesson plan -1: Each activity has a how-to guide -1: Global facilitator document describes how to set-up and run the training (online and/or face-to-face) -1: Global syllabus that describes all essential information about the learning resources including agenda and any certification information	Reusable	Facilitator kit

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>FAIR prin.</i>	<i>Property</i>
NO	Have you employed a <b>versioning system</b> to track and control changes in your materials?	0-2	0: No version management system implemented 1: Manual version management (versioning based on file name conventions) with no clear track of changes between versions 2: Complete version management system (track of all old versions on file content level and authorship)	Reusable	Versioning
NO	Did you follow the stages of the backward <b>instructional design</b> process while developing the learning resource?	0-1	YES (1) NO (0)	FAIR	Instructional design

### Best practices

In these guidelines all the indicators are non-essential, we should use them when they fit. When it comes to getting feedback and involving the community, letting users, trainers, or creators share their thoughts about the learning resource can really improve its quality (how easy it is to use, and to what degree it can be re-used). Having a phase where the learning/training resource gets reviewed internally, and the feedback is used to improve it, makes sure it stays in line with what the community and current trends need. Things like user or trainer ratings, reviews from peers, how many people joined, how many times it was downloaded, and how many certificates were given, are all helpful indicators of the quality of the resource. Also, having a kit for instructors and trainers makes the resource more re-usable. This means adding sections in the learning resource with useful stuff for each part, like workbooks, plans for assessments, guides for activities, clear instructions for joining the training, and a schedule for the training with details about certificates.

The idea of backward instructional design means planning the content based on learning goals. We start with the goals and then create the content that leads to them. This method is explained more in the Draft Methodology for FAIR-by-

design Learning Materials, along with step-by-step instructions for using it. We recommend using this instructional design method and thinking about it as a QA indicator.

Another important thing to consider is having different versions. This helps improve the quality over time. We can re-evaluate the learning or training resource and make new versions while keeping the old ones for reference. The information about versions should be clear in the details about the resource. This helps understand how the resource has changed and improved over time.

## Indicators: Schema, Metadata, Structure, Vocabularies and Open File Formats

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>FAIR principle</i>	<i>Property</i>
YES	Is the <b>RDA minimal</b> (or domain specific) <b>metadata schema</b> used for the learning material description?	0-1	YES (1) - schema is followed NO (0) - no schema is used	Interoperable	Schema
NO	If applicable, does the learning resource represent a <b>complete learning object or aggregation</b> consisting of content, tools and implementation resources defined around a minimum one learning objective?	0-1	YES (1) NO (0)	Reusable	Structure, Metadata
YES	Is metadata for the resource provided in both <b>human- and machine-readable</b> format (e.g JSON, XML or YAML)?	0-2	YES (2) - Metadata is populated in the resource as both machine AND human readable metadata PARTIAL (1) - Metadata field is populated in the learning resource machine OR human readable metadata NO (0)	Findable	Metadata
NO	Are <b>controlled vocabularies</b> (CVs) used for describing the resource characteristics aligned with the chosen metadata schema?	0-1	YES (1) - CVs are used where mandated by the schema NO (0) - no CVs are used	Interoperable	Vocabularies, Metadata
YES	Is your resource available in <b>open file formats</b> which are tool agnostic and compatible with a wide variety of existing software?	0-2	2 - Open file formats are used for both final resource for learners and intermediate resource for instructors 1 - Open file formats are used for intermediate resource for instructors 0 - Open file formats are not used	Interoperable	Tools & Formats

### Best practices

In the pursuit of enhancing interoperability, using a standard metadata schema is really important. There are different metadata schemas that we might consider:

RDA minimal metadata schema or domain-specific schemas, along with the adoption of open file formats (XML, RDF, JSON, etc.). It's a good idea to make sure the resource can be used in these open formats because they work with lots of different software. Both people who use the learning resource and the ones who teach with it should be able to use it easily. Also, the metadata schema employed should be imbued with attributes of both machine and human readability (e.g. formats such as JSON, XML, or YAML).

Although it is not obligatory, it is advisable to undertake an assessment of how detailed we want the FAIR implementation. If we want a high level of interoperability for our learning resources, aligned with the use of a standardised metadata schema, we will use controlled vocabularies (or “semantic artifacts” as they are called in the context of FAIR data). These vocabularies are structured lists of words and phrases that help find content, either by looking through it or by searching for it.

