EOSC-SYNERGY

WP6 Report

EOSC Synergy WP6: Initial review of systems, initiatives and development of selection criteria of the online learning/training platforms and initiatives

Document Identifier:	EOSC-SYNERGY-WP6-1
Date:	20/05/2020
Activity:	WP6
Leader Partners:	JISC/PSNC
Document Status:	APPROVED
Dissemination Level:	PUBLIC

Abstract:

This report describes a review of possible learning platforms and tools, and relevant previous and current projects and initiatives in the area of Open Science and EOSC training and education. It also includes reflections on the criteria we will use to select the platform and tools for the EOSC-Synergy project.

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1. Introduction

EOSC-synergy, is an H2020 project that extends the EOSC coordination to nine participating countries (Czech Republic, France, Germany, Netherlands, Poland, Portugal, Slovakia, Spain and United Kingdom). To achieve this, the project harmonizes policies and federates relevant national research e-Infrastructures, scientific data and thematic services, bridging the gap between national initiatives and EOSC. In addition, EOSC-synergy pushes the EOSC state-of-the-art in software and services life-cycle. By using a quality-driven approach to services integration, the project will promote the convergence and alignment towards EOSC standards and best practices.

The convergence towards EOSC standards and practices will be complemented in one of the EOSC synergy project work packages that aims to expand the EOSC training and education capabilities. To this end, the introduction of an online platform will boost the development of EOSC skills and competences.

This report describes the first phase of the project which includes a review of possible learning platforms and tools, projects and initiatives. It also includes reflections on the criteria we will use to select the platform and tools for our project. Finally, it will give recommendations for future planning.

2. Background

In 2016 the report Realising the European Open Science Cloud identified 10 challenges and general observations, three of which highlighted a need for relevant skills:

- "There is an alarming shortage of data experts both globally and in the European Union.
- This is partly based on an archaic reward and funding system for science and innovation, sustaining the article culture and preventing effective data publishing and re-use.
- A lack of core intermediary expertise has created a chasm between e-infrastructure providers and scientific domain specialists."[1]

One of the implementation recommendations of this report was to:

- **"I3: Fund a concerted effort to develop core data expertise in Europe.** We recommend a very substantial training initiative in Europe so as to locate, create, maintain and sustain the required core data expertise. This should be a community-based effort led by the major training stakeholders and consortia in the ESFRIs, e-Infrastructures and beyond, such as in national and international training consortia."[2]

The EOSC strategic plan states that 'In this process overall interoperability is the ultimate goal, therefore we have to train people, such that data, software, methods and publications can be shared as part of an Open Science community of practice'. [3]

One of a key focus of the EOSC-Synergy project is to expand the EOSC training and education capabilities through the introduction of an online platform aimed at boosting the development of EOSC skills and competences.

The platform will provide an environment for the easy creation and delivery of online training, with an accredited programme of training for users to ensure high quality material is produced. This will increase the training available to all EOSC stakeholders, reduce the learning curve to acquire the skills to become active in EOSC, and expand the EOSC training network.

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[1] Realising the European Open Science Cloud (2016)
https://ec.europa.eu/research/openscience/pdf/realising_the_european_open_science_cloud_2016.pdf, p.6
[2] Ibid, p.16.
[3] EOSC Strategic Implementation Plan, June 2019, DOI 10.2777/202370,
https://www.go-fair.org/wp-content/uploads/2019/08/European-Open-Science-Cloud-EOSC-strategic-implementation-plan.pdf

The 3 main Key Exploitable Results proposed by this contribution are:

1. EOSC training platform - a point for the creation of EOSC training courses based on a sustainable platform for massive online courses that can be used for some of the tutorials, a cloud training infrastructure that is self-deployable by persons performing the courses
2. Hackathon as a Service platform - facilitates organizing and conducting hackathons and datathones based on the EOSC infrastructure in a very agile and dynamic environment
3. How-to guides for trainers - facilitates the creation of high quality content

The results of this initiative are relevant for the whole EOSC community and will be available for full exploitation at the end of 2020/beginning of 2021 (with beta versions in advance).

This report will focus mainly on the EOSC training platform. However, discussions with previous projects will enable EOSC synergy to better understand how it can build on best practices and complement existing activities.

2.1 Initial EOSC-Synergy user scenarios

The initial analysis of the target users and the user scenarios has been performed. There are several target user groups, internal and external to the project, that will be addressed:

- Internal:
    - EOSC-Synergy WP6: EOSC Skills development - trainers
    - EOSC-Synergy WP2: Capacity Expansion at Infrastructure Level - service providers
    - EOSC-Synergy WP4: Capacity building for thematic services - user communities related to EOSC-Synergy project
- External
    - EOSC-5b call clustered projects
    - Other EOSC projects
    - Universities (faculties in particular in the area of computing): students and lecturers
    - Research librarians

Initially identified use cases:
- General EOSC introduction training to be delivered by EOSC-Synergy WP6
- Services responsible from EOSC Synergy WP2 to deliver training and materials through the EOSC Synergy training platform.
    - WP2 focusing on the core Synergy services related to integration with EOSC-Synergy infrastructure, like AAI integration
    - WP2 can organise MOOCs to explain to potential datasets consumers how dataset collections of WP2 participants may be exploited
    - The possible users include the service providers and infrastructure providers

- Repositories responsible from EOSC SYNERGY WP4 deliver training and materials through the EOSC SYNERGY platform
  - Example: A repository delivers a MOOC targeting institutional data creators and learning them how to describe their datasets in order to comply with the FAIR principles
- Lecturers and research librarians
  - link to content on the EOSC-Synergy platform
  - download and import content into their institutional learning platforms
- Universities that want to use EOSC courses

  - A Computer Science/Data Science Department in the University promotes the use of dataset collections/thematic services available via EOSC-Synergy by preparing MOOCs

Potential other use case
- Other EOSC projects could make use of the deployed platform (e.g. EOSC Life or ExPaNDs)
- Research infrastructures e.g. Elixir and Dariah-EU could hosts their own instance of the EOSC-Synergy platform or link to hosted material

2.2 Aims of research and methodology

There is already abundant research around learning platforms and an increasing amount of support for the teaching of open science. However, there is currently little activity around teaching open science online.

In this research we aimed to:

- Review currently available tools for online learning and identify trends in usage to inform the EOSC-Synergy project
- Review projects and initiatives in the European open science community in order to identify best practice and resources to reuse, review their use of online learning tools and discover future opportunities for collaboration
- Develop criteria for EOSC-Synergy to select the most suitable tools from the wide range of available technologies

In addition to desk research, 21 people were consulted (see Appendix 1), representing 20 of the 30 projects and initiatives we reviewed (see Appendix 2).

3. Trends in online learning

3.1 Trends / issues from literature

During the course of extensive desk research we have identified several main trends (mainly enabled by technological progress) and issues faced mainly related to openness and real costs of educational platforms.

Governance and sustainability

A recent review of 'The 100 Worst Ed-Tech Debacles of the Decade' by Audrey Watters, highlighted many of the key issues facing online learning, many using specific examples. "The promise of free" no 99 highlights the two aspects of so-called 'free' educational platforms: firstly, that they are not really free and that you actually pay by giving them your data; secondly, that the platform may start charging or disappear. This second point is exemplified in the example of Ning (no 96 on this list).

Legal and ethical issues

Copyright (see the case of Amazon Inspire no 87. "More than three years later, Amazon Inspire is still in "beta." But Amazon has since launched a new marketplace, Amazon Ignite, where teachers can sell not share their class materials."

"Feature creep"

"Feature creep", Systems integration, Move away from a single platform to ecosystem / package: Google Classroom, Google Course Builder - 'Once again we see many of the components of a learning environment being made available without being packaged as such' [4] Microsoft Teams / Microsoft Education / Microsoft Classroom

Containerized education

New concepts and solutions have been developed that are based on the container's technologies, that allows for combining together in a suitable learning setup for students. An excellent example of such concept realisation is the Up to University (Up2U) project that follows the LEGO approach of the Next Generation Digital Learning Environments

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[4] Jisc Next Gen learning environments report, p10.

(NGDLEs) published in 2015, putting the emphasis on interoperability, modularity and portability. https://up2university.eu/2017/09/28/containerized-education-by-up2u/

Social learning

Mainstream learning platforms have always incorporated some form of social communication function but the most common form of practice with these systems has been the storage and distribution of learning materials and objects to learners. The rapid growth in popularity in Microsoft Teams within the education sector in the last 18 months suggests some practitioners are looking for digital tools to support a more social model of learning. Where Teams can function as a repository for resources through its association with Microsoft

Sharepoint, its main functionality is to support communication with and between learners and teachers. This perhaps indicates a shift towards more social pedagogies, at least in the digital sphere.

Institutions have cited the benefit of being able to host social learning but with the added benefit of being able to host activities on a centrally managed "tenancy" rather than relying on 3rd party social tools where control, accountability and quality management are harder to achieve.

MoodleNet takes a different approach to supporting social learning, providing an open source communication platform focused on collaboratively curating collections of open content within the Moodle ecosystem. Here though, the emphasis is on sharing of open content rather than primarily being about conversation.

Currently digital social learning has to be mediated largely on either platforms owned by corporations or by learning institutions. A federated approach to social networking adds a third option where the identity and the data are owned by the individual learner, giving them more flexibility over how and where they learn.

A number of initiatives have emerged over the last few years, both supported by the World Wide Web Consortium, that propose different models for social networking to the current landscape of large commercial players such as Facebook and Twitter. Inrupt (https://inrupt.com/) and its associated platform Solid (https://solid.inrupt.com/) aim to allow users to have ownership over their social data rather than to a platform. Activity Pub (https://activitypub.rocks/) is a decentralised social networking protocol that forms the basis for federated platforms such as Mastodon (https://mastodon.social/about).

Both these initiatives could provide opportunities for supporting social learning in different ways, giving users more control and responsibility for their own data. In common with the distributed social network platform Diaspora (https://diasporafoundation.org/), which emerged in 2010, these decentralised platforms have yet to gain widespread traction outside of technical communities and so it is difficult to predict the impact they will have on the learning sector and whether they will come to fundamentally change the way people engage with social media technologies.

Learning experience platforms

"A Learning Experience Platform attempts to create a 'Netflix-like' learning environment, drawing in employees through targeted content, social media support, and intelligent recommendations."
https://www.hrtechnologist.com/articles/learning-development/what-is-a-learning-experience-platform-lxp-and-can-it-replace-your-lms/?utm_source=tweet_this&utm_medium=social

Examples such as LinkedIn Learning and Fuse tend to be used more in the corporate environment, pull in content from a range of sources and use artificial intelligence to deliver.

https://elearningindustry.com/learning-experience-platform-disrupting-corporate-learning

Analytics

Issues around privacy, ownership of data, (GDPR made this easier - GDPR constraints infrastructures that collect personal data to put in place policy and technical procedures to guarantee that personal data processing will be conducted along its recommendations), fragmentation of data across systems and loss of control for analytics (Jisc NGLE report). Ethical issues around use of data.

Badges / microcredentials

In the eLearning industry, it is necessary to recognise learners' achievements and successes wherever learning takes place, because this increases learner motivation, makes learning more enjoyable and gives a new dimension to workplace learning.

The badges are: "Verifiable, portable digital badges with built-in metadata on skills and performance". Each open badge is linked to the image and information of the badge, its recipient, issuer and any supporting evidence.

Open Badges allow learners to earn them and show what they are good at not only to the issuing organisation but also through the social networking platforms that matter to them. The data contained in these identifiers may be accessible to other companies or shared on social networking sites. As a result, students can get recognition for the learning that takes place everywhere.

Students have full control over the display of their badges anywhere - on LinkedIn, Facebook, Twitter, etc. They can also attach earned badges to their CV or send them by e-mail to the potential employer as confirmation of their references.

Gamification

Gamification is about using game mechanics, aesthetics and thinking in games to engage people, motivate them, promote learning and solve problems. It is the use of game technology to solve problems outside the game sector.

The purpose of introducing such things into education is to interest people, provide entertainment and commitment. It's not just about adding rewards, points and badges, it's a method of instruction, not just a delivery system that provides elements for learning in a game situation, that is, we have to ask what elements in games make them engaging, such as interactivity, content, history.

Metadata and Interoperability

LRMI

Learning Resource Metadata Initiative (LRMI) is a project co-run by the The Advisory Committee on Educational Publishers (AEP) and Creative Publishers Municipalities in order to build common metadata vocabulary for educational resources.

