European Software Skills Alliance.

# Train of the Trainer Programme

# Annex V DevOps expert EQF 7



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#### Train the Trainer Programme – Annex V– DevOps expert EQF 7, 2023.

Deliverable 13: "ESSA Train the Trainer Programme & Materials" – Annex V

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# **About ESSA**

The European Software Skills Alliance (ESSA) is a four-year transnational project funded under the EU's Erasmus+ programme. It ensures the skills needs of the rapidly evolving Software sector can be met — today and tomorrow.

ESSA provides current and future software professionals, learning providers and organisations with software needs with the educational and training instruments they need to meet the demand for software skills in Europe.

ESSA will develop a European Software Skills Strategy and learning programmes for Europe. It will address skill mismatches and shortages by analysing the sector in depth and delivering future-proof curricula and mobility solutions; tailored to the European software sector's reality and needs.

# **Project partners**

The ESSA consortium is led by DIGITALEUROPE. It is composed of academic and nonacademic partners from the education, training, and software sectors.

View all project partners: ESSA Partners | ESSA Associated Partners



**European Software** Train the Trainer Programme – Annex V – DevOps expert EQF 5kills Alliance 7

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# List of abbreviations and acronyms

Abbreviation	Term
e-CF, EN 16234-	European e-Competence Framework, European Norm 16234 - Part 1:
1	Framework
ECTS	European Credit Transfer and Accumulation System
EQF	European Qualifications Framework
ESSA	European Software Skills Alliance
LO	Learning Outcome
PLO	Programme Learning Outcome

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# 1 How to use the ESSA Learning programme for DevOps expert EQF 7 profile

#### 1.1 Introduction

In this Annex trainers, teachers and educators are provided with all information necessary to deliver the ESSA Learning Programme designed for the DevOps expert EQF 7 Educational profile.

The proposed learning path follows a modular and flexible structure based on Programme Learning Outcomes (PLOs). Each PLO includes self-consistent Learning Units (LUs) supported by specific learning materials.

In particular, this document provides:

- overall information about the Learning Programme Objective, Total number of Programme Learning Outcomes (PLOs) concerned, Total Learning Units (LUs), Overall duration (hours); Total number of ECTS; Targeted Institutions (learning providers);
- detailed Learning Programme including the Learning Units for each Programme Learning Outcome (PLO).

In this regard, more specifically, the following is provided for each Programme Learning Outcome (PLO):

- overall information (N. of Learning Units, Duration in hours, Total number of ECTS, Recommendations for Micro-credentials, possible integration with studies related to other PLOs, Recommended Didactical Approach, Recommended Delivery methods, etc);
- detailed information for each Learning Unit (Title, Duration in hours, Didactical Approach and delivery method, type of Assessment, Title of the related Learning material proposed, Link to access to the learning material ESSA Platform).

<u>This Annex is strictly related to the document "Train the Trainer Programme. DELIVERABLE 13 –</u> <u>ESSA Train the Trainer Programme & Materials".</u>

As a further support, it is advised to consult the documents indicated in the paragraph "Sources of reference" of the Deliverable 13 above mentioned, through the available links.

Learning materials developed to support the delivery of the ESSA Learning Programme for this Educational Profile are available on the ESSA platform at the following link: https://learn.softwareskills.eu/.

## **1.2 TARGET**

The following Learning Programme addresses University students and professionals.

# 2 How to deliver the ESSA DevOps expert EQF 7 profile

## 2.1 University students and professionals: graduates of Software Engineering Undergraduate Programmes 2.1.1 Overall Information about the Learning Programme

Objective The programme aims to empower learners with advanced DevOps methodologies and tools, fostering a culture of continuous integration, deployment, and collaboration, and equipping them to drive efficiency and reliability in software development and operations at an enterprise level. Total number of PLOs 6 concerned **Total Learning Units** 13 Duration 375 hours Total number of ECTS 15 **Targeted Institutions** Higher Education Institutions