### Indicators: Publication in Repositories & Catalogues, Licences and QA

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>FAIR prin.</i>	<i>Property</i>
NO	Is the resource searchable in at least one relevant <b>catalogue</b> ? Is it FAIR (can be searched based on metadata)?	0-2	0: Not published in a catalogue yet 1: Published (not in a FAIR catalogue) 2: Published in a FAIR catalogue	Findable	Publish
YES	Is the complete learning resource (incl. instructors' info) registered or indexed in at least one searchable <b>repository</b> ? Is it in a trustworthy/well-known repository?	0-2	0: Not published yet 1: Published 2: Published in a FAIR repository	Findable	Publish
YES	If applicable, is there clear attribution for all reused resources with compatible <b>licences</b> ?	0-1	YES (1) NO (0)	Reusable	Licence
YES	Has the learning resource been made available for use by defining a permissible <b>licence</b> or policy information that allows derivations?	0-1	YES (1) NO (0)	Reusable	Licence



<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>FAIR prin.</i>	<i>Property</i>
NO	Has the learning resource been checked by a third party regarding its <b>learning experience quality</b> ?	0-1	YES (1) NO (0)	FAIR	QA

### Best practices

Regarding the publication of the learning resource in a repository, there are multiple choices available including general data repositories, learning objects repositories and/or learning management systems (LMS) and platforms. These can be institutional, project-based, or public, and they can also be focused on generic or domain-specific content.

Also, it is preferable –but optional– that the chosen location for storing the learning materials is harvested (manually or automatically) by a relevant training catalogue. Having a catalogue entry increases the Findability and Reusability of the learning material while reducing the probability/risk of importing the same learning materials in multiple repositories or learning systems. Finally, it is strongly recommended to make the choice of the location where the generated material will be stored in advance, as the repository may impose limitations to the type of materials supported, formats and tools used, etc.

For reusability purposes, clear attribution for all reused resources, if any, including licensing information is highly recommended.

Finally, third-party QA evaluation of the learning experience of your resource is optional.

### 3.4. The ELSI sub-framework (ELSI-SF)

In this sub-framework we reflect the specific features that the OSLR (Open Science Learning Resources), material or courses should include related to Ethical, Legal, and Social issues. The indicators refer to the learning material itself not to the content of ELSI as a crucial training issue in the realm of Open Science.

### 3.4.1. Evaluation

In the ELSI-SF, there are 25 indicators in total, and 7 of them are considered essential. To guarantee the quality of the learning resource, it's important to score at least 1 in all the essential indicators. This shows that the resource meets the minimum ELSI quality standards. If the resource does not meet this threshold, more steps are needed to make sure it follows the necessary ELSI requirements.

### 3.4.2. Indicators and best practices

#### Indicators: Service Transparency Provisions - Terms of Service (ToS)

<i>Ess</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>Property</i>
YES	Does the resource provide or refer to <b>Terms of Service (ToS)</b> ? If so, is the ToS versioned?	0-2	0- No ToS provided 1- ToS is provided but not versioned 2- ToS is provided, versioned and periodically revised	ToS
NO	If needed, does the resource provide ToS <b>authentications/registration</b> sections?	0-1	YES (1) NO (0)	ToS
NO	If needed, does the resource provide ToS information about <b>charging and quotas</b> ?	0-1	YES (1) NO (0)	ToS

## Best practices

It is highly recommended to include the Terms of Service (ToS) of the learning resource. These terms and conditions explain the rules for using the resource and might include limits or rules for how it can be used. It's also a good idea to have different versions of the Terms of Service (ToS).

Although not required, it's a good idea to mention if people need to authenticate or get permission to access the resource. All the resources should be, coherently with Open knowledge, "as open as possible" being recommended to be conceived as OER, even if they need to register in the intended learning platform/service, it should be open.

