

Bringing synergy to better data management and research in Europe

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Welcome to the course!

In this course, you will be introduced to Open Science and related initiatives, such as the European Open Science Cloud (EOSC) and FAIR principles. By watching a series of recorded videos by experienced professionals from the field, you will be up to speed with innovative services and research data management approaches to help you do better research.

The course consists of eight modules:

1. What is Open Science?
2. What is European Open Science Cloud (EOSC)?
3. EOSC in practice: EOSC Synergy
4. EOSC in practice: Facilitating software quality assurance across EOSC services
5. EOSC in practice: Integrating resources into EOSC
6. Introduction to research data management
7. FAIR principles
8. Data management plans

By the end of this course you will:

1. Have a basic understanding of EOSC and Open Science in relation to the EOSC Synergy project.
2. Be familiar with key concepts and practical tools for FAIR data and data management.
3. Be aware of best practices in research data management and practical tools.

As these modules are introductory, you can choose to follow all of them or pick the ones that are most relevant to you.

Each module takes on average 30 minutes to complete, requiring around 4 hours to complete the entire course. Next to recorded video presentations, you will have full scripts, PowerPoint presentations and a number of learning activities and online resources to guide your learning.

Good luck!

EOSC Synergy's Learning and Skills Team

Activity 1: Forum

Before starting the course, let others know who you are and what you would like to learn in this course. Feel free to post your questions and comments while respecting others.



Module 1: What is Open Science?

In this module you will learn about the Open Science movement and its principles. We will also look at the practical advantages of embracing these principles and present some easy steps to join the movement.

By the end of this module, you will be able to:

- Define the concepts of Open Science and Open Access.
- Explain the benefits of Open Science practices from a researcher's and society's perspective.
- Start practicing Open Science.

Video presentation

Watch the introductory video and find out what the Open Science movement is about and how it helps you as a researcher or society in general.

YouTube link: <https://youtu.be/TpR358MqhlG>

Learning activities

Activity 1: Forum

After watching the videos, think of some Open Science practices you have already been using in your research. What are they? Do they help you in your research? What can you still do better?

Activity 2: Increase your visibility as a researcher

Distinguish yourself from every other researcher with the same or a similar name to you and gain the credit for your work. There are different ways to do so. Check out the following options:

- If you don't have one yet, create an ORCID ID (Open Researcher and Contributor ID). ORCID ID gives you a way to reliably, unambiguously and permanently connect your name(s) with your work.
- Alternatively, go to Researcher ID, sign up and complete your profile. If you already have made an ORCID ID you can link Researcher ID to that.
- In addition, you can increase your findability by using Google. First, create a Google account. Go to Google Scholar, make sure you are logged in and click "My Citations". Follow instructions to create your profile and add or remove publications that are yours or not yours.



If you want to find out more how you can enhance your visibility, check out this page.

Activity 3: Find open access policies of journals

Find out about open access policies of scientific journals and better plan your research:

- Go to [Sherpa Romeo website](#).
- Enter a journal title, for example, Journal of Structural Biology.
- Look up the open access policy of the journal. What does it say? What do you need to keep in mind before, during, and after publishing in your selected journal?

Activity 4: Archive your research

Research publications and underlying research data can often be shared in free open repositories. Copies of journal articles are often shared in open repositories as well as being published in the academic journals themselves (subject to licence agreements). Some repositories hold publications only, whereas others hold data as well as publications. Learn how to share and archive your research outputs in easy steps:

- **Explore a publications repository.** Go to [EOSC Synergy Spanish Landscaping Report](#) at DIGITAL.CSIC, the online open access repository of research produced by the Spanish National Research Council. Check out the details and download the report. Notice the Description shows a Creative Commons licence showing the report can be shared with attribution.
- **Explore data and publications repositories.** Go to the generic data repositories, such as [Zenodo](#), [OSF](#) or [Figshare](#) and explore their collections. Notice that in Zenodo, for example, you will see the type of resource deposited (Publication, Report, Dataset, Software etc).
- **Upload to a repository.** Choose a recent paper, poster or presentation of your own and create a digital object identifier (DOI) by publishing in a repository of your choice. You will need to register to deposit.