Nearly anything could be a learning resource. So, LRMI addresses those metadata properties that distinguish content when it is deliberately used for learning.

The LRMI™ specification is a collection of classes and properties for markup and description of educational resources. The specification builds on the extensive vocabulary provided by Schema.org and other standards. LRMI terms not included in schema.org may nevertheless be used to augment and enrich Schema.org markup.

SCORM

SCORM (Shareable Content Object Reference Model) defines a standardised way to build digital learning content so that it can "communicate" with digital platforms. Its role is to make these different learning content compatible, editable and, in particular, usable by most of them on multiple LMS platforms and other systems also using the same standard. Thanks to SCORM, all of this is possible even if the modules are not created with the platform's creation tool! Files that comply with this standard are very often Zip files.

In conclusion, any training content created within SCORM will be able to be used on an LMS platform that complies with the same standard and vice versa. The vast majority of LMS platforms on the market use this standard.

RestAPI

REST (Representational State Transfer)   is designed to use existing protocols in communication between devices. This means that no additional libraries are needed to be installed by the programmer. For example when using HTTP protocol for communication there is no need to install any additional tools. HTTP is a widely available and used communication protocol

xAPI

The Experience API (or xAPI) is a new specification for learning technology that makes it possible to collect data about the wide range of experiences a person has (online and offline). This API captures data in a consistent format about a person or group's activities from many technologies. Very different systems are able to securely communicate by capturing and sharing this stream of activities using xAPI's simple vocabulary.

People learn from interactions with other people, content, and beyond. These actions can happen anywhere and signal an event where learning could occur. All of these can be recorded with the Experience API.

When an activity needs to be recorded, the application sends secure statements in the form of "Noun, verb, object" or "I did this" to a Learning Record Store (LRS.)

Learning Record Stores record all of the statements made. An LRS can share these statements with other LRSs. An LRS can exist on its own, or inside an LMS.

Statement freedom: the structure of "statements" using nouns, verbs and objects lets you record almost any activity. Think: "I did this."

History freedom: the Experience API allows LRSs to talk to each other. LRSs can share data and transcripts with one another, and your experiences can follow you from one LRS (or organization) to another. Learners can even have their own "personal data lockers" with their personal learning information inside them.

Device freedom: any enabled device can send Experience API statements (mobile phones, simulations, games, a CPR dummy, the list goes on). A constant network connection isn't necessary — occasional connectivity is fine.

Workflow freedom: tracking learning events doesn't have to start or end in an LMS, it can start wherever the learner is and on whatever device they choose to use. Your content isn't tied to an LMS.

xAPI allows to get the data about anyone's online or offline experiences. It registers and sends them to the so called "Learning Record Stores". An LRS can share the collected statements with other LRSs. An LRS can exist on its own, or inside an LMS. Down below I put a link to a quick video tutorial, that demonstrates the usage of xAPI with an external LRS.

LTI

"Learning Tools Interoperability® (LTI®) revolutionized the way educators and students access digital learning resources, apps, and tools within any learning management system (LMS) by enabling a one-click, seamless connection. LTI is currently implemented certified in over 250 products. It is the only educational technology industry standard that securely connects your institution's LMS with external learning tools, confirms the tool's credentials, and exchanges information in teaching and learning workflow."

"The new core LTI version 1.3 and a package of high-value services align LTI with industry-best security and provides a clear path forward for existing services and new services to pursue the rich integration available between learning platforms and tools.

Introduction of the IMS Security Framework specification prescribing improved security based on OAuth2 and JSON Web Tokens.

Improved documentation and migration guidance to help move the market from the benefits of basic launch to the full suite of LTI possibilities.

Alignment with the LTI Advantage set of services that enable a fully integrated and innovative digital ecosystem.

LTI ADVANTAGE is a package of three essential end-user services that build on LTI v1.3. Together, these standards implement features that support key teaching and learning activities, such as the provisioning of usernames and roles so a tool can intelligently address the learner on launch, and the exchange of assignments from a platform to an assessment tool and the subsequent scores back to a central gradebook."

Source: (https://www.imsglobal.org/activity/learning-tools-interoperability)

3.2 Massive Open Online Course

The term Massive Open Online Course (MOOC) was coined in 2008 by Dave Cormier, who ran the "Connectivism and Connective Knowledge" MOOC. These were courses being run from universities which were openly available to anyone and could be run with a large number of learners.

MOOCs received a lot of hype and publicity, with 2012 even being named 'the year of the MOOC" by the New York Times[5]. MOOCs were seen as having the potential to revolutionise higher education and soon specialised MOOC platforms such as FutureLearn and Coursera emerged. While MOOCs have not necessarily lived up the early hype, they have nonetheless become part of the online learning landscape.

As MOOCs developed, different types of MOOC began to be identified. The first distinction was between cMOOCs, the original community driven type of MOOC developed by Dave Cormier, and xMOOCs, the large-scale content driven MOOCs delivered by the large MOOC providers.

Other acronyms emerged such as SPOCs (Small Private Online Course) and Micro-MOOCs

There (http://donaldclarkplanb.blogspot.com/2013/04/moocs-taxonomy-of-8-types-of-mooc.html)

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[5] https://www.nytimes.com/2012/11/04/education/edlife/massive-open-online-courses-are-multiplying-at-a-rapid-pace.html?pagewanted=all&_r=3&

have been defined 8 types of MOOC, which relate to different learning approaches and features:

- transferMOOCs – where existing courses are transferred to a MOOC. Many of them imitate a traditional academic course with lectures, short quizzes, text sets and grades.
- madeMOOCs – which are more innovative, making effective use of video and interactive material and are more quality driven. They also tend to have a more formal, quality-based approach to creating materials and more elaborate and demanding tasks, problem-solving and different levels of advanced software interactive experiences.
- synchMOOCs – with a fixed start and end date. There are deadlines for task allocation and evaluations and a clear end date.
- asynchMOOCs – which don't have fixed start and end dates and have more flexible assignment deadlines.
- adaptiveMOOCs – which provide personalised learning experiences, based on dynamic assessment and data gathering on the course. They are based on networks of predefined requirements and introduce the learner to different, personalized paths through content.
- groupMOOCs – where the focus is on collaboration in small groups.
- connectivistMOOCS – emphasis on connection across a network of peers, The idea is to collect and share the knowledge that participants bring.
- miniMOOCSs – which are much smaller than the traditional massive MOOC.

Some observations concerning trends in 2019 have been well reported in "Four MOOC trends we expect to see in 2019"
https://www.hrtechnologist.com/articles/learning-development/4-mooc-trends-we-expect-to-see-in-2019/?zd_source=hrt&zd_campaign=3171&zd_term=chiradeepbasumallick

4. Review of the MOOC platforms

We have reviewed the market and put together over 30 platforms (Moodle, Open Edx, Sakai, Canvas, Chamilo, Mos Chorus, Forma LMS, ILIAS, OpenOLAT, Claroline Connect, Totara Learn, Effectus LMS, LatitudeLearning, Opigno, LRN, ATutor, BeeD LMS, Edu-Sharing, Nera LMS, NexusComply Solution, Percolate LMS, Totara Social, Valamis, Dokeos, LearnDash, Edloomio cloud, OLAT, Opentute, Seamscloud LMS, Turn-Key Saas Training, Valamis). The first criteria we adopted were whether the platform is self hosted and free hosted. Based on these criteria we distinguished 14 platforms. Next selection was based on their continued development and customization possibilities. From the previously obtained list, 11 platforms remained. We have compiled these platforms and created a table to analyze them according to selected criteria: product information availability; support availability; product lifetime; browsers; supported specification (SCORM, xAPI, AICC); courses versioning; maturity; communication tools; operating system; hardware; frequency of

releases; programming language; supported databases; estimated usage; mobile versions; API/SDK; integration with jupyter notebooks; import/export data; supported learning types; user authentication; user roles; course format; gamification; certificate management; interface options; offline; student involvement; metadata standards; user stories to make PID graphs; measurement of material reuse.

4.1 Platforms comparison

Product information availability

Moodle has the best product information availability, has a clear website with lots of information about the product. For Open Edx, Canvas, Sakai, Chamilo and Open Olat product information availability is also at a high level. Ilias and Claroline Connect are the worst in this aspect. Very little information on the Internet.

Support availability

Most platforms have their own documentation. Some can also be contacted via other communication channels (Slack etc.).

Product lifetime

In the lead is the quite old Moodle platform (2002), which proves its great success. Open Edx is also in the lead, but is much younger than Moodle (2014). Illias, created in 1998, seems to be outdated. Its functionalities are less compared to the other platforms.

Age (years)
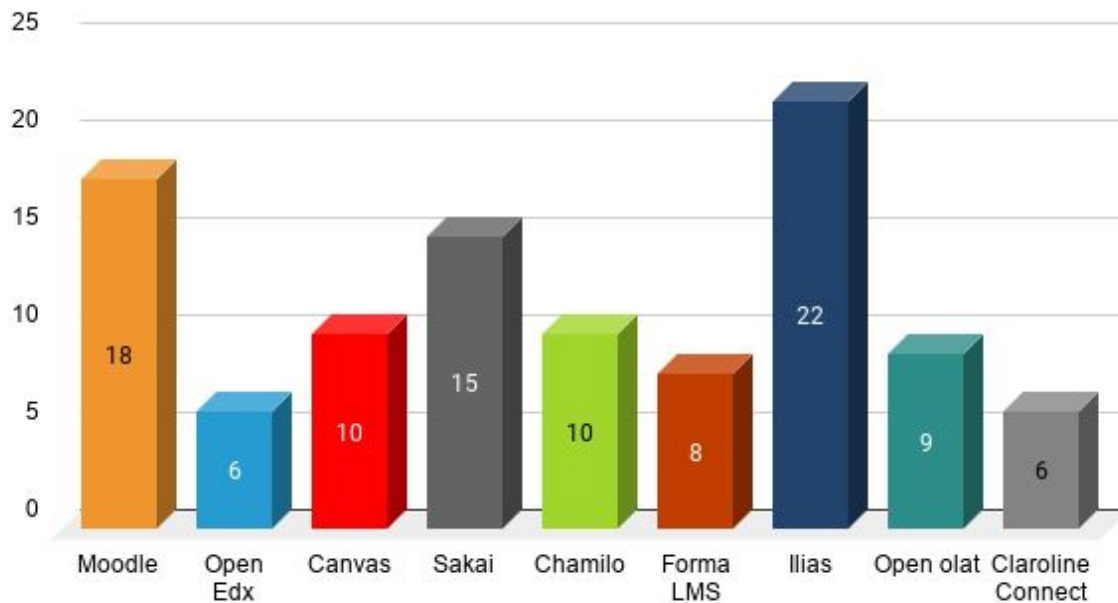
Browsers

The most popular browsers are supported by all platforms.

Supported specification (SCORM, xAPI, AICC)

Each platform supports SCORM. Additionally Sakai supports xAPI and LTI and Chamilo also supports xAPI as well asAICC.

Courses versioning

Canvas fully supports courses versioning features. Open Edx can change courses via API. Open olat can record course activities. Moodle doesn't have such a feature. For the rest of the platforms no information was found.

Maturity

For Moodle, Open Edx, Canvas, Sakai and Chamilo the average rating is respectively: 4.16 (1256 votes); 4.78 (65 votes); 4.45 (1341 votes); 3.7 (94 votes); 4.95 (19 votes). Chamilo and Opend Edx scored the highest average score, but the low number of votes should be noted. Canvas and Moodle came third and fourth, but the number of votes was much higher, which might reflect better the objective assessment of the platform. Sakai is in last place, but in this case the number of votes is low, which may disturb the result.