## Indicators: Intellectual Property Rights (IPR) - Basic Information

<i>Ess</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>Property</i>
NO	Are the types of <b>Intellectual Property (IP)</b> and other types of rights subsisting in a resource identified?	0-1	YES (1) NO (0)	IPR: Basic Information
YES	Is the <b>IP owner</b> identified? Is the identity of the <b>author / inventor</b> or other IP originator identified?	0-1	YES (1) NO (0)	IPR: Basic Information
NO	Is provenance or other type of <b>IP acquisition</b> related information provided?	0-1	YES (1) NO (0)	IPR: Basic Information
NO	If applicable, is the licence of the resource <b>Public Domain</b> equivalent?	0-1	YES (1) NO (0)	IPR: Basic Information

## Best practices

In the indicator about the kinds of Intellectual Property (IP) in a resource, we are widening it to cover "other types of rights", too. This is meant to include rights that might not be seen as IP everywhere, like Sui Generis Database Rights (SGDR). There are various kinds of intellectual property, like copyright, patents, trademarks, and trade secrets.

Learning resources can have both IPR and non-IP rights. For example, think about a database with pictures. In this case, there are different layers of rights due to non-personal data laws:

- The first layer is about the copyright for the pictures, even if they are in the database.
- The second layer is about copyright for the database itself, which comes from choosing its content.
- The third layer is about protecting the database using SGDR, because it took a lot to make it.

Sometimes different people hold these rights, each having their own interests and different ways of allowing use. However, the resources should, when they can, be licensed as Creative Commons (CC). Simple situations like taking pictures of people or artworks bring in more layers of both IPR and non-IP rights. When there are people in the pictures, personality rights become important in this complex situation.

### Indicators: IPR – Restrictions

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>Property</i>
NO	Are there any <b>Trade Secrets</b> contained in the resource?	0-1	YES (1) NO (0)	IPR: Restrictions
NO	If there any <b>restrictions</b> from cultural heritage law (e.g. in the use of pictures), personality rights and/or other rights that may require additional licence/authorization, are they provided?	0-1	YES (1) NO (0)	IPR: Restrictions

### Best practices

These 2 indicators about IP restrictions are considered as not essential and are subordinated to the answers given in the previous section’s questions. Trade Secrets may be referred to as “Confidential information” or “Statistical Confidentiality” in the resource.

### Indicators: IPR - licensing out

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>Property</i>
YES	Does the resource provide the <b>standard licences</b> used?	0-1	YES (1) NO (0)	IPR: licensing out

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>Property</i>
YES	Does the resource provide a <b>machine and human readable</b> version of the licence?	0-2	0- None 1- Only one version provided 2-Both versions (machine and human readable) are provided	IPR: licensing out
NO	If applicable, is there an available <b>URL</b> location of the licence or policy of the material/s?	0-1	YES (1) NO (0)	IPR: licensing out
NO	Is the licence of the resource <b>versioned</b> ?	0-1	YES (1) NO (0)	IPR: licensing out

### Best practices

These indicators aim to ensure that the licensing information is clear, accessible, and in line with recognized standards, making it easier for users to understand and comply with the terms of use for the learning resource. It is strongly recommended to attach open licenses to the educational/training material. The provision of a standardised license and the information about its availability both in machine and human readability formats are considered “essential” for the quality of the learning resource. On the other hand, the URL or specific location of the license and the fact that versions exist are not required.

## Indicators: IPR - Open Licences Information

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>Property</i>
NO	Is the licence compliant with <b>Free Cultural Work</b> or the <b>Free Software Foundation</b> (FsF) definition?	0-1	YES (1) NO (0)	IPR: Open Licences Information
NO	Is the licence <b>Open Permissive</b> ?	0-1	YES (1) NO (0)	IPR: Open Licences Information
NO	Is the licence <b>Open Protective</b> (Copyleft)?	0-1	YES (1) NO (0)	IPR: Open Licences Information
YES	Are the licences used <b>interoperable</b> with each other?	0-1	YES (1) NO (0)	IPR: Open Licences Information

### Best practices

In the context of looking at the indicators for different license agreements, it is important to recognize that there might be learning resources that follow different rules, policies, or terms. Some of these resources might have special requirements because of funding or other important responsibilities. For example, there could be resources that need to follow specific rules because they were developed under agreements with academic institutions. Also, decisions about keeping certain rights might affect how resources can be used. If a learning resource has more than one license or follows different terms, it is a good idea to make sure these licenses or terms do not clash with each other. This avoids any conflicts or problems when using the resource.