Learning resources

- **PowerPoint presentation**
- **Video script**

Documentary Paywall: The Business of Scholarship

Watch the widely acclaimed documentary [Paywall: The Business of Scholarship](#) by Jason Schmitt about the political economy of academic publishing.



Module 2: What is European Open Science Cloud?

The European Open Science Cloud (EOSC) will unleash a wide range of opportunities for researchers across Europe. In this module you will discover what this programme means in practice and how you will be able to benefit from it.

By the end of this module you will be able to:

- Define the European Open Science Cloud (EOSC) programme.
- Explain the key benefits and challenges of the EOSC.

Video presentation

Listen to the presentation of João Mendes Moreira, Head of Scientific Information at the National Funding Agency for Science, Research and Technology in Lisbon, Portugal. Find out what the European Open Science Cloud (EOSC) is and why it matters.

YouTube link: <https://www.youtube.com/watch?v=xzAzKD-KQn0&t=2s>

Learning activities

Activity 1: Quiz on EOSC

After watching the video, take a quiz and test your knowledge on EOSC.

Activity 1: Quiz

Listen to the presentation of João Mendes Moreira, Head of Scientific Information at the National Funding Agency for Science, Research and Technology (FCCN) in Lisbon, Portugal. Select correct answers to the following questions:

1. In the video, João Mendes Moreira speaks about the following benefits of the EOSC:
 - a) The EOSC will support researchers with scholarships.
 - b) The EOSC will enable building new knowledge.**
 - b) The use and reuse of cross-disciplinary data will become more effective.**
 - c) The EOSC will be a physical place for researchers to work with data.
2. The EOSC is an innovative programme with the potential to transform research and innovation in Europe significantly. What are some of the challenges for this programme?
 - a) The challenge is to have service providers align their services with the EOSC.**
 - b) Researchers will have to do research in new ways.**



- c) European universities will have to buy new machinery and equipment.
 - d) All of the above.
3. Next to delivering groundbreaking research and insights, the EOSC has a broader ambition. What is this ambition?
- a) Create a national network of services and infrastructures for better science in Brussels.
 - b) Become one of the official EU institutions for data.
 - c) Make all research data open to everyone without exceptions.
 - d) **Become a European data and knowledge economy.**

Activity 2: Reflection

Watch the video “European Open Science Cloud – The New Frontier of Data-Driven Science”. Reflect on the following questions:

- What is the role of the EOSC in tackling global issues? What relevant examples are used to illustrate this?
- Making data open poses a number of challenges to researchers as well as other stakeholders. What are some of these challenges? What could be the ways to address them?
- "The more people use the same dataset, the more valuable it becomes." What does this statement mean? Do you agree/disagree?

Learning resources

- Video script
- PowerPoint presentation



Module 3: EOSC in practice: EOSC Synergy

After learning about the European Open Science Cloud (EOSC), we delve deeper into some services this programme will offer to researchers throughout Europe.

By the end of this module you will be able to:

- Identify the underlying reasons behind EOSC Synergy and its innovative thematic services in the wider context of the European Open Science Cloud.
- Understand what thematic services EOSC Synergy will offer to end users.
- Understand the added value of thematic services to end users.

Video presentation

One of the EOSC initiatives, EOSC Synergy, will provide researchers with a number of innovative services to make their research even more reliable and faster across different scientific domains. Watch the video below and learn more about EOSC Synergy and its services.

YouTube link: <https://www.youtube.com/watch?v=RVCxjhpsIVs>

Learning activities

Activity 1: Quiz on EOSC Synergy

After watching the video, take a short quiz to test your knowledge about EOSC Synergy.

Activity 1: Quiz on EOSC Synergy

After watching the video, take a short quiz to test your knowledge about EOSC Synergy.