## 2.1.2 Learning Program PLO 1 – Component integration [e-4]

	Overall information PLO 1 – Component integration [e-4]
N. of Learning Units	3
Learning Outcomes	<ul> <li>Creates and guides a process for integration of an advanced/ innovative solution, software application or component (e.g., proposes standards of practice; for a solution related to e.g., machine learning, cloud, big data, blockchain, IoT)</li> <li>Writes a report/ advisory report/ paper/ research article on integration of a solution or software application in an innovative/ advanced/ complex situation</li> <li>(e.g., an analysis of software integration challenges related to a particular technology or method, a process/HR/internal standards design for an integration cycle, a resource assignment plan)</li> </ul>
Duration	-
Total number of ECTS	starting from n.3 ECTS
Recommendations	This PLO should be an integral part of the advanced studies for students with
for Micro-	prior knowledge of software development.
credentials	Recommended as an independent micro-credential for upskilling DevOps engineers.
Often integrated with studies of PLO	-

Recommended	e-learning
Didactical	work placement
	work placement
Approach	
Additional	-
comments	
Recommended	Lecture up to 50%
Delivery methods	Case study. Individual/team project 50 +%
Additional	Lectures, e-learning are recommended for learning the basic principles,
comments	terminology, and models of component integration. These should be reinforced through practical tasks, case studies, individual/team-projects.
Work Based	After learning the basic principles, terminology, and models of component
Learning Task	integration, the study should focus on analysing and simulating real work-life-
(If foreseen) and	like tasks as, for example:
Follow-up, learning	
reinforcement	<ul> <li>Component Documentation: Students will write clear, concise documentation for a software component's integration points. This exercise simulates the necessity of proper documentation in managing dependencies and expectations between different components and teams.</li> <li>Troubleshooting Integration Issues: This task involves simulating a component integration issue in a larger system and encouraging students to diagnose and solve the problem.</li> </ul>
Important (new) approaches and technologies to consider	<ul> <li>Containerization Technologies (Docker/Kubernetes): These allow the encapsulation of software components along with their dependencies, ensuring consistency across different computing environments. Kubernetes extends this by providing orchestration capabilities for managing containers at scale.</li> <li>Service Mesh (Istio/Linkerd): These are used to manage inter-service communication in a microservices architecture, providing capabilities such as load balancing, service discovery, and traffic control.</li> </ul>
Training facilities (Link to ESSA learning material Platform)	https://learn.softwareskills.eu/

## 2.1.2.1 Learning Units PLO 1 – Component integration [e-4]

LUI	Introduction to Component Integration
Duration	1 ECTS
Didactical Approach and delivery method	Lecture/Project

Additional	eLearning
information	
Assessment	Practical assignment
Title of the	Introduction to Component Integration.docx
Learning material	

LU2	Continuous Integration Practices
Duration	1 ECTS
Didactical	Lecture/Project
Approach and	
delivery method	
Additional	eLearning
information	
Assessment	Report
Title of the	Continuous Integration Practices
Learning material	

LU3	Integrating Components for Machine Learning Project
Duration	1 ECTS
Didactical	Lecture/Project
Approach and	
delivery method	
Additional	eLearning
information	
Assessment	Practical assignment
Title of the	Integrating Components for Machine Learning Project.docx
Learning material	

# 2.1.3 Learning Program PLO 2 – Testing [e-4]

Overall information PLO 2 - Testing [e-4]		
N. of Learning Units	2	
Learning Outcomes	<ul> <li>Creates and guides a process for testing an advanced/ innovative solution, software application or component (e.g., proposes standards or practice; for a solution related to e.g., machine learning, cloud, big data, blockchain, IoT)</li> <li>Writes a report/ advisory report/ paper/ research article on a topic related to testing of an innovative/ advanced/ complex solution, software application or component or on issues regarding testing in specific situations (e.g., agile testing, a process design for an entire testing activity, specification of internal standards of practice for testing, test management plan for CI testing)</li> </ul>	
Duration	-	