### Indicators: Personal Data

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>Property</i>
NO	If applicable, are conditions for further processing (if allowed) provided?	0-1	YES (1) NO (0)	Personal Data
NO	If applicable, are the data subjects rights provided? Are communication addresses (e.g. email) provided?	0-1	YES (1) NO (0)	Personal Data

### Best practices

Including indicators about personal data is for cases where the learning resource entails data related to a person that can be identified (personal data). The main goal of this part is to show that the resource follows the right laws and rules for data protection and privacy, like the General Data Protection Regulation (GDPR). We have to remember that these indicators only matter if there's personal data in the learning resource. So, they might not be needed for all resources (non-essential indicators). Again, recommendations are to make efforts on anonymisation if personal data that cannot be reveal are implied in the OSLR, and make the resources as open as possible.

### Indicators: Ethics Information

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>Property</i>
NO	Are there any <b>ethical rules</b> provided?	0-1	YES (1) NO (0)	Ethics Information
NO	Are there any <b>Codes of Conduct (CoC)</b> provided?	0-1	YES (1) NO (0)	Ethics Information
YES	Is there <b>attribution</b> to the data source?	0-1	YES (1) NO (0)	Ethics Information
YES	Is <b>data provenance</b> provided?	0-1	YES (1) NO (0)	Ethics Information

### Best practices

Within this section, attention is directed toward identifying any ethical indicators relevant to the learning resource. One illustrative instance involves the resource's

alignment with universally recognized principles or a specified Code of Conduct. The aim is to highlight any ethical parameters that are relevant to the resource's content and utilisation, notably the information provenance and attribution.

### Indicators: Public Sector Information

<i>Ess.</i>	<i>Checklist question</i>	<i>Indic</i>	<i>Indic. value definition</i>	<i>Property</i>
NO	Is this resource identified as research data under the <b>Open Data Directive</b> ?	0-1	YES (1) NO (0)	Public Sector Information
NO	Is this resource identified as a <b>High-Value Dataset</b> ?	0-1	YES (1) NO (0)	Public Sector Information

### Best practices

In the indicator that assesses whether the learning resource falls under the category of research data according to the Open Data Directive ([ODD. EU Directive 2019/1024](#)), the term “research data” refers to digital documents, excluding scientific publications, that are collected or generated during scientific research activities (ODD, article 2.9). Likewise, the indicator that identifies the learning resource as a “High-Value Dataset” is guided by the criteria set out in the ODD, EU Directive 2019/1024. High-Value Dataset is described as “datasets whose reuse brings significant benefits to society, the environment, and the economy. This is particularly due to their potential for creating value-added services, applications, and new, high-quality jobs.” It could happen that an OSLR is considered “research data” or even “High-Value dataset” but this is not going to be the norm, so both indicators are “non-essential” since its value might be almost always “no”.



## 4. Challenges and future work

The future work of this task involves the collaborative development and validation of the comprehensive quality assurance and certification framework (QAF) described here. We will engage with WP3-8 to validate indicators, properties and criteria that gain endorsement from the community. The document presented here shows the work done in the first year/period of Skills4EOSC in task 2.4, where we found several challenges to overcome to create a community-endorsed QAF for OSLR at the end of the project (M36). Some of the challenges to be faced are:

- Addressing overlaps between sections and finetune the QAF indicators. One of the overarching challenges encountered involves managing overlaps and interactions between the 4 different sub-frameworks. Harmonizing the indicators and ensuring seamless integration between them is a complex task.
- Mitigating subjectivity in Indicators. Balancing objectivity while evaluating Open Science learning resources (OSLR) across various dimensions remains a challenge and needs careful calibration. We might test indicators for reliability.
- Complexities of ELSI-SF section: Addressing legal aspects requires a user-friendly approach with the legal wording necessitating further elaboration to facilitate comprehension. To address this challenge, it is recommended to consider including an introductory section, important disclaimers, and opportunities for users to seek clarification or comment on specific questions within a future user self-assessment questionnaire.
- Despite addressing ELSI-SF indicators and properties, all the learning resources (OSLR) should be as open as possible, considering the open licensing a recommended practice.
- Reducing subjectivity in MVS-SF. Within the MVS-SF, a pressing challenge lies in diminishing subjectivity. Striving to establish objective criteria for learners' prerequisites while aligning with diverse contexts poses a substantial challenge.