1. How does EOSC Synergy support the vision of EOSC in practice?
 - a) By providing digital technologies to deliver services to researchers, complying with the transparency and openness principles.
 - b) By supporting observational, experimental and simulated data by latest technologies for transfer and storage.
 - c) By supporting advanced research projects by cutting-edge computing infrastructures.
 - d) By creating state-of-the-art software to enable technology, and streamline collaboration to solve fundamental problems in science and societal challenges.
 - e) **All of the above.**



2. What are some of the practical examples of transparency and openness to which EOSC-Synergy is committed?
 - a) Use of open-source software.
 - b) Making services open to all European researchers.
 - c) Making services freely available to all European researchers.
 - d) Integrating scientific applications in the EOSC federation services.
 - e) **All of the above.**

3. EOSC-Synergy set up the first EOSC-enabled service in March 2020. What was the idea behind this service?
 - a) To detect water using satellites, unmanned aerial vehicles and in-situ data.
 - b) To integrate the Earth Sciences' datasets within EOSC.
 - c) To support community-led scientific benchmarking efforts across different domains in the life sciences.
 - d) **To support the analysis of genomic data related to the COVID-19 pandemic on Cloud infrastructures.**

4. How many thematic services will EOSC-Synergy offer to the scientific community?
 - a) 5
 - b) 20
 - c) **10**
 - d) 12

5. Which of the following scientific areas cover the EOSC-Synergy services?
 - a) Biomedicine, Astrophysics, and Nuclear Engineering
 - b) **Earth Observation, Environment, Biomedicine, and Astrophysics**
 - c) Architectural Planning, Environment, and Astrophysics
 - d) Earth Observation, Aerospace Engineering, Environment, and Biomedicine

Activity 2: Thematic services

Find out more about the thematic services the EOSC-Synergy team is working on. Answer the following questions:

- What thematic services does EOSC Synergy cover? Which services are relevant to your field/work?
- If you work in a different field than the thematic services of EOSC Synergy, is there any thematic service that addresses some challenges and issues that are similar to your field? Which thematic service(s) is it? What are the challenges and issues?



Activity 3: Case study and quiz

Dr Alberto Azevedo from the National Laboratory for Civil Engineering in Portugal (LNEC) explains the development of the innovative service for water management, highlighting its main characteristics and the value it brings to end-users. Read the case study and test your knowledge by completing a short quiz.

Activity 3: Quiz accompanying the case study

Check your understanding of the case study by completing a short quiz.

1. Which of the following subjects is not addressed by WORSICA?
 - a) helps evaluate the volume of water in lakes
 - b) helps to predict weather**
 - c) useful for building marinas
 - d) helps solve leak problems
2. Which of the following statements about WORSICA are false?
 - a) The project will be scaled up on the national level in Portugal.**
 - b) The user will be able to run all offered services in their computer's browser.
 - c) The service will be available for European researchers at a reduced rate.**
 - d) The international cluster will take care of all the computational and management costs related to the service.
3. Thanks to EOSC Synergy, WORSICA benefits from:
 - a) Improvement of the technical aspects of the service.**
 - b) Establishment of a national office in Portugal.
 - c) Scaling up the service in Portugal and France.
 - d) Adaptation of the service to other European Open Science Cloud services.**

Activity 4: National EOSC landscape

EOSC-Synergy is a regional project involving eight European countries. Take a look at the recent country landscape infographics and find out more about the progress of different countries in achieving the European Open Science Cloud (EOSC) on a national level:

- What policies and strategies do these countries have?
- How high is EOSC awareness among researchers and decision makers?
- What maturity level have these countries reached in terms of getting closer to EOSC?



- If you are from one of the countries participating in EOSC, do you agree with the statements? If you do not agree, do you think your government would take a similar stand?

For further information and details, browse through national landscape reports that are available on infographics pages.

Learning resources

- Video script
- PowerPoint presentation



Module 4: EOSC in practice: Facilitating software quality across EOSC services

Today, researchers generally agree that software is a key pillar of Open Science. To ensure software quality across EOSC services, EOSC Synergy facilitates researchers and computational scientists by providing them with Software Quality Assurance as a Service (SQA-as-a-Service).

By the end of this module you will be able to:

- Explain the function of software quality assurance for EOSC services.
- Define the benefits of the baseline criteria for the quality assurance of software and services.

Video presentation

Learn more how EOSC Synergy facilitates researchers and computational scientists in the video by Pablo Orviz (Spanish National Research Council and the Institute of Physics of Cantabria).

YouTube link: <https://www.youtube.com/watch?v=1FJaBNrJ8XM&t=2s>

Learning activities

Activity 1: Quiz on software quality assurance

Take a short quiz to test your knowledge about software quality assurance across EOSC services.