Total number of	starting from n.3 ECTS
ECTS	starting normal etcas
Recommendations	This PLO should be an integral part of the advanced studies for students with
for Micro-	significant prior knowledge of DevOps practices.
credentials	Recommended as an independent micro-credential for upskilling senior
credentials	DeVOps experts.
Often integrated	-
with studies of PLO	
Recommended	e-learning
Didactical	work placement
Approach	
Additional	-
comments	
Recommended	Lecture up to 50%
Delivery methods	Case study. Individual/team project 50+%
Delivery methods	case stady. manuala, team project 307%
Additional	Lectures, e-learning are recommended for learning the basic principles,
comments	terminology, and models of DevOps testing practices. These should be
	reinforced through practical tasks, case studies, individual/team-projects.
Work Based	After learning the basic principles, terminology, and models of DevOps testing,
Learning Task	the study should focus on analysing and simulating real work-life-like tasks as,
(If foreseen) and	for example:
Follow-up, learning	
reinforcement	<ul> <li>Automating Infrastructure Setup with Infrastructure as Code (IaC): Using tools like Terraform, Ansible, or AWS CloudFormation, students can learn to set up and automate an entire infrastructure for a web application. This might include setting up the database, web server, application server, and load balancers.</li> <li>Implementing CI/CD Pipelines: Students can create CI/CD pipelines using tools like Jenkins, GitLab CI/CD, or GitHub Actions. This should include build automation, testing, deploying to a staging environment, manual approval processes, and deploying to production.</li> </ul>
Important (new) approaches and technologies to consider	<ul> <li>Progressive Delivery: It is an approach that focuses on advancing new features and services into production in a controlled and gradual way. Techniques under this include Canary releasing, Blue-Green deployments, etc.</li> <li>Observability: More than just monitoring, observability includes the gathering, visualizing, and analyzing of metrics, logs, and traces from a system. Tools like Prometheus, Grafana, ELK Stack, Jaeger, etc., play a significant role in this domain.</li> </ul>
Training facilities (Link to ESSA learning material Platform)	https://learn.softwareskills.eu/

## 2.1.3.1 Learning Units PLO 2 – Testing [e-4]

	Automation test strategies
LUI	
Duration	2 ECTS
Didactical	Lecture/Project
Approach and	
delivery method	
Additional	e-learning
information	
Assessment	Practical assignment
Title of the	Automation test strategies
Learning material	

LU2	Configuration Management
Duration	1 ECTS
Didactical	Lecture/Project
Approach and	
delivery method	
Additional	e-learning
information	
Assessment	Report
Title of the	Configuration Management
Learning material	

## 2.1.4 Learning Program PLO 3 – ICT Systems Engineering [e-4]

Overall information PLO 3 – ICT Systems Engineering [e-4]	
N. of Learning Units	2
Learning Outcomes	<ul> <li>Writes a proposal for a cohesive and efficient system infrastructure (e.g., incorporating advanced/ innovative solutions, methods, tools and/or technologies, e.g., focusing on practices, procedures, system requirements, security, data protection, energy efficiency) (e.g., architecture and design of complex systems, application of agile software development lifecycle methodologies, managing infrastructure engineering implications in system design, managing continuous delivery in systems integration, application of test specifications methodologies in systems integration)</li> <li>Designs a full DevOps pipeline, by formulating a set of practices and tools that the development and operations teams may implement to build, test, and deploy software</li> </ul>
Duration	-

Total number of	starting from n.2 ECTS
ECTS	starting nonni.z ects
Recommendations	This PLO should be an integral part of the advanced studies for students with
for Micro-	prior knowledge of software development.
credentials	Recommended as an independent micro-credential for upskilling junior
oredeficials	DevOps developers.
Often integrated	-
with studies of PLO	
Recommended	e-learning
Didactical	work placement
Approach	work placement
, pprodott	
Additional	-
comments	
Recommended	Lecture up to 50%
Delivery methods	Case study. Individual/team project 50+%
Additional	Lectures, e-learning are recommended for learning the basic principles,
comments	terminology, and models of ICT architectures. These should be reinforced
	through practical tasks, case studies, individual/team-projects
Work Based	After learning the basic principles, terminology, and models of ICT architecture,
Learning Task	the study should focus on analysing and simulating real work-life-like tasks as,
(If foreseen) and	for example:
Follow-up, learning	
reinforcement	<ul> <li>Develop a CI/CD Pipeline Proposal: Students could design a complete CI/CD pipeline, including stages for building the application, running automated tests, deploying to a staging environment, manual approval, and deploying to a production environment. The pipeline should incorporate advanced practices like blue/green or canary deployments.</li> </ul>
	<ul> <li>Implement DevSecOps: Ask students to propose a strategy for integrating security into the DevOps lifecycle, considering aspects like static code analysis, dependency scanning, and secrets management.</li> </ul>
Important (new)	Infrastructure as Code (IaC): While not entirely new, the emphasis and reliance
approaches and	on IaC have grown. Newer tools like Pulumi, which extends the concept of IaC
technologies to	to allow developers to use familiar general-purpose languages like Python or
consider	JavaScript, are gaining traction.
Training facilities	https://learn.softwareskills.eu/
(Link to ESSA	
learning material	
Platform)	