- Defining the final user of the QAF. As we explained in the introduction, this initial version of the deliverable is meant for Skills4EOSC partners. However, in the end, the Quality Assurance and Certification Framework will be intended for a wider audience of Open Science trainers and educators. We are working on this challenge in Task 2.5. Our goal is to ensure that both the training materials and the trainers themselves meet high standards. This includes making sure the trainers have the necessary skills to effectively teach others. The main users of the QAF will be these certified trainers, but also other potential creators of Open Science/ FAIR data Learning Resources.
- Establishing different levels of QAF compliance. While the primary intent of the QAF is to offer guidance during the creation of Open Science Learning Resources (OSLR), its potential as an evaluation tool for existing resources could also be explored. Although its primary role is advisory, the QAF's adaptability to serve as an evaluative instrument adds to its versatility and utility. A promising approach in refining the QAF might be introducing distinct levels of compliance. To transform the QAF into an effective certification tool, the concept of different quality levels (QAF1, QAF2, QAF3) could be adopted. For instance, QAF1 might denote adherence to essential indicators.
- The final challenge will be the comprehensive implementation of the QAF. This endeavour might encompass organizing workshops to introduce the framework and get input from a wide spectrum of stakeholders, extending beyond the Skills4EOSC project. Simultaneously, we intend to enhance the framework's comprehension by presenting it visually and/or interactively (e.g. a flowchart) on the project's website. This approach not only ensures widespread dissemination but also fosters better comprehension of the framework's nuances. Moreover, it offers the opportunity for the wider community to review and contribute to the framework's refinement based on the community insights.

## References

No	Description/Link
R1	<a href="#">MERLOT Materials</a>
R2	<a href="#">EOSC Marketplace Resources</a>
R3	<a href="#">OpenPlato,</a>
R4	<a href="#">FOSTER OPENSCIENCE</a>
R5	<a href="#">ELIXIR TESS,</a>
R6	<a href="#">EOSC Synergy Online Training Handbook,</a>
R7	<a href="#">NHS - NHS Shared Learning Quality Assurance Checklists for Evaluating Learning Objects</a>
R8	<a href="#">Online and the QLT - Quality Learning &amp; Teaching Rubric 3rd Edition (2022) Self-Review</a>
R9	<a href="#">Catalogue of Open Science Career Profiles - Minimum Viable Skillsets</a>
R10	<a href="#">Draft Methodology for FAIR-by-Design Learning Materials</a>
R11	<a href="#">Research Data Alliance (RDA) minimal metadata schema</a>
R12	<a href="#">Universal Design for Learning Guidelines</a>
R13	<a href="#">Self-Publishing Guide by BCcampus</a>
R14	<a href="#">W3C Accessibility Standards</a>
R15	<a href="#">ODD. EU Directive 2019/1024</a>

## Appendix

Here below we summarise in two tables the already existing QA and certification frameworks and learning resource catalogues considered in this document.

Lang	Title	Offered by	Yr.	Discipline	Focus (topic)
EN	<a href="#">Quality Assurance Guidelines for Open Educational Resources: TIPS Framework</a>	Commonwealth Educational Media Centre for Asia (CEMCA)	2014	Interdisciplinary	OER
EN	<a href="#">Quality assurance of online learning</a>	Asian Association of Open Universities (AAOU) Quality Assurance Framework	2019	Interdisciplinary	Online learning
EN	<a href="#">Recommendation on Open Educational Resources (OER)</a>	UNESCO	2019	Interdisciplinary	OER
EN	<a href="#">Quality Assurance of E-learning</a>	European Association for Quality Assurance in Higher Education	2010	Interdisciplinary	Online learning
ES	<a href="#">Certidigital</a>	UC3M and other Spanish universities	2022	Interdisciplinary	Online learning
EN	<a href="#">Quality assurance criteria for learning resources</a>	Alves, Renato et. al	2023	Interdisciplinary	Online learning
EN	<a href="#">EOSC Synergy Online Training Handbook</a>	EOSC-synergy - European Open Science Cloud	2022	Interdisciplinary	Online learning
EN	<a href="#">Designing a Blueprint</a>	Massachusetts Institute of Technology (MIT)	2017	Interdisciplinary	Online learning
EN	<a href="#">Considerations for quality assurance of e-learning provision</a>	European Network for Quality Assurance in Higher Education (ENQA)	2018	Interdisciplinary	Online learning