1. Which of the following objectives is not relevant to the baseline criteria for the quality assurance of software and services?
 - a) Fostering good practices for developing a source code.
 - b) Enabling researchers to analyse and assess the quality of software-based EOSC services.
 - c) Developing a national policy for software development.**
 - d) Achieving customer satisfaction with EOSC services.
2. What are the main benefits of the SQA-as-a-Service platform?
 - a) The end user receives an automatically generated software code.
 - b) A report and a digital badge demonstrate the quality of the source code of the end user.**

- c) **The end user can customise their own baselines with the criteria they want to apply to their code.**
- d) **The end user can select their criteria for the software code.**

3. According to Pablo Orviz, one of the biggest challenges to complying with quality assurance for software and services is:

- a) Financial
- b) **Cultural**
- c) Physical
- d) None

Learning resources

- Video script
- PowerPoint presentation



Module 5: EOSC in practice: Integrating resources into EOSC

Making research services and resources available and widely usable across Europe is one of the main goals of realising EOSC. In this module we discuss what the federated structure, such as EOSC is, why it matters, and how it works.

By the end of this module, you will be able to:

- Understand what a federated structure, such as the European Open Science Cloud (EOSC) is, why it matters, and how it works.
- Identify the key aspects of IT service (resource) management in relation to the EOSC portal.
- Understand the concept of resource integration into EOSC.
- Distinguish between different steps of EOSC integration.

Video presentation

Are you a service provider or you simply want to learn more about EOSC and how to make services and resources available on the EOSC portal? Watch these three introductory video presentations by Matti Heikurinnen, Strategy and Innovation Officer from the EGI Foundation in the Netherlands and be up to date with the latest developments.

Description: EOSC as a federation (part 1)

In order to facilitate open science, EOSC needs to be a well-integrated federation. In other words, users should be able to find services in one place and trust them. Learn more by watching the video.

YouTube link: <https://www.youtube.com/watch?v=SHlesZliwwk&t=2s>

Description: Integrating services or resources into EOSC (part 2)

What is the difference between services and resources? What role does IT service (resource) management play in relation to the EOSC portal? Learn more by watching the video.

YouTube link: <https://www.youtube.com/watch?v=DFsa0cqboec&t=2s>

Description: Process for connecting resources into EOSC (part 3)

How do I get my service or resource on the EOSC portal? What should I know before I start? Learn more by watching the video.

YouTube link: <https://www.youtube.com/watch?v=hHLLpSKpJF4>



Learning activities

Activity 1: Quiz on integrating resources into EOSC

After watching the video, take a short quiz to test your knowledge.

(Video 1: EOSC as a federation)

1. According to Gartner research, 80% of the service outages are due to issues related to:
 - a) People and software
 - b) Hardware and processes
 - c) Lack of time and funding
 - d) People and processes**

2. What is one of the main reasons for service providers to use EOSC?
 - a) It develops the service.
 - b) It makes a service future-proof.
 - c) It reduces time and effort spent on dealing with users.**
 - d) It guarantees a business model.

3. Why does EOSC as a federation require a high level of integration?
 - a) The user has to be able to find services in the same place.
 - b) The user should trust the quality of the service.
 - c) The user should trust the available support.
 - d) All answers are correct.**

(Video 2: Integrating resources into EOSC)

4. Which of the following is not a prerequisite for integrating resources into EOSC
 - a) Registering the service provider
 - b) Describing the resources in a way that make sense to potential new users
 - c) Getting training and certification on IT Service Management (e.g. according to FitSM or ITIL)**
 - d) Assigning a security contact point

5. What is the fastest way to learn more about the foundations of the EOSC IT Service Management
 - a) Take a certified engineering course
 - b) Register on an online shop of a standards body and purchase the relevant standards documents



- c) **Go to <https://www.fitsm.eu/> and browse downloads section for standards, training course slide decks and other supporting material**
- d) Hire a consultant

4. The added value of EOSC integration is based on:

- a) Common standards and approaches to managing resource lifecycle
- b) Making the service more visible to new users
- c) Providing a common framework for documenting and ensuring that the resources (especially data resources) are as FAIR as possible
- d) **All of the above**

(Video 3: Process for connecting resources)