Maturity (ratings)

Platform	Rating
Moodle	4,16
Open Edx	4,78
Canvas	4,45
Sakai	3,7
Chamilo	4,95
Forma LMS	0
Ilias	0
Open olat	0
Claroline Connect	0
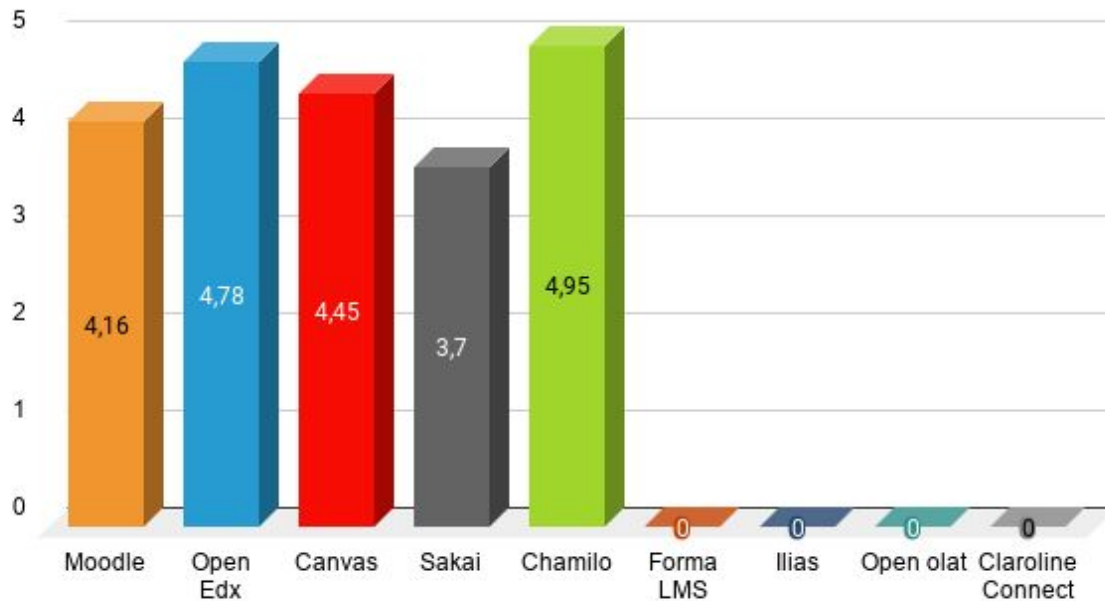
Communication tools

Most platforms use typical communication tools such as chat rooms, announcements, calendars, forums, wikis and emails.

Operating system

All platforms except Forma LMS support Linux operating system. Mac is supported by all platforms except Ilias, Moodle and Open Edx, Sakai, Chamilo, Forma LMS, Open Olat, Claroline Connect and Moodle are also supported on Windows.

Hardware

As far as the processor is concerned, Moodle has by far the smallest requirements. It also takes up little disk space and does not need a lot of RAM. The rest of the platforms require a very average dual-core processor. Ilias requires the most disk space (250 GB).

Frequency of releases

Moodle, Open Edx, Chamilo, Forma LMS and Open Olat receive new releases on average every six months. Sakai is improved every year. For Canvas, new releases appear every two or three weeks. For Ilias, it happens every two/three months.

Frequency of releases (months)
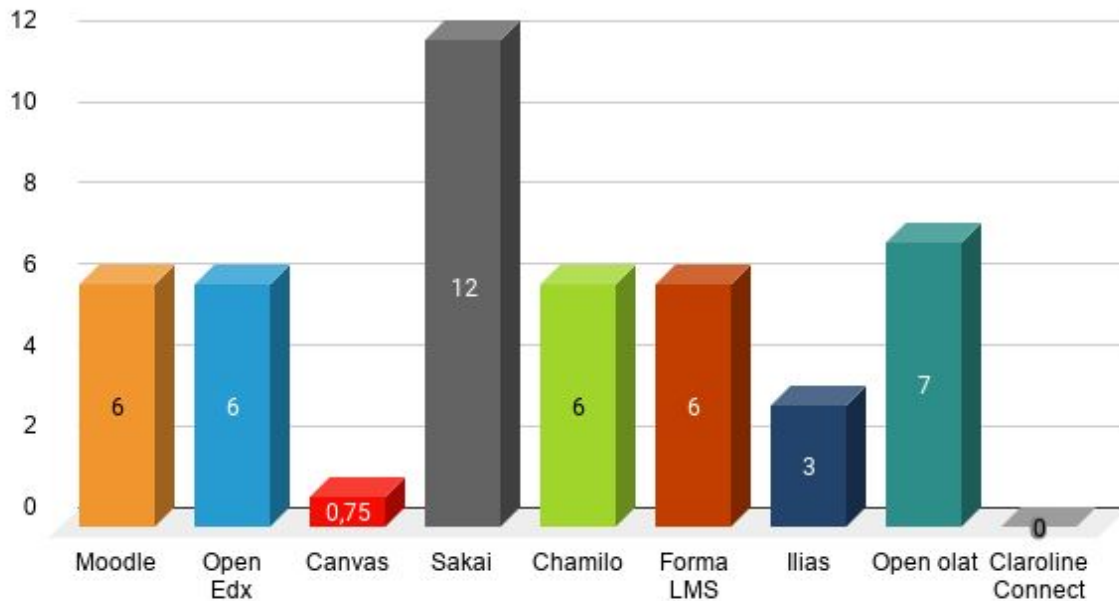
Programming language

Moodle, Chamilo, Forma LMS, Ilias and Claroline Connect platforms have been written in PHP. Open Olat and Sakai in Java. Canvas in Ruby (and JavaScript) and Open Edx in Python.

Supported databases

Moodle supports the largest number of databases (PostgreSQL, MySQL, MariaDB, MS SQL Server, Oracle Database). Sakai, Chamilo, Forma LMS, Ilias, Open Olat and Claroline Connect support MySQL. PostgreSQL is also popular. Only Open Edx supports Mongo and this is the only database it supports.

Estimated usage

Moodle 175M (2019), Open Edx 18M (2018), Canvas 4.5M, Sakai 4M, Chamilo 20M (2018). For Forma LMS, Ilias, Open Olat and Claroline Connect no information was found.

Estimated usage (M)
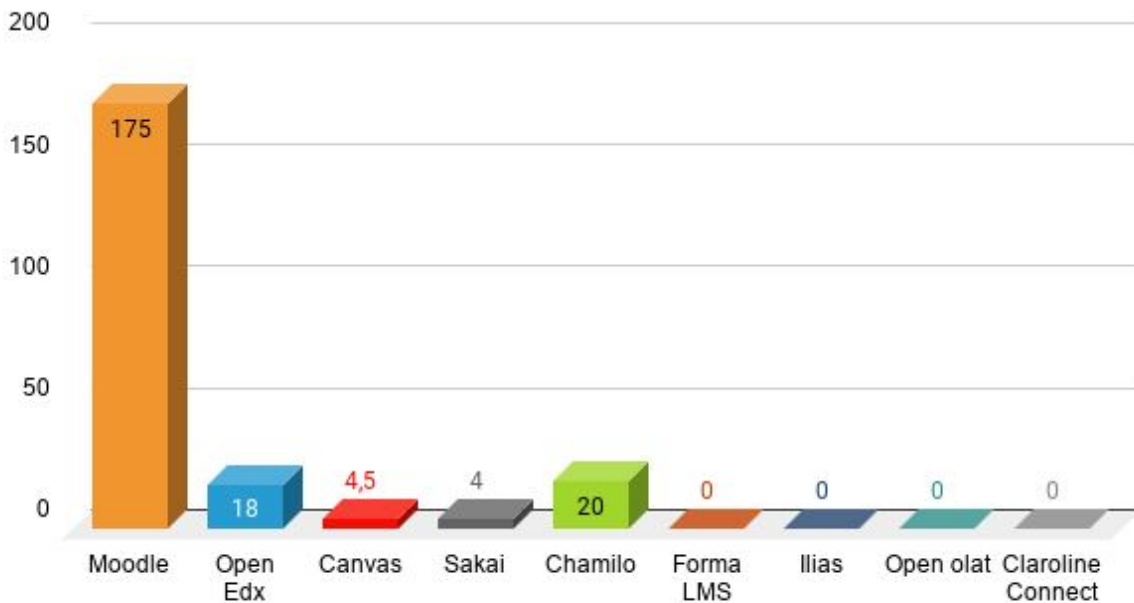
Mobile versions

There is a mobile version for each platform.

API/SDK

APIs are available for each platform.

Integration with jupyter notebooks

This feature is available by default only for Open Edx. For Moodle it is possible via a special Code Runner plugin.

Import/export data

All platforms except Claroline Connect (no information) have the possibility to import/export data. These are mainly user lists, grades or even entire courses.

Supported Learning Types

All platforms support similar learning types. They are mainly asynchronous instructor-led, asynchronous self-paced, blended learning and synchronous virtual classroom.

User authentication

Each platform uses some kind of user authentication system. Most of them enable self-registration. Many platforms also use an LDAP server. Admin confirmation and SAML2/API integration are also very popular.

User roles

Most platforms have the feature to define and manage roles. Examples of such functionality are role assignment systems, permissions per role, teams and team hierarchies.

Course format

Each platform uses both course discussions and LIVE chats. Most of them focus on video and media learning.

Gamification

For Sakai, Forma LMS, Ilias and Open Olat there is no gamification function. Other platforms have badges, levels, leader boards and rewards.

Certificate Management

Every platform except Open Olat has the ability to generate and manage certificates. Moodle uses special plugins for this.

Interface options

For every platform, except Ilias, it is possible to manage settings such as: language, time zone, location, media management.

Offline

Moodle, Open Edx and Claroline Connect have offline functionality via a mobile application. Sakai allows only to view the grades.

Student involvement

Canvas, Sakai and Forma LMS track student's engagement through the gradebook. Chamilo has a special tool for learners to do this.

Metadata standards (schema.org, Dublin Core, LMRI)

No information could be found for Sakai, Chamilo, Forma LMS and Claroline Connect. Canvas and Open Olat use Dublin Core. Moodle allows to manage metadata through different LOM profiles.

User stories to make PID graphs

Only for Moodle and Open Edx information about such a feature has been found. The first platform can use the Blocks: Analytics graphs plugin. Open Edx can create grade charts.

Material reuse

This information was collected only for Moodle, Open Edx, Canvas and Sakai. Moodle can migrate to Canvas but there is a chance to migrate to Open Edx which can migrate to Canvas (no officially supported scripts).

Learning management systems usage

We have investigated some available statistics on the usage of different Learning Management Systems, not limited to the above selections. The 2018 data shows the dominance of the Moodle platform, where only in North America, 3 platforms have equal usage.
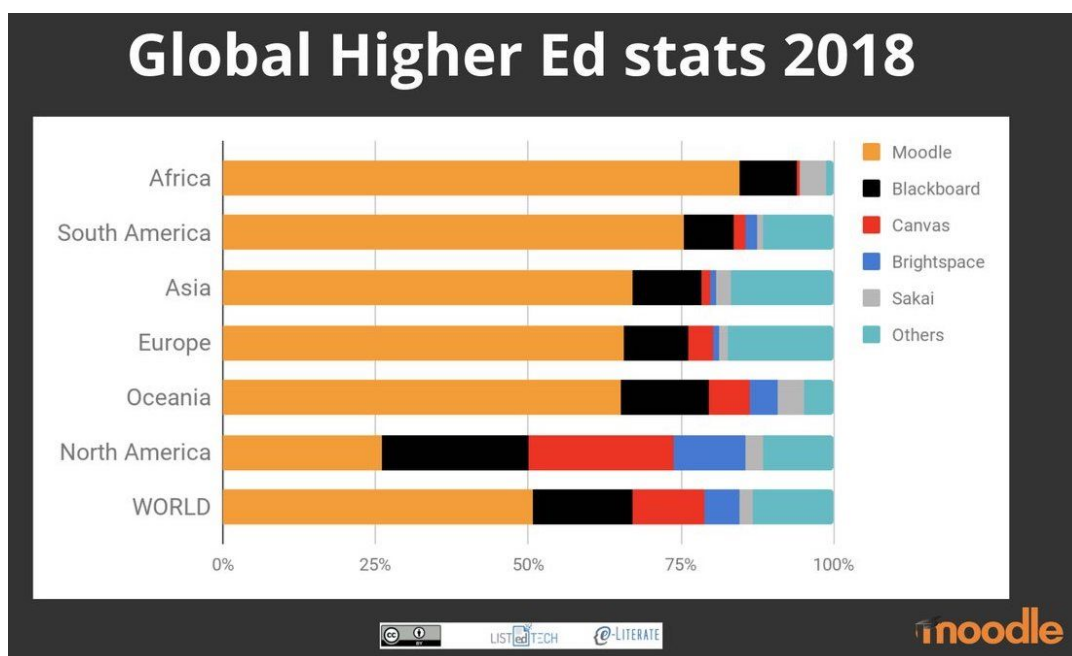
Taking into account one country - in this case the UK - and trends that the available data are presenting up to 2018, we can see the importance of Moodle and Blackboard.
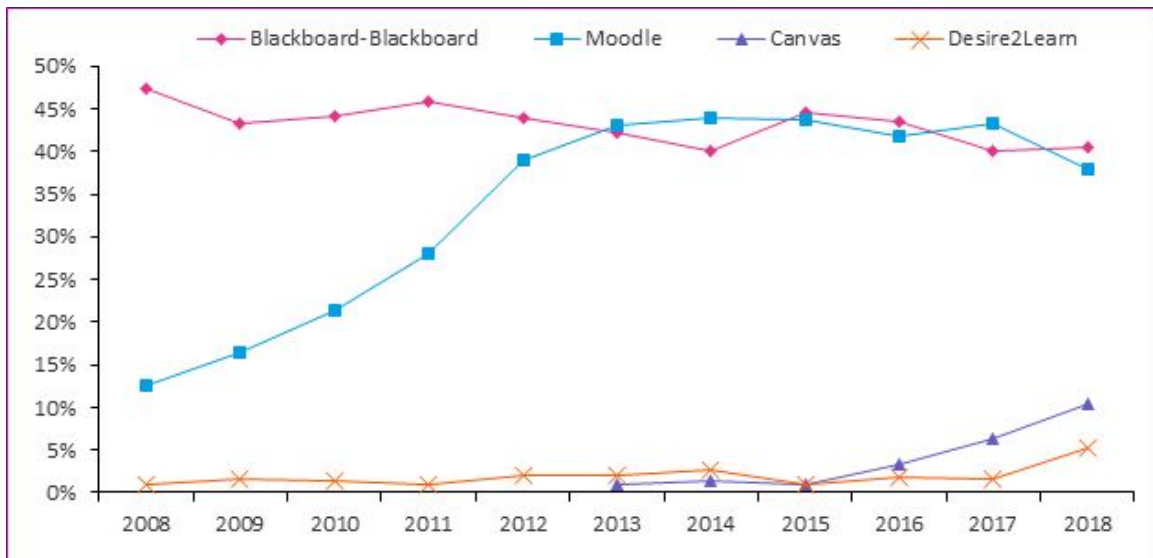
Figure: Trends in the 4 most popular VLE Systems of 2018 in the UK.
Source: https://www.ucisa.ac.uk/Groups/Corporate-Information-Systems-Group/CIS-surveys