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Lang	Title	Offered by	Yr.	Discipline	Focus (topic)
EN	Ensuring Quality Open and Online Learning (eQOOL)	California State University (CSU) - MERLOT	2020	Interdisciplinary	Online learning
EN	Quality Assurance Resource Repository (QuARRy)	California State University (CSU) - MERLOT	2023	Interdisciplinary	Online learning
EN	The Quality Reference Framework (QRF)	European Alliance for the Quality of Massive Open Online Courses (MOOCs)	2019	Interdisciplinary	Online learning
EN	OpenupEd	The Open University	2014	Interdisciplinary	Online learning
EN	Quality and Standards Framework for Learning & Teaching	University of Wollongong (UOW)	2014	Interdisciplinary	Online learning
EN	European Union Digital Education Framework and Companion Evaluation Toolkit	Project Erasmus+ Dig-it	2020	Interdisciplinary	Online learning

### MERLOT Materials

### EOSC Marketplace Resources

### OpenPlato

### FOSTER OPENSOURCE

### ELIXIR TESS

Property	Info	Property	Info	Property	Info	Property	Info	Property	Info
Title	(text)	Title	(text)	Title	(text)	Title	(text)	Title	(text)
Type of resource	Materials, Members, Learning Exercises, Bookmarks...	Research step	Access Training Material						

D2.3 Community-endorsed quality assurance and certification framework for professional training and qualifications



MERLOT Materials

EOSC Marketplace Resources

OpenPlato

FOSTER OPENSOURCE

ELIXIR TESS

Property	Info	Property	Info	Property	Info	Property	Info	Property	Info
Title	(text)	Title	(text)	Title	(text)	Title	(text)	Title	(text)
<b>Discipline</b>	Academic Support Services, Business, Education, Health...	<b>Scientific categorisation</b>	Generic					<b>Scientific topic</b>	(text)
<b>Descr. of resource</b>	(text)	<b>Descr. of resource</b>		<b>Information</b>	(text)	<b>Information</b>	(text)	<b>Descr. of resource</b>	(text)
		<b>Learning Outcomes</b>	(text)	<b>Learning Outcomes</b>	(text)	<b>Learning Outcomes</b>	(text)		
				<b>Program</b>	(text)	<b>Preview</b>	(text)		
<b>Material Type</b>	Animation, Assessment Tool, Case Study, Collection...	<b>Resource type</b>	Activity plan, recorded lesson, supporting document...	<b>Learning resource types</b>	Activity Plan, Assessment Item, Educator Curriculum Guide...			<b>Resource type</b>	Slides, Video, E-learning, Training materials, Documentation...
<b>Technical format</b>	Audio File, Common Cartridge,	<b>Material type</b>	slides, text, video, image						

D2.3 Community-endorsed quality assurance and certification framework for professional training and qualifications



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Property	Info	Property	Info	Property	Info	Property	Info	Property	Info
Title	(text)	Title	(text)	Title	(text)	Title	(text)	Title	(text)
	Document, Executable Program...								
<b>Primary Audience</b>	Pre-K, Grade School, Middle School, High School, College General Ed, College Lower Division...	<b>Target group</b>	students, research groups, research organisations, research communities, research projects, funders, providers...	<b>Target groups</b>	Citizen Scientists, Data Stewards, IT Professionals, Librarians, Policy Makers, Research Support...	<b>Audience</b>	Researchers and Students, Librarians and Repository managers, Policy makers...	<b>Target audience</b>	Students, Researchers, Biologists, Genomicists, Computer Scientists, Post-DocFellows...
								<b>Tool</b>	Bioconductor, REDCap, Data Stewardship Wizard, COPASI, RStudio...
								<b>Operation</b>	Data handling, Data retrieval, Modelling and