#### 2.1.4.1 Learning Units PLO 3 – ICT Systems Engineering [e-4]

LU1	DEVOPS system infrastructure
Duration	1 ECTS
Didactical	Lecture/Practical Assignment
Approach and delivery method	

Additional	eLearning
information	
Assessment	Practical assignment
Title of the	DEVOPS system infrastructure.docx
Learning material	

LU2	Design of deployment pipelines
Duration	1 ECTS
Didactical Approach and delivery method	Lecture/Practical Assignment
Additional information	eLearning
Assessment	Practical assignment
Title of the Learning material	Design of deployment pipelines.docx

## 2.1.5 Learning Program PLO 4 – Profession related competences [EQF7]

Overall information PLO 4 – Profession related competences [EQF7]	
N. of Learning Units	3
Learning Outcomes	<ul> <li>Advises on the application of a new technology. Given a certain situation or context, writes a report with recommendations or some advice on a solution that involves the application of a new technology. Reflects critically on a new technology.</li> <li>Analyses, improves, and provides expert advice and guidance on security standards, regulations, measures, methods, tools, and techniques, taking into account the broader business context and current IT developments</li> <li>Analyses, improves, and provides expert advice and guidance on sustainability standards, regulations, measures, and methods, taking into account the broader business context and current IT developments</li> <li>Is continuously aware of ethical considerations and issues and applies these in professional context and activities. Forms and communicates an opinion based on incomplete and or limited information, taking into account social, scientific and ethical responsibilities related to the application of own knowledge and opinions. Promotes ethical thinking</li> </ul>
Duration	-
Total number of ECTS	starting from n.3 ECTS
Recommendations for Micro-	This PLO should be an integral part of the studies for students with no prior knowledge of software development.
credentials	Recommended as an independent micro-credential for upskilling Solution Designers.

Often integrated	-
with studies of PLO	
Recommended	e-learning
Didactical	work placement
Approach	
Additional	-
comments	
Recommended	Lecture up to 50%
Delivery methods	Case study. Individual/team project 50 + %
Denvery methods	Case study. Marvada, team project - 50 + 70
Additional	Lectures, e-learning are recommended for learning the basic principles,
comments	terminology, and behaviour models of various DeVOps Competences. These
comments	
	should be reinforced through practical tasks and case studies.
Work Based	After learning the basic principles, the study should focus on analysing and
Learning Task	simulating real work-life-like tasks as, for example:
(If foreseen) and	
, Follow-up, learning	• Ethical Impact Assessment: Students can be given a scenario where
reinforcement	they have to design a solution with potential ethical implications (e.g., a
	facial recognition system). They will need to identify the ethical
	considerations, discuss possible mitigation strategies, and justify their
	decisions in the context of existing ethical frameworks.
	<ul> <li>Sustainable Solution Development: In this task, students could design a</li> </ul>
	software solution with specific sustainability requirements, like
	minimizing power usage or ensuring the solution is designed in a way
	that it would remain relevant and usable for a long period of time
	(longevity). They could also be asked to assess and optimize the energy
	consumption of existing software systems.
	<ul> <li>Accessibility and Inclusivity: In this task, students can be asked to</li> </ul>
	design software that meets accessibility standards and is usable for
	people with various disabilities. They could be asked to simulate the
	experience of using their software as a person with a disability, and
	make necessary adjustments to improve accessibility.
	······································
Important (new)	
approaches and	• Green Software Engineering: This involves developing software in a way
technologies to	that minimizes its impact on the environment, for instance by optimizing
consider	its resource usage. This approach aligns with the growing emphasis on
CONSIGE	sustainability in all fields of technology.
	• Ethics in AI: Given the increasing use of AI in decision-making processes,
	understanding how to develop and implement these systems ethically
	is crucial. This includes knowledge of bias, fairness, transparency, and
	accountability in AI systems.
Training facilities	https://learn.softwareskills.eu/
(Link to ESSA	
learning material	
Platform)	
,	I