5. Which of the following will be a factor when deciding whether to accept a resource for integration?

- a) **Criteria documented in the Rules of Participation document**
- b) Expiration date of the credit card
- c) Whether the service logo fits the EOSC portal graphical standards
- d) Number of LinkedIn followers of the service provider

6. What is the correct order of resource integration steps?

- a) Resource description -> resource review -> provider registration -> order management description
- b) **Provider registration -> Resource description -> resource review -> order management description**
- c) Order management description -> resource description -> provider registration -> resource review

7. What are the benefits of EOSC profiles and the supporting tools?

- a) Freely available for anyone intending to integrate resources to EOSC
- b) Support EOSC and also help launching thematic, community-run registries
- c) Encouraging standardisation of resource descriptions and integration processes across different registries (option to interoperate and/or integrate)
- d) **All of the above**

Learning resources

- **Video script**
- **PowerPoint presentation**



Module 6: Introduction to research data management

Have you ever considered how research data management can help you become more effective, transparent and achieve better results? You will learn more about that in this module.

By the end of this module, you will be able to:

- Understand the importance of managing research data.
- Understand how the most important players in research data management (RDM) can influence research.
- Identify different types of research data within different disciplines.
- Understand what RDM entails when looking at a research data lifecycle.

The video material has been imported from Holmstrand, K.F., den Boer, S.P.A., Vlachos, E., Martínez-Lavanchy, P.M., Hansen, K.K. (Eds.) (2019). Research Data Management (e-Learning course). doi:[10.11581/dtu:00000047](https://doi.org/10.11581/dtu:00000047)

Video presentation

Watch this introductory video from the eLearning course in Research Data Management brought by the Danish National Forum for Data Management.

YouTube link:

https://www.youtube.com/watch?time_continue=8&v=wK4o7iliJHQ&feature=emb_logo

Learning activities

Activity 1: Quiz on research data management

After watching the video, take a quiz to test your knowledge about research data management.

1. According to a recent study of IBM, the percentage of the world's data which was created during the past two years equals to:
 - a) 50%
 - b) 85%
 - c) **90%**
 - d) 45%
2. Thanks to the modern technologies for accessing, transferring, and analysing data, researchers have opportunities to collaborate and advance research more rapidly as long as their data is:



- a) **Of high quality**
 - b) **Well described**
 - c) **Well structured**
 - d) Stored locally
 - e) **Properly stored**
 - f) **Made available to others**
3. Researchers are encouraged to share their data. However, not all data can be made publicly available by default. Based on the video, what justification can be used to not share data?
- a) Personal preference
 - b) **Data contains personal information**
 - c) Raw data
 - d) **Confidentiality agreements**
 - e) **Copyrights**
4. Keeping in mind the purpose of research data, which of the following can be defined as research data?
- a) Laboratory samples
 - b) Drafts of scientific papers
 - c) **Flight records**
 - d) Communication with colleagues
 - e) **Media texts**
5. After listening to the researchers sharing their experiences about research data management, indicate which of the following statements is false?
- a) Research data management helps prevent sloppy science.
 - b) Research data management allows to build on existing datasets saving time and costs.
 - c) **Research data management only applies externally funded research projects.**
 - d) Research data management allows to be transparent how you built your datasets.
 - e) Research data management allows the reuse of data.

Module 7: FAIR principles

The increasing availability of online resources means that data need to be created with a long-term perspective in mind. Providing other researchers with access to your data facilitates knowledge discovery and improves research transparency.

By the end of this module, you will be able to:

- Identify key elements that help make research data discoverable, accessible, interoperable and reusable.
- Understand how these key elements are used in different research disciplines and different research workflows.
- Distinguish between FAIR data and open data.

The video material has been imported from Holmstrand, K.F., den Boer, S.P.A., Vlachos, E., Martínez-Lavanchy, P.M., Hansen, K.K. (Eds.) (2019). Research Data Management (e-Learning course). doi:[10.11581/dtu:00000047](https://doi.org/10.11581/dtu:00000047)

Video presentation

Watch this introductory video from the eLearning course in Research Data Management brought by the Danish National Forum for Data Management.

YouTube link: <https://www.youtube.com/watch?v=hxK09n52-mA>

Learning activities

Activity 1: Quiz on FAIR principles

After watching the video, take a quiz to test your knowledge about FAIR principles.