However those data do not yet take into account the growing popularity of the OpenEdx.

5. Review of European open science training initiatives

In 2017 the EOSCpilot project conducted a comprehensive review and catalogue of EOSC skills training and educational materials. In this review we aim to take a snapshot of the landscape two years on, particularly focussing on the areas of interest to the EOSC-Synergy project: online learning and learning platforms.

Summaries of the aims and features of over 30 projects and initiatives can be found in Appendix 2. A table comparing the features of selected initiatives that had more focus on online delivery can be found in Appendix 3. We are aware that this is still not the complete picture as this is a very active area (there are over 50 ESFRI projects alone), but we are confident it covers the major initiatives.

5.1 Key observations

More detail of individual projects and initiatives can be found in the appendices. In this section we identify the key areas of activity and our observations on the findings. We have highlighted selected examples within each section below – this is not intended to be a comprehensive listing of features. The whole comparison tables are available as an Appendix.

- **Calendars**. Most projects had events listings and/or calendars.
- **Events**. Webinars and face to face training events are common.
- **Train the trainer training.** These were also a common feature, with several initiatives featuring a face to face approach, such as the [FOSTER open science bootcamps,](#) The Carpentries Instructor Training course and the [Elixir train the trainer programme](#).
- **Training toolkits.** Some projects have train the trainer toolkits which include lesson plans and materials (FOSTER [Open Science Training Handbook](#) and [Open science training toolkit](#); CESSDA [Train the Trainers package](#); The Carpentries, OpenAIRE has produced an [Overview of Research Data Management training materials](#) for trainers, including a mapping of resources to the data lifecycle.
- **Online modules and courses**. Webinars were a common method of delivering content online, some online workshops, some short videos, and we found that fewer projects focussed on structured online modules or courses. FOSTER and PARTHENOS were strong on video content. For structured module or course delivery, the most active initiatives were FOSTER (53 courses) PARTHENOS (8 courses), Dariah Teach (13 courses), PRACE (two MOOCs); RDNL/DCC/Edinburgh University Futurelearn MOOC. The standalone community developed an Open Science MOOC. Some universities also deliver relevant content (eg TU Delft), but this is beyond the scope of this review.
    - Synchronous MOOCs: FOSTER, RDNL/DCC Futurelearn, PRACE MOOCs (Supercomputing and Managing Big Data with R and Hadoop)
    - Asynchronous MOOCs: OS MOOC
- **Train the trainer for online delivery.** Support for online delivery of training was not widespread. FOSTER [Course on Course Creation](#) – this included information on how to use the FOSTER platform and 3 short videos on how to create quality course content, focussing on use of images, copyright and presentation skills for courses. It also provided templates for trainers and support for developers. The Gallantries has experimented with 'hybrid delivery', where several face to face training venues are linked. They have produced a [handbook](#) to deliver these events.
- **Trainer networks.** Communities that develop and deliver common content such as the [Open Science MOOC Slack community](#) and [The Carpentries community](#), discipline-based communities eg Elixir, or broader cross-cutting communities eg the OpenAIRE community of practice of training coordinators.
- **Resource collections.** FOSTER (1800+ resources, mainly slides), filtering by different Open Science topics, DCC hosts a large collection of resources.

- **Registries / catalogues of linked resources.** Registries and catalogues were common but varying considerably in size. For example, the EOSC portal (22 links), Elixir TeSS (1355 resources), DH Course Registry (includes formal university delivered courses and programmes).
- **Navigating resources.**
  - FOSTER describes author, publication year, topic, language, level of knowledge, usage rights.
  - Use of metadata schema, Elixir TeSS training registry (Bioschemas.org), ENVRI (LOM),
  - FOSTER taxonomies allow users to browse resources in a hierarchical way – there are 5 range of taxonomies to aid resource discovery. These were mainly by topic (open science, research data management etc) but also included a mapping of resources to the research workflow.
  - Elixir's TeSS Training workflows are visual, step-by-step protocols that allow users to navigate TeSS in topic- or task-related ways. These are user generated and seem to be at a fairly experimental stage.
- **Learning pathways.** FOSTER began work on a set of learning paths which were intended to lead to badges, requiring the completion of a set of their online courses. The paths included: The open peer reviewer, The responsible data sharer, The responsible research practitioner, The open innovation accelerator and The open access author.
- **Learning platforms.** Moodle is by far the most common (FOSTER, Elixir, Dariah Teach, Geant e-Academy, NI4OS). Open Science MOOC - use of a range of tools, with LMS used for limited features. Up2U (containerized education) and FOSTER (a Drupal CMS, Adapt to create tutorial content and Moodle for the structured courses). bringing together tools with different functions. EGI offers an infrastructure of dedicated computing and storage for training and education.
- **Online learning functions used.** Most online delivery had a requirement for a standard set of tools: content sequencing / lesson delivery, embedded video, basic quiz type assessment, certification/badges, and communication channels. Often the communication channels were separate to the learning platform (eg Gitter, Slack). Videos and downloadable content may be hosted elsewhere (Github, YouTube), with the learning platform acting as a tool for presentation and delivery.
- **Export of courses.** FOSTER has made its tutorial content available as SCORM packages to download. Up2U "Our"Up2Universe is an open container of Learning Tools Interoperability (LTI) based tools and services accessible via the main Learning Management System (LMS)". Some initiatives made material available on Github to download content (Open Science MOOC, The Carpentries).
- **Badges / accreditation.** FOSTER learning paths are intended to lead to badges but this is not implemented, Carpentries badges, SSHOC planning certified trainers, Up2U, RITrain offers an executive masters, EGI offers FiTSM service management and ISO 27001 information security management accreditation.
- **Analytics.** Few projects highlighted learning analytics as a feature of their online platforms. Up2U has a learning analytics module and Elixir has a Training Metrics

[Database](#) for Training Coordinators which streamlines data collection, storage, and visualisation of ELIXIR Training quality and impact data.

- **Translations.** Generally, material was available in English only, but some initiatives provide selected translated material.

In general we observed that there are many overlapping, related communities. Initiatives are or discipline focussed, regional, pan-European or international and focussed on specific activities such as FAIR, research data management, reproducibility, or data science.

6. EOSC-Synergy positioning

6.1 Learning platform selection process

When selecting any system it is normal to start by thinking about its potential uses and users [6]. Our use cases, described in section 2.1, will come primarily from WP2 and WP4 of the EOSC-Synergy project and from institutions in the EOSC-Synergy countries that we have identified already during proposal preparation. Our initial research has also revealed that many of the existing projects and initiatives could provide use cases for EOSC-Synergy, for example the Open Science MOOC and EOSC Life.

Our project has many potential use cases, but our more significant criteria include the need to fit with the vision for the European Open Science Cloud. While more work needs to be done on use cases, our criteria are guided by the common values of the EOSC [7]:

- Focused on research needs
- Community-driven
- Inclusive and respectful of diversity
- Accessible to all from large equipment, large computers & 'big data' to 'small data' and long-tail research
- Open by default – closed where necessary
- Hands-on and participatory
- Transparent and trustworthy

Our initial criteria were related to technical requirements and governance. The MOOC and related tools (that will create the EOSC Platform) we choose should be open source and have the option to self-host. Following discussion with other training initiatives, we identified the requirement for control over data in order to avoid vendor lock-in, and ownership and import/export issues emerged.

Since EOSC-Synergy is a regional project, the ability to integrate with existing systems used by institutions, projects and initiatives, is essential. As a result, metadata for discoverability

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[6] https://vle.ucisa.ac.uk/
[7] EOSC Strategic Implementation Plan, June 2019

and interoperability became the next priority, including the use of standards like SCORM, schema.org and LRMI.

Our initial technical and governance requirements were:

- Open source
- Self-hosted
- Control over data (including import/export)
- Interoperable
- Support for discoverability
- Customization possibility
- Sustainability (maintenance)
- GDPR compliance

The key features mentioned and used also by other projects so far include the ability to: track usage, track versions, sequence content, conduct assessment and issue certificates.

This resulted in a list of 30 platforms (see Appendix 4). The first criteria we adopted to narrow this choice were whether the platform is self hosted and free hosted. Thanks to these criteria, the selection was narrowed to14 platforms. Next we checked for the continued development and customization possibilities. From the previously obtained selection, only 11 platforms remained.

6.2 Synergy's alignment with other projects

Many of the initiatives are tied to subject communities, so the tools are customised to specific usage. However we have identified a few promising collaborations from an EOSC-Synergy perspective. In particular the FOSTER project and initiative is fulfilling most of the EOSC-Synergy initial requirements. However, the FOSTER - courses require an approval request to be sent, the process is moderated, and currently not being maintained. The set of tools proposed by this initiative cannot be instantiated on the EOSC-Synergy infrastructure. The possible collaboration would require moving all the tutorials and materials to the central FOSTER platform, and courses would require the activities from the FOSTER team. The badge system and train the trainer materials could be reused as well as their introductory open science materials. FOSTER provides basic guidance on creating good online material.

The EOSC-hub project, that EOSC-Synergy closely collaborates with, provides the basic EOSC training materials catalogue that can be considered as an additional place where

created EOSC-Synergy training material can be stored and linked. Elixir's TeSS provides a very advanced platform/solution for a training material catalogue. TeSS is scalable, follows schema.org, and allows for easy harvesting of the training initiatives and materials from communities websites. However, TeSS is community specific (and software-wise based on a not very popular programming language). It can be an interesting option for EOSC-Synergy, it would however require software and schema adjustments and modifications.

Up2U provides a set of containerised building blocks composed of MOOC, interactive computing courses, sharing of the materials, video-conferencing tools. The solution is currently widely used in the schools (eg in Poland) due to the pandemic COVID19 situation. It fulfils as well all the initial EOSC-Synergy requirements and in addition can be used/instantiated in the EOSC-Synergy infrastructure.

In respect to other EOSC-5b projects that EOSC-Synergy is being clustered with, for example NI4OS-Europe that has already selected Moodle as their MOOC platform, and is still expanding their training materials repository, needs further investigation. We foresee also collaboration with the FAIRsFAIR competence centers in respect to the FAIR principles.

7. Conclusions and next steps

This report is the outcome of several months of investigation of the initial user needs, available technologies for online learning and appliance of those technologies in the context of different projects and initiatives focused on delivering training and/or teaching.