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Property	Info	Property	Info	Property	Info	Property	Info	Property	Info
Title	(text)	Title	(text)	Title	(text)	Title	(text)	Title	(text)
									simulation...
<b>Mobile Platform</b>	Android, Blackberry, iOS (Apple), Windows Mobile								
		<b>Resource organisation</b>	eosc.openaire, eosc.athena...	<b>Category</b>	OpenAIRE, Data Research Management, EOSC Providers, EOSC End-Users...				
		<b>Providers</b>	eosc.openaire, eosc.athena...			<b>Content providers</b>	(name, logo, description and link)		
		<b>Duration</b>	Hours: from 0 to +40h	<b>Estimated work (hours)</b>	0-20 h, 20-60 h, 60-100 h, 100+ h				
<b>Authors</b>	Name/s (text)	<b>Authors</b>	Name/s (text)	<b>Authors</b>	Name/s (text)	<b>Authors</b>	Name/s (text)	<b>Authors</b>	Name/s (text)
<b>Submitter</b>	Name/s (text)							<b>Contributor</b>	Name/s (text)
<b>Material Quality</b>	Peer Review, Editor Review, Member Comment...					<b>Reuse this course</b>	SCORM		



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Property	Info	Property	Info	Property	Info	Property	Info	Property	Info
Title	(text)	Title	(text)	Title	(text)	Title	(text)	Title	(text)
		<b>Access right</b>	Open Access			<b>Usage rights: CC 0</b>			
<b>Licence</b>	Any Creative Commons Creative Commons Zero	<b>Licence</b>	CC BY 4.0	<b>Licence</b>	CC-0 (Public Domain), CC-BY-NC-ND, CC-BY-NC-SA...	<b>Licence</b>	Unless otherwise stated, CC-Attribution4.0	<b>Licence</b>	Not Specified, CC Attribution 4.0...
<b>Cost involved</b>	Yes No Not specified								
<b>Source code available</b>	Yes No Not specified								
<b>Language</b>	Many (text)	<b>Language</b>	English	<b>Language</b>	Many (text)	<b>Languages</b>	English (EN), Spanish (ES), German (DE)...		
<b>CEFR/ACTFL</b>	Any, CEFR: A1...								
		<b>Level of expertise</b>	beginner, all	<b>Expertise level</b>	"all"	<b>Level of knowledge</b>	Introductory: aware of, Introductory: no previous		Not specified, Beginner, Intermediate,

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Property	Info	Property	Info	Property	Info	Property	Info	Property	Info
Title	(text)	Title	(text)	Title	(text)	Title	(text)	Title	(text)
							knowledge required		Advanced
Date Added to MERLOT	(date)	Version date	(date)			Publication year	(year)		
Date Modified in MERLOT	(date)								
				Next course dates	(text)				
Keywords	(text)	Keywords	(text)	Keywords	(text)	Topics	RRI, Open Science, Open Data, Ethics, RDM...	Keywords	(text)
Other Filters	Has Course ePortfolios, Has Accessibility Info, Is for Partners only, Is part of Leadership							Node	Norway, Switzerland, Denmark, Portugal
								Standard database or policy	NCBI Gene, Ensembl, OBO Foundry...

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Property	Info	Property	Info	Property	Info	Property	Info	Property	Info
Title	(text)	Title	(text)	Title	(text)	Title	(text)	Title	(text)
	Library								
<b>Accessibility info</b>	YES/NO and number								
		<b>Geographical availability</b>	Europe, World...						
<b>Awards</b>	MERLOT Classic, Editor's choice...					<b>Certified by</b>	FOSTER, OpenAIRE, FIT4RRI		
<b>Browse...</b>	People who viewed this also viewed... , Other materials like...					<b>Similar resources</b>	(links)	<b>Related resources</b>	DS Wizard ELIXIR-Norway, RCN Open data policy, RDMkit
<b>Authored by member of Minority Serving Institution In US</b>	AANAPISI, HBCU, HSI, TCU...								

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Property	Info	Property	Info	Property	Info	Property	Info	Property	Info
Title	(text)	Title	(text)	Title	(text)	Title	(text)	Title	(text)
MERLOT catalogue's QA policies		EOSC Marketplace catalogue's QA policies		OpenPlato's catalogue QA policies		FOSTER catalogue's QA policies		ELIXIR TESS catalogue's QA policies	
<a href="#">Policies and Practices</a>		<a href="#">Data Model documentation</a>	<a href="#">EOSC Portal Profiles documentation</a>	<a href="#">Quality Assurance OpenPLATO</a>		<a href="#">Privacy policy</a>	<a href="#">Accessability</a>	<a href="#">Registering Resources in TeSS</a>	<a href="#">Widgets &amp; API</a>