1. What is FAIR about?
 - a) Official guidelines for data management
 - b) Exclusively open data
 - c) A set of best practices for sharing research data**
 - d) Mandatory research standards
2. What is open data?
 - a) A practice of sharing data except for restrictions from copyright, patents or other mechanisms of control.
 - b) Data that can be freely used, shared and built on by anyone, anywhere and for any purpose.**



- c) Exclusively scholarly journal data.
- d) None of the above

Read the following statements and select the incorrect ones. In FAIR:

3. “F” implies that:

- a) Others can discover your data.
- b) Your data is published in a scholarly journal.**
- c) Only machines can read your data.**
- d) Others can access your data.

4. “A” implies that:

- a) Your data can be made available to others.
- b) Everyone can access and use all of your data.**
- c) Your data is stored locally.**
- d) Your metadata is understandable to machines.

5. “I” implies that:

- a) Your data can be integrated with other data or it can be easily used by machines.
- b) Your data uses vocabularies that follow any principles.**
- c) Your data can only be used by humans.**
- d) Your data can be integrated within a single research domain.**

6. “R” implies that:

- a) Your data can be used for new research.
- b) Your data should specify the conditions under which the data can be used by machines.
- c) A Creative Commons licence should always be linked to your data.
- d) Your data should be reused only by you.**

7. If you cannot share your data openly, you should:

- a) Do nothing as you cannot share your data by default.
- b) Publish your data in a trustworthy digital repository.
- c) Present your data to a selected audience.
- d) Create and publish a description of your data, so that researchers with a relevant purpose can request permission to reuse the data.**

8. What are the key motivations for establishing the FAIR principles?



- a) Better research output
- b) More value to publicly funded research
- c) Improved peer-review process
- d) High research integrity
- e) **All of the above.**

Activity 2: Data repositories and FAIR

Data repositories provide an easy way to publish your data following the FAIR principles. They play a central role in making your data discoverable for reuse by others or finding someone else's data.

Think of or find a specific dataset, e.g. something related to your research domain. You can use the websites below to search for a preferred repository (think of the domain and trustworthiness) where you can find a dataset:

- re3data <https://re3data.org>
- FAIRshairing <https://fairsharing.org>
- Data Deposit Recommendation Service (DDRS) <https://ddrs-dev.dariah.eu/ddrs/>
- Repository Finder <https://repositoryfinder.datacite.org>

Alternatively, choose one of the two datasets below:

- <https://bit.ly/CycloneData>
- <https://bit.ly/3wPIHWy>

Go to <https://fairaware.dans.knaw.nl> and check the FAIRness of the dataset (if you prefer to use the French version, click here <https://doranum.fr/enjeux-benefices/outil-fair-aware>). The test will take between 10 and 30 minutes depending on your current knowledge. If you use the suggested datasets above, replace “Are you aware that...” with “Do you think that the data creator was aware that...”

Interesting fact. CycloneData won a Dutch Data Award 2020. See <https://bit.ly/3gXwx7t>



Module 8: Data management plans

As you have learned from the previous modules, research data management has numerous benefits for you as a researcher as well as others who use your research data. Find out how you can benefit even more as a researcher by developing a data management plan.

By the end of this module, you will be able to:

- Understand the added value of making data management plans in research projects.
- Identify challenges in projects related to research data management.
- Identify stakeholders who require a DMP and know how to start making a DMP, including what topics to cover.

The video material has been imported from Holmstrand, K.F., den Boer, S.P.A., Vlachos, E., Martínez-Lavanchy, P.M., Hansen, K.K. (Eds.) (2019). Research Data Management (e-Learning course). doi:[10.11581/dtu:00000047](https://doi.org/10.11581/dtu:00000047)

Video presentation

Watch this introductory video from the eLearning course in Research Data Management brought by the Danish National Forum for Data Management (21 min).

YouTube video: https://www.youtube.com/watch?v=tv55_X5rn8w

Learning activities

Activity 1: Quiz on data management plans

After watching the video, check your knowledge of data management plans by doing a quiz. Read the statements and select the correct answer(s).