As a first step we have identified our potential users and their initial use cases, both from inside and outside of the project. As the next step we have looked into current trends in online learning, and analysed available technical solutions, in particular focusing on online learning courses. We have analysed the free to use platforms (over 30) where after initial prefiltering 11 of them have been compared, based on over 30 criteria. The most promising platforms for EOSC-Synergy are Moodle (most popular worldwide) and Open Edx platforms.

Organising over 22 interviews with representatives of existing initiatives, we have identified a few promising collaborations from an EOSC-Synergy perspective, where we could profit from the approach, methodology, best practices, existing toolsets (if they can be reused) or existing tutorials and materials, or join effort to create and share whole training catalogues. The most promising are the initiatives like FOSTER, UP2U and NI4OS-Europe, and FAIRsFAIR. Further discussions on possible collaborations will take place.

We have learned a lot during this analysis, however still a lot of questions need to be answered during the follow-up phase, as part of close interaction with the users.
List of future activities will cover the following aspects:

- An iterative/agile approach to development, involving:

- ○ Identifying user needs / reviewing / extending the platforms as we proceed, based on user feedback
- Following from our original project proposal, it would be useful to have a shared terminology so we have a clear understanding of the types of resources we aim to support. The EOSCpilot project created a glossary which could be extended.
- More detailed agile user needs analysis to understand our users better and understand what type of learning resource / MOOC they want to create
  - ○ Develop detailed use cases and personas with our potential users
  - ○ What tools and features do our users want to use and how?
  - ○ Define the tool stack needed as part of the user consultation
  - ○ Which other tools will form part of the ecosystem?
- Build expertise and knowledge on standards and metadata schema for discovery and interoperability of learning content (SCORM, LTI, using RestAPIs or xAPI) and align with EOSC wide discussions. Explore options for an app to work with Teams through Microsoft's open API.
- Clarify with the wider EOSC community the role of various platforms in the EOSC ecosystem, in collaboration with the other EOSC 5b projects,the FAIRsFAIR Competence Center project and the EOSC Skills and Training Working Group.

- Explore scalability/sustainability/governance of our platform
  - ○ How will we manage copyright issues for uploaded content?
  - ○ Who will be allowed to use the platform? Eligibility?
  - ○ What are the conditions on reuse of the platform itself?
  - ○ How will the platform be sustained beyond the lifetime of the Synergy project?
  - ○ What performance indicators will we use to monitor adoption and usage?
  - ○ How will we process personal data so as to be GDPR compliant?

Appendix 1: List of interviewees

- Chris Thomson, Subject specialist: digital practice (lead/communication and collaboration), Jisc
- Zac Gribble, Subject specialist (learner systems and information), Jisc
- Kate Nicolson, Education technologist, Jisc
- Tobias Steiner, OpenAIRE / Open Science MOOC
- Jon Tennant, Open Science MOOC
- Iryna Kuchma, Open Access Programme Manager, EIFL / FOSTER / OpenAIRE
- Mateusz Kuzak, Elixir / Carpentries / Gallantries
- Rene van Horik, RDNL / DANS
- Nancy Pontika, FOSTER / FIT4RRI, Open University / CORE
- Carole Goble, University of Manchester / Elixir
- Celia van Gelder, Elixir
- Gabriella Rustici, Elixir / EOSC Life
- Joy Davidson, DCC / FOSTER
- Phil Barker, CETIS / LRMI
- Niall Beard, Tess / Elixir
- Isabelle Boscaro-Clarke, ExPaNDs (Diamond Light Source, UK)
- Nazare Guimard, ExPaNDs (Synchrotron-Soleil, FR)
- Petr Knoth, Open University / FOSTER
- Doug Belshaw , MoodleNet Product Manager
- Irina Mikhailava, Head of Learning and Development, Géant
- Lawrie Phipps, Jisc

Appendix 2: Full list of related projects

Appendix 2.1: Completed projects

FOSTER (Facilitating Open Science Training for European Research) https://www.fosteropenscience.eu/ "The FOSTER portal is an e-learning platform that brings together the best training resources addressed to those who need to know more about Open Science, or need to develop strategies and skills for implementing Open Science practices in their daily workflows. Here you will find a growing collection of training materials."

The FOSTER project ran for 30 months from January 2014. It ran over 100 training events, collected more than 1800 training items in its catalogue and developed 11 e-learning courses. "

The training programme included different approaches and delivery options: eLearning, blended learning, self-learning, dissemination of training materials, helpdesk, face-to-face training, especial training-the-trainers, seminars, etc."

FOSTER plus ran from May 2017 to May 2019. This delivered further training events and online courses, developed the Open Science toolkit and an Open Science Training Handbook.

There are currently 53 online courses. It also consolidated the training network begun in the FOSTER project It developed a range of taxonomies to aid resource discovery https://www.fosteropenscience.eu/resources. These were mainly by topic (open science, research data management etc) but also included a mapping of resources to the research workflow.

FIT4RRI - Fostering Improved Training Tools For Responsible Research & Innovation. Materials and courses hosted on FOSTER platform. Providing training and governance advice. H2020 project runs 2017 - early 2020

EOSCpilot WP7 - Towards a Stewardship Skills Framework for EOSC

1 Jan 2017 – 31 May 2019. Funded to support the first phase in the development of the European Open Science Cloud. "Building upon existing work, EOSCPilot is establishing a skills framework that will help infrastructures, institutions, and other stakeholders to find, access and benefit from relevant skills development activities." Created a catalogue of EOSC skills training and educational materials.

EDISON project – Sept 2015-Aug 2017/ Funded by Horizon 2020. Produced the Edison Data Science Framework, the Edison network and the community portal (no longer live). The EDSF included:

- Data Science Competence Framework (CF-DS),

- Data Science Body of Knowledge (DS-BoK), and

- Data Science Model Curriculum (MC-DS), and Data Science Professional Profiles (DSPP).

Appendix 2.2: Current projects

INOS project – September 2019-August 2022. Integrating Open and Citizen Science Into Active Learning Approaches in Higher Education (INOS). Funded by the European Union's Erasmus+ Programme, the INOS project aims at modernizing Higher Education Institutions' (HEIs) curricula through civic engagement in Open Science (OS) and Citizen Science (CS). The main activities include:

- Generating an evidence-based overview of trends in OS and CS public activities

- Strengthening OS and CS practice through solid pedagogical grounding from well-tested active learning pedagogies

- Inviting citizens at partner HEIs to join CS projects in the form of Open Knowledge Activities (OKAs)

- Organizing Open Innovation Activities (OIAs) bringing together higher education (HE) staff and students in collaborative and interdisciplinary projects

- Upskilling HE staff (academic and library) and students through the exposure of contemporary trends in public engagement and modernizing HE curricula by integrating and mainstreaming OS and CS practices in HE teaching practice

- Triggering policy change by raising awareness on the societal impact of OS and CS.

RI Train – 1 September 2015-31 March 2020. (https://cordis.europa.eu/project/id/654156) RItrain, the Research Infrastructure Training Programme, is an EU-funded Horizon 2020 project aimed at improving and professionalizing the training of managerial and leadership staff in research infrastructures (RIs). The tailored training comprises:

- Executive Masters in Management of Research Infrastructures

- A series of webinars with experienced leaders in research infrastructures

- Staff Exchanges to access managerial and leadership expertise directly from leading research infrastructures

EOSC Hub - WP 11: Training and Services for Service Operators, Research and Higher Education. "EOSC-hub brings together multiple service providers to create the Hub: a single contact point for European researchers and innovators to discover, access, use and reuse a broad spectrum of resources for advanced data-driven research."

EOSC Portal https://www.eosc-portal.eu/ The Training and Support page provides a catalogue of resources related to open science. It has a range of filters by research area (subject), provider, and Dedicated for (audience), research infrastructures and platforms and rating.

UP2U Up To University https://up2university.eu/ Jan 2017-May 2020. "Up2U is a 36 month collaborative project with 5M Euro funding that kicked off in January this year. This project is coordinated by GÉANT and gathers 18 partners from 12 countries across Europe including NRENs, traditional and open universities, infrastructure providers and two commercial partners." "The aim is to develop an innovative ecosystem that facilitates more open, effective and efficient co-design, co-creation and use of digital content, tools and services specially adapted for personalised, collaborative or experimental learning by students preparing for university.

Appendix 2.3: Organisations / initiatives

GoFAIR specifically GO TRAIN. GO FAIR is a bottom-up, stakeholder-driven and self-governed initiative that aims to implement the FAIR data principles, making data Findable, Accessible, Interoperable and Reusable. GO TRAIN is one of its three activity pillars. Currently it runs a small number of workshops and has a collection of links in its RDM Starter Kit. Training and skills are addressed via some of its Implementation Networks, such as the Data Steward Competence Centers (DSCCs). DSCCs collaborate with the researchers in their institutions to enable better data management and comply with FAIR principles, also to better support open science.

The Carpentries - "The Carpentries teaches foundational coding, and data science skills to researchers worldwide. Software Carpentry, Data Carpentry, and Library Carpentry workshops are based on our lessons. Workshop hosts, Instructors, and learners must be prepared to follow our Code of Conduct." Lessons and curricula are available to reuse. There is an instructor training programme. The model is focussed on delivery of face to face training.

The Gallantries "Gallantries aims to bridge the different training communities (EMBL, The Carpentries, Galaxy, ELIXIR, GOBLET) and fill the remaining gap in bioinformatics training." The Gallantries team aims to address the scalability of training delivery via hybrid training events, i.e. pairing-up on-site helpers with remote instructors across multiple sites simultaneously. They have created a handbook on how to organise hybrid events.

Research Data Alliance "With over 9800 members from 144 countries, RDA provides a neutral space where its members can come together to develop and adopt infrastructure that promotes data-sharing and data-driven research". It has working and interest groups, including an interest group on training in research data handling. They run webinars and produce a range of outputs, including some teaching / learning resources, mainly categorised under 'RDA Supporting Outputs' in their catalogues of recommendations and outputs.

Software Sustainability Institute an official partner of The Carpentries and coordinates activities in the UK. The SSI also hosts a set of guides, top tips, case studies and videos.

Digital Curation Centre An extensive list of resources that it has created including guides, checklists, tools, case studies and links to training resources. It runs webinars and face to face training courses, both publicly advertised and onsite on request. Printed versions of its guides can be bought. It is a partner in the Delivering Research Data Management Services MOOC, along with RDNL and the University of Edinburgh.

European Data Portal. https://www.europeandataportal.eu/ The EDP is a European portal that harvests metadata from public sector portals throughout Europe. It has a set of 16 short e-learning modules designed for anyone to discover more about open data. It also has a Training Companion to support trainers in delivering 16 short lessons (1-3 hours), which correspond to the e-learning modules.

List of research infrastructures:
http://roadmap2018.esfri.eu/media/1044/part1-project-landmarks-list.pdf

OpenAIRE https://www.openaire.eu/ The OpenAIRE infrastructure has been in operation since 2010 and has been developed by several funded projects (see OpenAIRE History). OpenAIRE focusses its work in three areas: services, policies and training. Its support website offers short primers on the basics of open access, a Research Data Management Handbook, guides on policies and services and quick reference factsheets. There is also a helpdesk and FAQ, webinars and face to face workshops. Finally, OpenAIRE facilitates a community of practice for training coordinators in EOSC-related initiatives.

EGI https://www.egi.eu/services/ EGI delivers advanced computing services to support scientists, multinational projects and research infrastructures. Offers training in FitSM and ISO 27001. Also offers an infrastructure of dedicated computing and storage for training and education.

GÉANT https://www.geant.org/ is the pan-European data network for the research and education community. https://learning.geant.org/ The GÉANT Learning and Development team (GLAD) run a diverse portfolio of learning services for the European NREN community, including events, webinars, a knowledge hub (collections of resources for Technical Skills [9 links] and Professional Competencies [21 links]) , training and learning advice, content creation, coaching and meetups. It uses a combination of face to face and blended learning events. Their e-Academy uses the Moodle platform.

DARIAH-EU Digital Research Infrastructure for the Arts and Humanities. Training and Education activities include:

- Dariah Teach - an open source, multilingual, community-driven platform for high quality teaching and training materials for the digital arts and humanities.

- DH Course Registry - registry of formal training programmes in digital humanities in Europe

- PARTHENOS project http://www.parthenos-project.eu/ Parthenos training https://training.parthenos-project.eu/ 2016-2019. The online Parthenos training suite was launched in February 2017. Hosts 8 training modules and has a range of videos and online modules, presentation slides and other support materials available for reuse. Produced templates for module development.