#### 2.1.5.1 Learning Units PLO 4 – Profession related competences [EQF7]

LUI	Security Considerations
Duration	1 ECTS
Didactical Approach and delivery method	Lecture/Project
Additional information	e-learning
Assessment	Report
Title of the Learning material	Security Considerations.docx

LU2	Cost Considerations
Duration	1 ECTS
Didactical	Lecture/Project
Approach and	
delivery method	
Additional	e-learning
information	
Assessment	Report
Title of the Learning	Cost Considerations.docx
material	

LU3	Solution Architecture Document
Duration	1 ECTS
Didactical	Lecture/Project
Approach and	
delivery method	
Additional	e-learning
information	
Assessment	Report
Title of the Learning	Solution Architecture Document.docx
material	

## 2.1.6 Learning Program PLO 5 – Soft competences [EQF7]

Overall information PLO 5 – Soft competences [EQF7]	
N. of Learning Units	7
Learning Outcomes	<ul> <li>Related to the occupation, knowledge domain, and field of science, critically collects: in-depth and detailed professional and scientific information on a range of basic theories, principles and concepts, as well as information on some important current issues and topics.</li> </ul>

	Analyses, evaluates, and combines critically this information, knowledge and insights and presents this in a scientific way. Critically
	applies/translates/interprets results of research (possibly executed by
	others) to the own context (the occupation and/or knowledge domain).
	Executes detailed scientific research
	- Exercises (self-)management in situations that are complex,
	unpredictable and require new strategic approaches. Is able to cope
	with change (positive or negative), to adapt to a considerable level of
	variety in the workplace and to transform the work or study context.
	Handles pressure and setbacks and maintains composure. Shows
	initiative, creativity and originality and carries responsibility for the
	results of own activities, work and or study and for the work results of
	others. Works correctly and carefully, fully aware of the importance of
	trustworthiness and accountability.
	- Realises learning and personal development, mostly autonomous and
	based on intrinsic motivation, looking for personal learning objectives.
	Selects and uses training/instructional methods and procedures
	appropriate for the situation when learning or teaching new things.
	· · · · · · · · · · · · · · · · · · ·
Duration	-
Total number of	starting from n.2 ECTS
ECTS	
Recommendations	This PLO should be an integral part of the initial studies for students with some
for Micro-	knowledge of software development.
credentials	Recommended as an independent micro-credential for upskilling DevOps
	Experts
Often integrated	-
with studies of PLO	
Recommended	e-learning
Didactical	work placement
Approach	
Additional	-
comments	
Recommended	Lecture up to 50%
Delivery methods	Case study. Individual/team project 50 + %
Additional	-
comments	
Work Based	After learning the basic principles, terminology, and model soft competences,
Learning Task	the study should focus on analysing and simulating real work-life-like tasks as,
(If foreseen) and	for example:
Follow-up, learning	
reinforcement	Project Management Simulation: Assign students a project where they
	need to develop a hypothetical software solution. This could be
	anything from a mobile app to a data analysis system. Make the project
	parameters vague and open-ended, and introduce unexpected
	changes or challenges partway through. This will require them to
	strategize, adapt, and manage their resources effectively. To enhance

	<ul> <li>the complexity, include multiple stakeholders with varying interests and requirements.</li> <li>Peer-Led Learning Sessions: Encourage students to select a topic related to the course content that they're particularly interested in, and then task them with leading a class session or workshop on that topic. This will help foster autonomous learning and teaching skills, and help them develop the ability to choose appropriate instructional methods for different situations.</li> <li>Failure Analysis: Have students examine real-life cases of software solution failures. They could analyse why the solution failed, how the situation was managed, and how it could have been handled better. This will help them learn how to handle setbacks, manage pressure, and strategize in complex, unpredictable situations.</li> <li>Independent Research Project: Assign an open-ended research project that requires students to investigate and present on a current trend or issue in the software solutions field. The project can be chosen based on the students' own interests, encouraging intrinsic motivation and personal learning objectives.</li> </ul>
Important (new) approaches and technologies to consider	<ul> <li>Collaborative Tools: Technologies like Microsoft Teams, Slack, and GitHub facilitate collaboration and can help students learn to work as part of a team, manage their time and tasks, and navigate a remote work environment.</li> <li>Online Learning Platforms: Sites like Coursera, edX, and LinkedIn Learning allow students to pursue additional learning autonomously. This can be particularly useful for helping them find and explore personal learning objectives.</li> <li>Digital Portfolios: Tools like GitHub, Behance, and Dribbble allow students to showcase their work and track their learning progress. These portfolios can also help them reflect on their growth, set goals, and take responsibility for their learning outcomes.</li> </ul>
Training facilities (Link to ESSA learning material Platform)	https://learn.softwareskills.eu/