1. A research data lifecycle:
 - a) Ensures all relevant stakeholders are aware of your research.
 - b) Specifies data management tasks throughout a research project.**
 - c) Guarantees external funding for your research.
 - d) Demonstrates that research data is a valuable resource in itself.**
2. A data management plan involves the following elements:
 - a) Improves access, discovery and reuse of your research.
 - b) Defines the storage and preservation of data.
 - c) Establishes data maintenance and documentation practices.
 - d) All of the above.**

3. When collecting or creating research data you should do it in a way, so that others can understand your data and reuse it, for example by using:
 - a) Standardised methods
 - b) Common data formats
 - c) Quality control
 - d) Documentation
 - e) **All of the above**

4. Processing and analysing data includes the following elements:
 - a) **Cleaning and validating**
 - b) **Transcribing and translating**
 - c) Interviewing and recording
 - d) **Anonymising**

Activity 2: Storing your research data

In the planning phase, you should ensure appropriate and secure storage solutions for your data. Find your institution's policy on research data storage. If you can't find any relevant documents, reflect on these questions:

Where can you store your data?

- Is the data frequently and safely backed up?
- Who is responsible for storage, back-up and security of your data?
- How do you prevent unauthorised access to your data, if relevant?

Learning resources

Data management planning tools

A data management plan or DMP is a formal document that outlines how data is to be handled both during a research project, and after the project is completed. There are different tools to help researchers develop a data management plan, such as:

- **DMPonline**. It's a free tool that helps to write, share and export a data management plan. It offers built-in data management plan templates for many major funders. The tool is provided by the Digital Curation Centre (DCC). <https://dmponline.dcc.ac.uk>
- **ARGOS**. This is a joint effort of OpenAIRE and EUDAT, offering a free service for creating and publishing data management plans. <https://argos.openaire.eu>
- **Data Stewardship Wizard**. This is a joint ELIXIR CZ and ELIXIR NL initiative, helping researchers to build their own data management plans. <https://ds-wizard.org/>



If you are interested in seeing examples of filled in data management plans, you may want to check out the following resources:

- Data management plans created using the **DMPonline tool** and shared publicly by their owners. https://dmponline.dcc.ac.uk/public_plans.
- You can find additional resources, including more examples of filled in DMPs, checklists and guidance on the website of the Digital Curation Centre (DCC). <https://www.dcc.ac.uk/dmps>
- Examples of filled in DMPs and a checklist with DMP related questions for additional guidance can be found in the **CESSDA Data Management Expert Guide**. <https://www.essda.eu/Training/Training-Resources/Library/Data-Management-Expert-Guide/1.-Plan/Adapt-your-DMP-Part-1>

Completion

Congratulations on completing the course!

Thank you for taking our course. We hope that our course met your expectations and that you have deepened your knowledge in a number of areas that are relevant for your work and career.

If you have any suggestions or comments, please feel free to leave them in the forum on the 'Welcome' page or drop us an e-mail at linas.cepinskas@dans.knaw.nl. Please feel free to refer your colleagues and friends to the course.

Last but not least, you are free to use all our materials under CC BY 4.0 licence with the attribution to the authors unless otherwise stated.



Contributors and sources

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- Maaïke Verburg, Research Data Management Specialist, Data Archiving and Networked Services, the Netherlands.

Module 1: What is Open Science?

- Script, video, and PowerPoint presentation: Linas Cepinkas, Policy Officer, Data Archiving and Networked Services, the Netherlands, 2021.
- Learning activities 1 and 2: Linas Cepinkas, Policy Officer, Data Archiving and Networked Services, the Netherlands, 2021.
- Learning activities 3 and 4 as well as a learning resource have been adapted from ORION MOOC for Open Science in the Life Sciences. <http://tiny.cc/ORIONMOOC2>, 2021.

Module 2: What is European Open Science Cloud (EOSC)?

- Video: João Mendes Moreira, Head of Scientific Information, Foundation for Science and Technology (FCT), FCCN Unit, Portugal, 2021.
- Script editing and PowerPoint presentation: Linas Cepinkas, Policy Officer, Data Archiving and Networked Services (DANS), the Netherlands, 2021.
- Learning activities 1 and 2: Linas Cepinkas, Policy Officer, Data Archiving and Networked Services (DANS), the Netherlands, 2021.