ELIXIR is an intergovernmental organisation that brings together life science resources from across Europe. These resources include databases, software tools, training materials, cloud storage and supercomputers. Elixir has a training platform https://elixir-europe.org/platforms/training which provides:

- [TeSS](#) - the training registry/portal for the ELIXIR community. Over 1000 resources listed in 'Materials', 83 'tutorials', 75 content providers, 298 events. Can create 'Workflows' through topics

- [The Training Metrics database](#) – a dashboard of training statistics

- Platform also doing tasks around:

    - Training toolkit

    - Gap analysis, training materials development and training delivery

    - Training technical infrastructure (mainly TeSS)

    - Training capacity building - train the trainer resources

CESSDA https://www.cessda.eu/ Consortium of European Social Science Data Archives. It has a [Data Management Expert Guide](#), designed by European experts to help social science researchers make their research data Findable, Accessible, Interoperable and Reusable (FAIR). There is also a train the trainer package to accompany this https://www.cessda.eu/Training/Training-Resources/Library/Training-Packages/Train-the-Trainers The package contains different materials that trainers can use in developing and giving Research Data Management trainings for (social science) researchers. CESSDA also has a training YouTube channel and a resource catalogue of mainly webinar recordings and associated resources.

Appendix 2.5: ESFRI cluster projects

ESFRI, the European Strategy Forum on Research Infrastructures, is a strategic instrument to develop the scientific integration of Europe and to strengthen its international outreach. "The mission of ESFRI is to support a coherent and strategy-led approach to policy-making on research infrastructures in Europe, and to facilitate multilateral initiatives leading to the better use and development of research infrastructures, at EU and international level."

[SSHOC (Social Sciences and Humanities Open Cloud) training](#) January 2019-April 2022

- "The Social Sciences and Humanities Open Cloud unites 20 partner organisations and a further 27 associates realising the vision articulated by the European Commission in 2016: To offer researchers in the social sciences and humanities seamless access to a full and unified panorama of flexible, scalable, relevant data and the services, tools and training required to make optimal use of that data."

- Aim: "Fostering Communities, Empowering Users & Building Expertise":

    - Mapping the SSH landscape

- ○ Gap analysis

- ○ Organising training events and workshops

- ○ Identifying potential training nodes

- ○ Creating learning materials

- Will create a SSHOC train the trainer toolkit - "Using the "hub-and-spoke" bootcamp approach which has proven effective in European initiatives and projects such as CESSDA Training Working Group, FOSTER Plus, and OpenAIRE 2020, the SSHOC Train the Trainer Toolkit will be showcased at workshops to be held with training organizations in pre-selected national nodes. In this way, a consistent, coordinated and cross-disciplinary approach will be encouraged."

- Will lead to a Europe-wide directory of certified trainers

- SSHOC training community - link to join

- Has listing of events

ENVRI-FAIR January 2019 – December 2022

ENVRI is Europe's environmental research infrastructures. They are currently supported by the ENVRI FAIR project - ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research. Brings together 14 environmental research infrastructures.

- The overarching goal of ENVRI-FAIR is to implement the FAIR principles in the ENVRI community and connect it to the European Open Science Cloud (EOSC).

- One of their 5 objectives is "Capacity building for improved skills of the Research Infrastructure personnel so they can develop and maintain the FAIR infrastructures"

- ENVRI Training material page but no content (broken link)

- The ENVRI training platform can be found here: https://training.envri.eu/ A username and password is required to access e-learning content.

EOSC-life http://www.eosc-life.eu/ 1 March 2019 – 28 February 2023. Creating EOSC for the life sciences. EOSC-Life brings together the 13 biological and medical 'ESFRI' research infrastructures (BMS RIs) to create and open, digital and collaborative space for biological and medical research. Training and outreach is provided by workpackages 7-10. WP9 is specifically around 'Training of the EOSC Life community'. It "will train RI operators and users in the skills needed to enable effective data access and preservation for immediate and future sharing and re-use of data in the Biological and Medical Sciences. WP9 will provide hands-on training in use EOSC-Life tools, data resources and other services developed by the project, effective re-use of publicly available data, and best practices that

users should adopt in managing their own data (WP6, FAIRassist)." Training page is currently a list of upcoming events.

ESCAPE https://projectescape.eu/ 1 February 2019-31 July 2022. Astronomy & particle physics cluster. It aims to create a "Big Science domain-specific "EOSC cell" to be connected / integrated in the global EOSC infrastructure." It has 6 components: a software repository, a science platform, a virtual observatory, data lake cloud services and a citizen science gateway and 'deep training, education and capacity building programmes for the new generation of scientists and engineers that fully exploit ESFRI and EOSC facilities, to ensure the requirements and services features are properly understood and uptake". Training is listed on their events page.

PaNOSC - Photon and Neutron Open Science Cloud. 1 December 2018-20 November 2022. Workpackage 8 – Staff and User Training. "This workpackage foresees the development of an e-learning platform for the PaN user community and staff at the partner facilities. Training materials will be developed to promote FAIR principles, as well as to introduce users to the PaNOSC services and capabilities of PANOSC facilities." The training platform is currently in development, but there is a calendar of events and a catalogue of training materials.

Appendix 2.6: INFRAEOSC-5b regional projects

EOSC Synergy https://www.eosc-synergy.eu/ WP6: creating training platform and hackathon platform, 'train the trainer guidance to create online material

EOSC Nordic https://www.eosc-nordic.eu/ Objective 5: EOSC-Nordic will consolidate and expand a distributed network of experts and service operators at local and national levels. A distributed team will be created involving experts within and from outside the consortium to deliver training and technical support to new service providers and communities willing to engage with EOSC, during and after the project lifetime.

EOSC-Pillar will coordinate national Open Science efforts across Austria, Belgium, France, Germany and Italy, and ensure their contribution and readiness for the implementation of the European Open Science Cloud (EOSC). Training is not specifically mentioned but dissemination, outreach and community building are mentioned.

NI4OS-Europe http://ni4os.eu National Initiatives for Open Science in Europe. The project has its own training platform http://training.ni4os.eu for training materials related to the events organized by the project, but also self-paced online courses on various topics related to EOSC.

ExPaNDS https://expands.eu The European Open Science Cloud (EOSC) Photon and Neutron Data Service. WP5: Training activities through EOSC platform. Will organise workshops and deliver training materials through the e-learning platforms made available on the EOSC. Training will be organised in cooperation with EOSC related activities.

FAIRsFAIR https://www.fairsfair.eu/ Main activities include: Surveys on FAIR policies, practices and training; Organise an open call to repositories to get support for certification; Build a network of Trusted Digital Repositories; Improve interoperability of FAIR resources; Increase production and use of FAIR data; Develop a capability maturity model towards FAIR certification; Set up a FAIR competence centre for all communities; Embed FAIR data education in university programmes. The competence centre would create a catalogue of resources to support FAIR data stewardship, provide a networking tool, provide helpdesk support and deliver training on core competencies for data stewardship (see full list of proposed activities).

Appendix 2.7: Courses

RDNL/DCC Delivering Research Data Management Service MOOC

Open Science MOOC

Eurodoc Open Science Ambassador Training - The course consists of 10 modules focusing on aspects of Open Science. Each module is made up of an online tutorial on the FOSTER portal and a webinar with an expert on a specific topic of Open Science. The modules specifically address Open Science, Open Access, Open/FAIR Data, Open Peer Review, Data Management, Plan S, Open Licensing, Open Clouds, Open Policies, and Open Source. Each module takes approximately 4 hours: 3 hours to complete the FOSTER tutorial and one hour to watch the webinar. Each module also comes with a light literature list to dive deeper into the topic.

CESSDA Data Management Expert Guide

Research Data MANTRA course - Edina/University of Edinburgh

Partnership for Advanced Computing in Europe (PRACE) MOOC on RHadoop approach to big data - "This course will give you access to a virtual environment with installations of Hadoop, R and Rstudio to get hands-on experience with big data management"

ELIXIR Training Platform for Life Sciences https://elixir-europe.org/platforms/training

CLARIN infrastructure also focuses on training a lot, about Linguistics and related areas, also about data curation, https://www.clarin.eu/sites/default/files/clarinuni-slides_0.pdf

Appendix 3: List of open source learning platforms evaluated

	Moodle	Open Edx	Canvas	Sakai
Product information availability	Very good. Readable website with many informations about product.	Good. Available documentation, a lot of information on the web.	Good. A lot of information can be found at wiki. Moderate amount of information on the web.	Good. Large community documentation. Moderate amount of information on the web.
Support availability	Documentation, community discussions, books, email support.	Documentation, FAQ, email, forum, slack.	Documentation, online community, email, guides, forum, FAQ, tutorials, videos.	Documentation, online community, email.
Product lifetime	2002	2014	2010	2005
Browsers	Chrome, Safari, Firefox, Edge, Internet Explorer.	Chrome, Safari, Firefox, Edge, Internet Explorer.	Chrome 19, Safari 5, Firefox 12, Internet Explorer 8, Flash 9.	Chrome, Safari, Firefox, Edge.
Supported specification (SCORM, xAPI, AICC).	SCORM, xAPI, AICC, LTI.	SCORM, xAPI, LTI.	SCORM.	SCORM, LTI, xAPI.
Courses versioning	No	API allows to get and post different courses.	Yes	**No info**
Maturity	**Rating: 4,16** (1256 votes). Moodle is 17 years old and it's got a lot of positive reviews, so it suggests, that the platform offers a good stability and meets the expectations.	**Rating: 4,78** (65 votes). Bitdegree (252 user reviews). Relatively young platform with positive reviews (small amount of votes though).	**Rating: 4,45** (1341 votes). Canvas is in the middle when it comes to lifetime compared to the other platforms. The rating is pretty good with not so small amount of votes (compared to for example Open Edx), which suggests that the platform meets the expectations.	**Rating: 3,7** (94 votes). Pretty old platform with not so much information about user experience on the web. It suggests that this platform isn't preferred by LMS users.
Communication tools	The Announcements Forum, Email, Discussion Forums, Upcoming Events Block & Calendar, Checklist Activities.	Course Talk widget, course discussion, surveys, tables, presentations, live chats.	Announcements, conversations, discussions, calendar, chat, conferences.	Announcements, calendar, chat, commons, contact us, email, email archive, forums, messages, sign-up, wiki.
Operating system	Linux, OS X or Windows.	Linux Ubuntu 16.04.	Linux, Mac OS X.	Linux, OS X, Windows, Sun Solaris.
Hardware	**Disk space: 200MB plus minimum 5GB for content. Processor: 1GHz (min), 2GHz dual core or more. Memory: 512MB (min), 1GB or more.**	**Disk space: Minimum 25GB, 50GB for production servers. Processor: At least one 2.00GHz CPU or EC2 unit. Memory: Minimum 8GB.**	**Memory:** At least 8GB.	**Memory: 8GB.**
Frequency of releases	Every six months.	Every six months.	Every three weeks.	Almost every year.
Programming language	PHP	Python	Ruby, Javascript.	Java
Supported databases	PostgreSQL, MySQL, MariaDB, MS SQL Server, Oracle Database.	Mongo	Postgres, SQLite.	MySQL, MariaDB, Oracle.
Estimated usage	175M(2019)	18M(2018).	4,5M.	4M.
Mobile versions	Yes	Yes	Yes	Yes
API/SDK?	Yes	Yes	API, GraphQL.	APIs

	Moodle	Open Edx	Canvas	Sakai
Integration with jupyter notebooks?	CodeRunner plugin.	Yes	In the future, possible via lillumidesk, but it doesn't seem to work right now.	No information whether it is possible to integrate with jupyter notebooks, or it's not. So there's probably no such feature.
Import/export data	Users, grades, database entries, questions (ODS, CSV, XML, ZIP, GIFT). Import course data, glossary entries. Export excel data.	Courses, but not users (.tar.gz/XML files).	Import a course package (IMSCC file). Export a course (IMSCC/ZIP files).	**I&E assessments (XML, IMSCC). Export a course (IMSCC).**
FEATURES				
Supported Learning Types	Asynchronous instructor-led, asynchronous self-paced, blended learning.	Asynchronous Instructor-led, asynchronous self-paced, blended learning, synchronous virtual classroom.	Asynchronous self-paced, synchronous virtual classroom.	Asynchronous instructor-led, asynchronous self-paced, blended learning, synchronous virtual classroom.
User authentication	Manual accounts, no login, email-based self-registration, CAS server (SSO), external database, LDAP server, LTI, Moodle network authentication, no authentication, Shibboleth, web services authentication.	Active directory/LDAP integration, custom user login page, manual accounts, no login, SAML2/API integration, self-registration, self-registration w. admin confirmation.	OAuth2.	CAS, Kerberos, LDAP, ADFS, and Shibboleth.
User roles	Define roles, Role Assignment, System Permissions per role, Teams and Team Hierarchies.	Define roles, role assignment, system permissions per role, teams and team hierarchies.	Two default roles. It's possible to create new, custom roles with different permissions.	Default editable roles, defining roles, custom roles.
Course format	Course discussions, learner upload, social format, topics format, weekly format.	Course discussions, learner upload, LIVE chat option, LIVE videoconferencing / webinar, social format, topics format, weekly format.	On-campus course, online course or blended course.	Course discussions.
Gamification	Available via plugins.	Badges, badge customization, Levels.	Quiz, discussion boards, canvabadges to reward students.	No
Certificate Management	Available via plugins.	Certification life-cycle, manage certification templates, predefined certification templates, unique certificate by course, unique certification by curriculum.	Certificate creation.	LTI advantage, certificates creation.
Interface options	Block management, calendar settings, language settings, location settings, media embedding settings, multilanguage support, ready-made themes.	Block management, language settings, media embedding settings, multilanguage support.	Language, time zone, features (high contrast UI, underlining links etc.).	Language settings, media embedding settings, multilanguage support, ready-made themes.
Offline	Via mobile app.	Via mobile app.	No	Grading offline.
Student involvement	Via plugins e.g. Active Quiz Moodle plugin.	Insights.	Via gradebook.	Via gradebook.