#### 2.1.6.1 Learning Units PLO 5 – Soft competences [EQF7]

LU1	Learning Soft Skills to Become a Better Solution Architect
Duration	2 ECTS
Didactical Approach and delivery method	Lecture/Project
Additional	e-learning
information Assessment	Practical assignment

Title of the	Learning Soft Skills to Become a Better Solution Architect.docx
Learning material	
<b>3</b>	

## 2.1.7 Learning Program PLO 6 – Functioning in organisation [EQF7]

Ov	erall information PLO 6 – Functioning in organisation [EQF7]
N. of Learning Units	2
Learning Outcomes	<ul> <li>Explains organisation theory and behaviour</li> <li>Describes the relationship between business and IT</li> <li>Works in an organisational context under broad direction, performing coordinating activities, with at least 3 years of working experience at an intermediate or senior level, as e.g., a specialist, team leader, manager, or a comparable role</li> <li>Leads a project</li> <li>Writes a report on functioning in organisation</li> </ul>
Duration	-
Total number of ECTS	starting from n.2 ECTS
Recommendations for Micro- credentials	Recommended as an independent micro-credential for upskilling DevOps Experts.
Often integrated with studies of PLO	-
Recommended Didactical Approach	e-learning work placement
Additional comments	-
Recommended Delivery methods	Lecture up to 50% Case study. Individual/team project 50 + %
Additional comments	-
Work Based Learning Task (If foreseen) and Follow-up, learning reinforcement	<ul> <li>After learning the basic principles, terminology, and models of how a DevOps expert should function within an organisation, the study should focus on analysing and simulating real work-life-like tasks as, for example:</li> <li>Case Study Analysis: Students can study real-life examples of successful and unsuccessful software projects within organizations. They can analyze what went well, what went wrong, and how organizational theory and behavior influenced the outcomes.</li> <li>Cross-functional Teamwork: Assign students to teams that mimic the structure of a real software development team, with roles such as project manager, developer, UX/UI designer, and quality assurance. This task will help them understand the dynamics of working in a cross-functional team and the challenges and benefits that come with it.</li> </ul>

	<ul> <li>Stakeholder Communication Simulation: In this task, students can simulate meetings with various stakeholders, such as clients, senior management, or other teams within the organization. This will give them practice communicating effectively in a professional setting and managing expectations.</li> </ul>
Important (new) approaches and technologies to consider	<ul> <li>Digital Collaboration Tools: Platforms like Slack, Microsoft Teams, or Asana can simulate real-world project management and team collaboration. They can help students learn how to coordinate with remote or distributed teams, which is increasingly common in the software industry.</li> <li>Business Process Automation Tools: Software like Zapier or Integromat can be introduced to show students how repetitive tasks can be automated in an organization, thus improving efficiency, and allowing more focus on strategic tasks.</li> <li>Data Analytics Tools: Understanding data analytics tools like Google Analytics, Tableau, or PowerBI can be essential for making data-driven decisions. These tools can support case study analysis and help students grasp the impact of metrics and KPIs on organizational behavior and strategies.</li> </ul>
Training facilities (Link to ESSA learning material Platform)	https://learn.softwareskills.eu/

## 2.1.7.1 Learning Units PLO 6 – Functioning in organisation [EQF7]

LUI	Organisational Culture for Continuous delivery
Duration	1 ECTS
Didactical Approach and delivery method	Lecture/Project
Additional information	E-LEARNING
Assessment	Practical assignment
Title of the Learning material	Organisational Culture for Continuous delivery.docx

LU2	Collaborative Management for DEVOps
Duration	1 ECTS
Didactical Approach and delivery method	Lecture/Project
Additional information	E-LEARNING

essa.	European Software Skills Alliance	Tr

Assessment	Self-reflection report
Title of the Learning	Collaborative Management for DEVOps
material	

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