Module 3: EOSC in practice: EOSC Synergy

- Video: EOSC Synergy, 2020.
- PowerPoint presentation: Linas Cepinskas, Policy Officer, Data Archiving and Networked Services (DANS), the Netherlands, 2021.
- Learning activities 1-4: Linas Cepinskas, Policy Officer, Data Archiving and Networked Services (DANS), the Netherlands, 2021.
- Case study: Alberto Azevedo, Assistant Researcher, National Laboratory for Civil Engineering (LNEC), Portugal with Linas Cepinskas, Policy Officer, Data Archiving and Networked Services (DANS), the Netherlands, 2021.

Module 4: EOSC in practice: Facilitating software quality assurance across EOSC services

- Video: Pablo Orviz, Spanish National Research Council and the Institute of Physics of Cantabria, Spain, 2021.
- Script editing, PowerPoint presentation and learning activity 1: Linas Cepinskas, Policy Officer, Data Archiving and Networked Services (DANS), the Netherlands, 2021.

Module 5: EOSC in practice: Integrating resources into EOSC

- Video, PowerPoint presentation and learning activity: Matti Heikurinnen, Strategy and Innovation Officer at the EGI Foundation, the Netherlands, 2021.
- Script and PowerPoint presentation editing: Linas Cepinskas, Policy Officer, Data Archiving and Networked Services (DANS), the Netherlands, 2021.
- Learning activity 1: Matti Heikurinnen, Strategy and Innovation Officer, EGI Foundation, the Netherlands, 2021.

Module 6: Introduction to research data management

- Video: Holmstrand, K.F., den Boer, S.P.A., Vlachos, E., Martínez-Lavanchy, P.M., Hansen, K.K. (Eds.) (2019). Research Data Management (e-Learning course). doi:[10.11581/dtu:00000047](https://doi.org/10.11581/dtu:00000047)
- Learning activity 1: Linas Cepinskas, Policy Officer, Data Archiving and Networked Services (DANS), the Netherlands, 2021. The quiz is based on the video by Holmstrand, K.F., den Boer, S.P.A., Vlachos, E., Martínez-Lavanchy, P.M., Hansen, K.K. (Eds.) (2019). Research Data Management (e-Learning course). doi:[10.11581/dtu:00000047](https://doi.org/10.11581/dtu:00000047).

Module 7: FAIR principles

- Video: Holmstrand, K.F., den Boer, S.P.A., Vlachos, E., Martínez-Lavanchy, P.M., Hansen, K.K. (Eds.) (2019). Research Data Management (e-Learning course). doi:[10.11581/dtu:00000047](https://doi.org/10.11581/dtu:00000047)

- Learning activities 1-3: Linas Cepinskas, Policy Officer, Data Archiving and Networked Services (DANS), 2020 with adaptation from Grootveld, Marjan, Herterich, Patricia, Dimper, Rudolf, Rouchon, Olivier, Verburg, Maaïke, & Sutton-Long, Peter. (2021, June). How repositories can increase their FAIR share. Presented at the Open Repositories 2021 (OR 2021). doi: <http://doi.org/10.5281/zenodo.4913179>. The quiz is based on the video by Holmstrand, K.F., den Boer, S.P.A., Vlachos, E., Martínez-Lavanchy, P.M., Hansen, K.K. (Eds.) (2019). Research Data Management (e-Learning course). doi:[10.11581/dtu:00000047](https://doi.org/10.11581/dtu:00000047).

Module 8: Data management plans

- Video: Holmstrand, K.F., den Boer, S.P.A., Vlachos, E., Martínez-Lavanchy, P.M., Hansen, K.K. (Eds.) (2019). Research Data Management (e-Learning course). doi:[10.11581/dtu:00000047](https://doi.org/10.11581/dtu:00000047)
- Learning activities 1-2 and a learning resource: Linas Cepinskas, Policy Officer, Data Archiving and Networked Services (DANS), the Netherlands, 2021. The quiz is based on the video by Holmstrand, K.F., den Boer, S.P.A., Vlachos, E., Martínez-Lavanchy, P.M., Hansen, K.K. (Eds.) (2019). Research Data Management (e-Learning course). doi:[10.11581/dtu:00000047](https://doi.org/10.11581/dtu:00000047).