	Moodle	Open Edx	Canvas	Sakai
Metadata standards (schemas.org, Dublin Core, LMRI)	Different LOM application profiles.	Repository metadata. Metadata extraction.	Dublin Core.	**No info**
User stories to make PID graphs	Blocks: Analytics graphs plugin.	Grading chart.	No information whether it's possible or not. So there's probably no such feature.	No information whether it's possible or not. So there's probably no such feature.
Measurement of material reuse	Migrate to Canvas. Migrate to Open Edx (unsupported script but it might be possible).	Re-run a course, migrate to Canvas (no officialy supported scripts).	Possible migration from other LMS to Canvas, not the other way.	Migrate to Canvas.

	Chamilo	Forma LMS	Ilias	Open olat	Claroline Connect
Product information availability	Good. Relatively big user guide documentation. Some information are missing though.	Ok. Small amount of technical information. Big manual for users. Not so much information on the web.	Not so good. Basic information in English, advanced information in German. Most of the time web redirects to the site only with concepts.	Good.	Not so good. Most of the information found on the web. Website not in English.
Support availability	Documentation, community forum, email.	Big manual, community forum, email.	Support and community forum.	OLAT community server, email, Twitter feed.	Development documentation, online community, email.
Product lifetime	2010	2012/2017	1998	2011	2014
Browsers	A modern web browser (versions younger than 3 years old) and optionally requires the Flash plugin.	Chrome, Apple Safari, Firefox, Internet Explorer.	Chrome 18+, Safari 7+, Firefox 14+, IE11+, Microsoft Edge.	Chrome 58+, Safari 10+, Firefox 53+, Internet Explorer 11/Edge.	Chrome, Safari, Firefox, Chromium, Microsoft Internet Explorer 11, Microsoft Edge.
Supported specification (SCORM, xAPI, AICC).	SCORM, AICC, xAPI.	SCORM	SCORM	SCORM	SCORM
Courses versioning	**No info**	**No info**	**No info**	Record of course activities.	**No info**
Maturity	**Rating: 4,95** (19 votes). Same lifetime as Canvas but such small amount of votes can suggest that it's not so preferred by LMS users. "Cluttered code", "lack of english certification".	Very poor amount of information about reviews and user experience (if present, they are very mixed), it suggests that this platform isn't preferred by LMS users.	Very poor amount of information about reviews and user experience which suggests that this platform isn't preferred by LMS users.	No information about reviews and user experience which suggests that this platform isn't preferred by LMS users.	Very poor amount of information about reviews and user experience which suggests that this platform isn't preferred by LMS users.
Communication tools	Email.	Communication area, chat, forum, wiki, calendar.	Chat, forum, podcasting, etherpad/edupad plugin.	Wiki, videos, podcasts, blogs, tasks, portfolios.	**No info**
Operating system	Linux, Mac OS X, Windows.	Macintosh, Windows, Android.	Linux	Linux, macOS, Windows.	Linux, macOS, Windows.

	Chamilo	Forma LMS	Ilias	Open olat	Claroline Connect
Hardware	**Disk space:** 50MB free disk space (for caching). **Processor:** Pentium II CPU or equivalent. **Memory:** 1GB RAM. **Resolution:** a minimum 360 pixels wide.	**No info**	**Disk space: 250 GB for usual ILIAS deployments,Bandwidth:at least 100 Mbit/sec. Processor: common dual core. Memory: minimum of 4096 MB.**	**No info**	**No info**
Frequency of releases	Every six months.	Mostly every six months.	Minor releases every two/three months.	Minor releases twice a month, major releases every seven/eight months.	**No info**
Programming language	PHP	PHP	PHP	Java	PHP
Supported databases	MySQL and MariaDB.	MySQL	PostgreSQL 9.x, MySQL, MariaDB.	PostgreSQL (recommended), MySQL.	MySQL/MariaDB.
Estimated usage	20M (2018).	**No info**	**No info**	**No info**	**No info**
Mobile versions	Yes	Yes	Yes	Yes	Android, iOS.
API/SDK?	APIv1	API	API	API	API libraries.
Integration with jupyter notebooks?	No information whether it is possible to integrate with jupyter notebooks, or it's not. So there's probably no such feature.	No information whether it is possible to integrate with jupyter notebooks, or it's not. So there's probably no such feature.		No information whether it is possible to integrate with jupyter notebooks, or it's not. So there's probably no such feature.	No information whether it is possible to integrate with jupyter notebooks, or it's not. So there's probably no such feature.
Import/export data	I&E courses (CSV), users list (CSV, XML), events (Outlook, iCal). Import documents (doc).	I&E users (CSV). Export courses list (CSV) and course usage statistics.	Yes	I&E questions (CSV).	**No info**
FEATURES					
Supported Learning Types	Asynchronous instructor-led, asynchronous self-paced, blended learning, synchronous virtual classroom.	Asynchronous learning, mobile learning, synchronous learning, blended learning.	Asynchronous Instructor-led, asynchronous self-paced, blended learning.	Asynchronous instructor-led, asynchronous self-paced, synchronous virtual classroom.	Asynchronous instructor-led, asynchronous self-paced, blended learning, synchronous virtual classroom.
User authentication	Active directory/LDAP integration, custom user login page, manual accounts, no login, SAML2/API integration, self-registration, self-registration w. admin confirmation.	Active directory/LDAP integration, custom user login page, manual accounts, no login, SAML2/API integration, self-registration, self-registration w. admin confirmation.	Self-Registration.	Servlet filter. Self-registration.	Active directory/LDAP integration, custom user login page, manual accounts, no login, SAML2/API integration, self-registration, self-registration w. admin confirmation.
User roles	Roles management menu.	Define roles, role assignment, system permissions per role, teams and team hierarchies.	Role-based access control (RBAC) of ILIAS to the repository.	Teams and team hierarchies.	Define roles, role assignment, system permissions per role, teams and team hierarchies.

	Chamilo	Forma LMS	Ilias	Open olat	Claroline Connect
Course format	Course discussions, LIVE chat option, LIVE videoconferencing/webinar, social format, topics format.	Course discussions, learner upload, LIVE chat option, LIVE videoconferencing/webinar.	LIVE videoconferencing/webinar.	Course discussions, LIVE chat option.	Course discussions, learner upload, LIVE chat option, LIVE videoconferencing/webinar, social format, topics format, weekly format.
Gamification	Badges, badge customization, leaderboards, points, rewards.	No	No	No	Badges, badge customization, points.
Certificate Management	Certificates management tool.	Certification life-cycle, manage certification templates, predefined certification templates unique certificate by course, unique certification by curriculum.	Certificate plugin for ILIAS.	No	Manage certification templates, unique certificate by course, unique certification by curriculum.
Interface options	Additional external pages, language settings, media embedding settings, multilanguage support, ready-made themes.	Additional external pages, language settings, media embedding settings, multilanguage support.	No customization.	OpenOLAT has a customizable portal page. Multilanguage support.	Additional external pages, block management, calendar settings, language settings, location settings, media embedding settings, multilanguage support, ready-made themes.
Offline	No	No	No	No	Yes (disconnected Mobile app).
Student involvement	Learners tracking tool.	Gradebook.	**No info**	**No info**	Manual grading ("marking"), multiple grading scales.
Metadata standards (schemas.org, Dublin Core, LMRI)	**No info**	**No info**	Local Advanced Metadata. Custom Metadata for Individual Assessment.	Dublin Core.	**No info**
User stories to make PID graphs	No information whether it's possible or not. So there's probably no such feature.	No information whether it's possible or not. So there's probably no such feature.	No information whether it's possible or not. So there's probably no such feature.	No information whether it's possible or not. So there's probably no such feature.	No information whether it's possible or not. So there's probably no such feature.
Measurement of material reuse	**No info**	**No info**	**No info**	**No info**	**No info**

Appendix 4: Comparison table of selected projects

Name of initiative	Foster	Up2U	Elixir	OpenScience MOOC	GLAD	DARIAH-Teach
Starting date	First phase - February 2014. Second phase - May 2017.	January 2017.	April 2016.	2017	2014	March 2017
Website	www.fosteropenscience.eu	https://up2university.eu/	https://tess.elixir-europe.org https://elixir.mf.uni-lj.si/	https://opensciencemooc.eu/	https://learning.geant.org/	https://www.dariah.eu/
Short description	The FOSTER project's main activities centred on integrating OA, open data and open science principles and practices into research workflows by providing training for early career researchers.	The key objective of the project is to bridge the gap between secondary schools and higher education & research by better integrating formal and informal learning scenarios and adapting both the technology and the methodology that students will most likely be facing in universities.The aim is to develop an innovative ecosystem that facilitates more open, effective and efficient co-design, co-creation and use of digital content, tools and services specially adapted for personalised, collaborative or experimental learning by students preparing for university.	One of the goals of ELIXIR is to train research scientists to better use available computational infrastructures to address critical research questions. It has the TESS registry of training courses/events, a community of trainers and an e-learning portal.	This MOOC is designed to help equip students and researchers with the skills they need to excel in a modern research environment.	A diverse portfolio of learning services for the European NREN community.A national organization providing professional development to states, districts, and schools.	#dariahTeach was created through the generous funding of an ERASMUS+ strategic partnership to create a platform and test modules for open-source, high-quality, multilingual teaching materials for the digital arts and humanities. Services include Standardization survival kit, DARIAH docs, isidore, collection registry, DARIAH wiki, DARIAH etherpad, TaDiRAH, DARIAH AAI
Training services offered	A resource sharing repository, self-learning course modules and a time based moderated MOOC.	Containerized education' Up2U is designing, developing and deploying a NGDLE with existing components, where possible using open source software, that are glued together in a specific way. In contrast with the market leaders who obviously put their particular products in the centre of their universe, Up2U is putting the emphasis on interoperability, modularity and portability.	Training registry (Tess), community of trainers, training modules., Train the trainer, including certification	MOOC	Training events, webinars, knowledge hub, preferred training providers, training and learning advice, content creation with SME, knowledge briefing, coaching and Meet-Ups, blog.Offers a range of training and development services including the eAcademy online courses.	DARIAH Teach, PARTHENOS Training, DH Course Registry
Current / active	Only for FIT4RRI	Yes	Yes	Yes	Yes	Yes

Name of initiative	Foster	Up2U	Elixir	OpenScience MOOC	GLAD	DARIAH-Teach
Sustainability plan	Platform being maintained for FIT4RRI until April 2020.	Has a sustainability plan including possible business models. https://owncloud.gwdg.de/index.php/apps/onlyoffice/s/cEW5I0ZyPHSZeou	As a distributed infrastructure, ELIXIR has a mixed funding model with contributions coming from a number of mostly public sources. See 'How we are funded' - includes long-term sustainability plan. https://elixir-europe.org/about-us/how-funded 75 content providers.	Community driven initiative - volunteer led. 45 partners.. No formal sustainability plan. Many partners listed but not clear what support they provide. See https://opensciencemooc.eu/about/	Part of Geant.	Part of DARIAH. Currently, DARIAH has 19 Members and several cooperating partners in eight non-member countries.
Domain specific	No.	No.	Yes.	No.	No.	Yes.
Subject of content	Integrating OA, open data and open science principles and practices.	Integrating formal and informal learning scenarios and adapting both the technology and the methodology before universities.	A better use of available computational infrastructures. Unclear how many online courses are available - listing here includes f2f courses https://elixir.mf.uni-lj.si/course/index.php	Knowledge, tools and skills we need to do research effectively in the 21st century. Open principles, open collaboraton, reproducible research and data analysis, open research data, open research software and open source, open access to research papers, open evaluation, public engagement with science, open educational resources, open advocacy.	To build NREN capabilities, to foster knowledge sharing and tocreate inspiration. A range of technical and professional courses (ITIL, project management etc)	Digitally enabled research and teaching across the Arts and Humanities.
Who are users	Mostly early career researchers.	Students, teachers.	Research scientists.	Students and researchers.	European NREN community	Research communities.
Support for online course creation						
Delivers/hosts online training courses	Yes	Yes	Yes	Yes	Yes	Yes.
If yes, can users create/add their own courses?	Yes	Yes	no info	Yes	no info	no info
Level of mediation for course creation	You fill a form, then you will have access to system, they then create a course, use of templates, supported development.	Need to be involved in a pilot school	no info	Model is community collaboration - interested individuals can become part of the community and contribute. There are 12 people forming the Steering Committee for this project, as well as a core Production Team and Advisory Network, both of which are open to anyone to join.	N/A - delivers its own content.	All courses/workshops will go through a rigorous post-launch review process according to #dariahTeach's Quality Assurance plan.

Name of initiative	Foster	Up2U	Elixir	OpenScience MOOC	GLAD	DARIAH-Teach
Curriculum design (support in creating good content)	There is a course on creating content in Moodle and 3 videos on making good quality content. https://www.fosteropenscience.eu/node/472 Open Science Training Handbook for f2f training. Train the trainer bootcamps with attendance certificate (?)	They have run a techno-pedagogical conference. Online support for using the platform and some support for learning design.	Train the trainer programme, but not clear if this includes developing online content / delivery. https://elixir-europe.org/platforms/training/train-the-trainer	Support from volunteer community.	no info	no info
Trainer certification?	For bootcamp attendance?	no info	Yes - in development, but not clear if it will include online training	No	no info	no info
Trainee certification?	Yes - badges for individual courses and learning paths https://www.fosteropenscience.eu/learning-paths	no info	no info	Completion certificate.	no info	no info
Which tools they are using						
Online learning platform	**Adapt** - Self-paced learning materials. **Moodle** - Moderated elearning courses. **Portal** - a place for users to share resources.	Moodle.	**Elearning platform** - used Moodle and set up remote compute and virtual support. **Slovenian platform** - had some difficulties with interoperability. But they've had difficulty exporting required metadata for Tess.	Eliademy (now bankrupt)	Moodle for eAcademy	*.Dariah Teach - Moodle?*
Criteria to choose platform	A full requirements analysis was produced as part of WP4. Criteria for selecting Adapt included: online editing, open source, free to run, interoperable, customisable, learning analytics.	no info	no info	Eliademy was chosen as free use was offered by the company.	no info	no info
Which learning platform features are used? (lesson structuring, quizzes, calendar, forums etc)	All courses are different, but mainly structured content delivery, embedded videos and quizzes.	Plugins e.g. Active Quiz Moodle plugin. Up2U 'universe' includes LMS, content, collaborative editing, learning analytics, social interactions, real-time interactions, recording and publishing, document sharing https://up2university.eu/up2universe	no info	Content sequencing, quizzes.	no info	*Lessons, quizzes, announcements, assignments*
Tools supporting online platform (jupyter notebooks, github, etc)	Jupyter notebooks (CodeRunner plugin), Github, H5P Widget	Github.	Github.	Content developed and versioned in Github, Internet Archive for video., Zenodo, Slack	GÉANT github,	no info

Name of initiative	Foster	Up2U	Elixir	OpenScience MOOC	GLAD	DARIAH-Teach
Interoperability	SCORM.	Our "Up2U Service Bus" constitutes the backbone of our NGDLE architecture. It includes a defined set of standard protocols and APIs (in coordination with IMS Global and other standards) to ensure seamless interoperability of the functional building blocks. Our "Up2Universe" is an open container of Learning Tools Interoperability (LTI) based tools and services accessible via the main Learning Management System (LMS). SCORM.	TESS includes: Json API for events, widgets like maps, calendar URL into Google Calendar.	Content is shared from Github and other platforms rather than from LMS	no info	SCORM
A&A tools	Provided through authentication plugins: Manual accounts, No login, Email-based self-registration, CAS server (SSO), External database, LDAP server, LTI, Moodle Network authentication, No authentication, Shibboleth, Web services authentication.	Provided through authentication plugins: Manual accounts, No login, Email-based self-registration, CAS server (SSO), External database, LDAP server, LTI, Moodle Network authentication, No authentication, Shibboleth, Web services authentication.User authentication via federated EduGAIn AAI.	Moodle requires login	Login required for Eliademy	no info	Login required to access certain features eg quizzes
Training material metadata standards	Different LOM application profiles.	Different LOM application profiles.	TESS uses Schemas.org, bioschemas. At some point will convert Tess metadata into bioschemas.	no info	no info	no info
Pricing for hosting	Free self-paced learning materials.	no info	no info	Eliademy was given free but no longer being supported.	Free.	Free.
Pricing for end users of training services	Free	no info	Free.	Free		Free.

Name of initiative	Parthenos Training	PANOSC	RDNL/DCC MOOC	OpenAIRE Support	EOSC-hub	Carpentries
Starting date	2016	December 2018.	September 2019.	December 2009.	January 2018.	January 2018.
Website	https://training.parthenos-project.eu/	www.panosc.eu https://www.panosc.eu/e-learning-platform/	https://www.futurelearn.com/courses/delivering-research-data-management-services	www.openaire.eu	www.eosc-hub.eu	http://www.carpentries.org
Short description	PARTHENOS cluster of humanities research infrastructure projects has devised this series of training modules and resources for people who want to learn more about research infrastructures and the issues and methods around them. Training plan http://training.parthenos-project.eu/wp-content/uploads/2016/10/D7.1-Initial-Training-Plan-FINAL.pdf	The PaNOSC project, Photon and Neutron Open Science Cloud, brings together six strategic European research infrastructures with the goal of contributing to the construction and development of the ecosystem allowing universal and cross-disciplinary open access to data through a single access point, for researchers in all scientific fields.	Develop confidence among research support professionals in designing, developing and reviewing institutional RDM services.	Support on how to practice open research. A total of 65 European universities, research centres and institutions as partners.	A single contact point for European researchers and innovators to discover, access, use and reuse a broad spectrum of resources for advanced data-driven research.Offers access to services in data management, processing and analysis, compute, storage, sharing and discovery, security and operations.	The Carpentries project comprises the Software Carpentry, Data Carpentry, and Library Carpentry communities of Instructors, Trainers, Maintainers, helpers, and supporters who want to teach foundational computational and data science skills to researchers.
Training services offered	Online courses, training materials, course outlines	Training material catalogue, events calendar, online modules	An online course on Delivering Research Data Management Services (DRDMS).	Open access basics, an RDM handbook, Guides on policies and services, Factsheets. Supports a Training Coordinators Community of Practice	Links to training materials used in EOSC hub training. Database of training events	Train the trainer support for delivering face to face workshops. Materials and lesson plans. **Data Carpentry:** ecology, genomics, geospatial, social sciences. **Software Carpentry:** plotting and programming in Python, programming with R, R for reproducible scientific analysis. **Library Carpentry.**
Current / active	No?	Yes but elearning platform not yet live.	no info	Yes	Yes - 79 partners.	Yes. More than 70 member organisations in 10 countries.
Sustainability plan	Parthenos project ended October 2019, but says resources will be sustained on partner websites.	Duration - 4 years.	Maintained by Edinburgh Unversity, DCC and RDNL.	Fourth phase - untill 2021.	End in December 2020.	Memberships generate 58.8% of our revenue. Workshop fees bring in 18.6% of our annual revenue, and grants and donations account for 22.4% of revenue.

Name of initiative	DARIAH-Teach	Parthenos Training	PANOSC	RDNL/DCC MOOC	OpenAIRE Support	EOSC-hub	Carpentries
Domain specific	Yes.	Yes.	Yes.	No.		No	No.
Subject of content	Digitally enabled research and teaching across the Arts and Humanities.	Research infrastructures and the issues and methods around them.Research Infrastructures, Management Challenges in Research Infrastructures, Collaborations in Research Infrastructures, Manage, Improve and Open Up Your Research Data, Formal Ontologies: A Complete Novice's Guide, Digital Humanities Research Questions and Methods, Citizen Science in the (Digital) arts and Humanities, eHeritage Webinars.	Contribution to the realization of a data commons for Neutron and Photon science	Designing, developing and reviewing institutional RDM services.	Transform society through validated scientific knowledge.	Multiple service providers to create the Hub.	Foundational computational and data science skills.
Who are users	Research communities.	Researchers, educators, managers, and policy makers.	Researchers.	Individuals that support researchers to manage and share their data, including librarians, IT and information specialists, data stewards, and research office staff.	Researchers.	Researchers.	Researchers, librarians.
			Support for online course creation				
Delivers/hosts online training courses	Yes.	Yes.	Yes but elearning platform not yet live.	Yes	No	No	No.
If yes, can users create/add their own courses?	no info	no info	no info	No	no info	N/A	N/A
Level of mediation for course creation	All courses/workshops will go through a rigorous post-launch review process according to #dariahTeach's Quality Assurance plan.	no info	GEANT step-up authentication service.	N/A - it is a standalone coures hosted on Edinburgh University's FutureLearn account. Content provided by RDNL and DCC.	no info	no info	Request a workshop or register a self-organised workshop by filling a form. Complete a dwo-day instructor training workshop to become a certified Carpentries instructor.

Name of initiative	DARIAH-Teach	Parthenos Training	PANOSC	RDNL/DCC MOOC	OpenAIRE Support	EOSC-hub	Carpentries
Curriculum design (support in creating good content)	no info	no info	no info	RDNL and DCC worked with learning designers at the University of Edinburgh to create the course.	no info	no info	Very nice design. Everything divided into lessons with time needed for each one. Very convenient way to make teacher's life easier.
Trainer certification?	no info	no info	no info	no info	no info	no info	no info
Trainee certification?	no info	no info	no info	no info	no info	no info	no info
Which tools they are using							
Online learning platform	.Dariah Teach - Moodle?	Not clear which platform is used: Parthenos training - http://training.parthenos-project.eu/sample-page/management-challenges/?	Platform not yet live. Not clear whether a platform has been chosen yet.	Future learn.	no info	no info	no info
Criteria to choose platform	no info	no info	no info	no info	no info	no info	no info
Which learning platform features are used? (lesson structuring, quizzes, calendar, forums etc)	Lessons, quizzes, announcements, assignments	Structured content with % progress tracking.	no info	Comments alongside content (discussion in context, rather than separate forum). To do list - showing what's due and what you have completed.	no info	no info	no info
Tools supporting online platform (jupyter notebooks, github, etc)	no info	no info	Github, ViNYL, jupyter notebooks.	Uses only tools within Futurelearn?	no info	no info	no info
Interoperability	SCORM	no info	Federated search engine compatible with OpenAIRE.	no info	no info	no info	no info
A&A tools	Login required to access certain features eg quizzes	No authentication, no login.	no info	Future Learn login	no info	no info	no info

Name of initiative	DARIAH-Teach	Parthenos Training	PANOSC	RDNL/DCC MOOC	OpenAIRE Support	EOSC-hub	Carpentries
Training material metadata standards	no info	no info	NeXus format.	no info	no info	no info	no info
Pricing for hosting	Free.	Free.	no info	no info	no info	no info	no info
Pricing for end users of training services	Free.	Free.	no info	*Free - Course access for 7 weeks. £52 - Course access as long as it's on FutureLearn, Certificate. £189 - Unlimited access to all FutureLearn courses and certificates*	no info	no info	no info