

European Software
Skills Alliance.

ESSA Learning programmes

DELIVERABLE 10 - ESSA Learning Programmes & Materials

30 November 2023
Status: Final version

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Co-funded by the
Erasmus+ Programme
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ESSA Learning programmes – Final version.

DELIVERABLE 10 - ESSA Learning Programmes & Learning Materials

This document is a draft version and is subject to change after review coordinated by the European Education and Culture Executive Agency (EACEA).

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Co-funded by the
Erasmus+ Programme
of the European Union

About ESSA

The European Software Skills Alliance (ESSA) is a four-year transnational project funded under the European Union's Erasmus+ programme. It ensures that 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 non-academic partners from the education, training, and software sectors.

View all project partners: [ESSA Partners](#) | [ESSA Associated Partners](#)



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List of abbreviations and acronyms

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

1. Executive Summary

1.1 Introduction

This report “ESSA Learning Programmes & Materials” presents the educational activities designed by the European Software Skills Alliance (ESSA) for skilling, up-skilling and re-skilling students and professionals into in-demand software roles, in order to achieve the ESSA learning objectives and complete a specific set of tasks. The ESSA Learning Programmes provided by Work Package (WP) 4 are based upon the ESSA [Educational Profiles](#), a key outcome of previous WP3, which are included again into this document for overall comprehensiveness. Four main software professional roles identified by the Alliance are covered: Developer, DevOps expert, Solution Designer, Test Specialist, and this at their applying qualification levels (EQF 4-7).

This document — and the eight related Annexes — was produced within the overall implementation of Work Package 4 “Learning Programmes, Testing & Rollout” under the European Software Skills Alliance (ESSA) project and specifically refers to task 4.1 “Design and develop ESSA Learning Programmes”. Main goal of this task was to practically implement the previously developed Curricula Guidelines (D.7) and related [Educational Profiles](#) into learning and teaching practice.

The contents and information are organised as follows:

- Chapter two presents in eight sub-chapters four Educational Profiles (Developer, DevOps expert, Solution Designer, Test Specialist) developed by the ESSA Alliance according to different EQF levels in previous WP3; they were identified in the first project phase to match market needs. Each sub-chapter provides in the final sub-section a brief overview of the ESSA Learning Programmes designed by the ESSA piloting partners per Educational Profile and EQF level, leaving consultation of the full Learning Programmes to the Annexes.
- Chapter three briefly describes the ESSA dedicated platform www.learn.softwareskills.eu. The platform contains the collection of learning materials developed by the Alliance for Europe-wide free access and use to support the delivery of the ESSA Learning Programmes designed for each Educational Profile and applying EQF level(s). This chapter also provides links to other relevant documents produced within the project that can be consulted as in-depth reading. The contents provided in each of the eight annexes are essential to the implementation of the ESSA Learning Programmes piloting action (see Deliverable 11; Task 4.2).

Each Annex presents details of the ESSA Learning Programmes designed for each Educational Profile at a specific EQF level (4-7), focusing on the type of target group and learning provider. It should be stressed that, consistent with the project goals and in order to meet local needs, to support flexibility in educational programmes and to promote the use of individualised learning pathways, more than one learning programme has been designed for some Educational Profiles at a specific EQF level, each one presented in the related Annex.

Each Annex is structured as follows:

- Executive summary — general overview of each ESSA Learning Programme.
- Learning pathways specifically related to each Programme Learning Outcome (PLO), providing the following Information:
 - Duration of the study (ECTS/Hours);
 - Recommendations for micro-credentials;
 - Recommendations on didactical approach, delivery method and training environment;
 - Indications, if applicable, on WBL and Follow up reinforcement;
 - Indications, if applicable, on approaches and technologies to be considered;
 - Assessment method for each Learning Unit Outcome;
 - Learning resources (additional information is provided for each Learning Unit: on the duration, didactical approach, assessment, title of learning material, delivery method for the learning material, link to the ESSA Learning platform where the learning materials are available).

1.2 Target groups

The contents of this document are relevant for the following users/target groups:

- learning programme developers;
- curricula designers;
- teachers, trainers, educators;
- learning providers of all types (VET, HE, public and private) delivering learning programmes to individuals and in the context of organisations;
- professionals and students.

1.3 Objective

The overarching objective of this document is to support:

- the ESSA Learning Programmes Piloting phase (Task 4.2, see Deliverable 11);
- the evaluation and review of the ESSA Learning Programmes and ESSA material proposed for each Educational Profile;
- ESSA Associated Partners in running their pilot version of the ESSA Learning Programmes;
- a general audience to consult, use and transfer the contents according to their specific training needs.

1.4 Methodological approach

The ESSA Learning Programmes presented in this document and related learning materials stored in the ESSA Platform www.learn.softwareskills.eu are built on the results achieved by the ESSA Alliance during the first two years of project implementation.

The ESSA Learning Programme conceptual approach agreed upon by the ESSA Alliance is focused on the following challenges:

- facilitating skilling, reskilling, and upskilling of professionals;
- developing learning programmes to meet local needs and address students/learners with different level of experience/skills;
- supporting flexibility in educational programmes by designing modular programmes based on self-consistent Learning Units, to facilitate planned soft piloting actions;
- promoting the use of individualised learning pathways;
- developing learning materials addressing specific target groups, designed around the Programme Learning Outcome (PLO) and Learning Unit (LU) Outcome level.

In order to meet these challenges, the following activities were implemented:

- weekly meetings to share information about the work in progress and to agree upon the formats provided;
- analysis of the curricula designed by the ESSA Alliance for each Educational Profile at a specific EQF level. This action was also implemented through the realisation – on weekly basis – of working group sessions. Working groups involved piloting partners and reviewing/contributing partners, consistent with the Educational Profile at a specific EQF level. These working groups were also meant to exchange — amongst the partners involved - more detailed information about the learning materials they could provide consistent with the specific field of competence and local market/educational needs;
- weekly monitoring, to update the work in progress and implement supporting actions when needed.

The activities implemented were useful for designing, reviewing and refining the educational contents and related learning materials that are presented in this document as the “ESSA Learning Programmes”, and are currently under pilot testing (see Deliverable 11).

1.5 Conclusions

This “ESSA Learning Programmes” document — including eight annexes — supports the implementation of the pilot and soft pilot actions planned in the project workplan (task 4.2 “Pilot the ESSA learning programme”) by providing the information necessary to:

- implement an innovative outcome-oriented learning programme, based on the expertise of all EU partners involved in the project and organised around flexible and modular learning units;
- support trainers, teachers, educators and organisations in arranging and running new learning programmes at national and regional/local level;
- contribute to the testing and final designing of specific Educational Profile dedicated Learning Programmes — and related learning materials — designed within the ESSA project, that could be used by different types of entities concerned with educational and training aspects (public and private located in different EU Countries).

1.6 Use of this document

At this stage, the document — including its annexes — is used by the partners in support of implementing their pilots, currently running as defined in the project workplan (see Task 4.2 and Deliverable D.11 “Pilot the ESSA learning programmes”)

The document can furthermore be adopted by ESSA Associated Partners to implement soft pilot versions of specific programmes (e.g. piloting only a portion of a programme limited to specific PLOs or Learning Units). This document provides Associated Partners with the relevant tools to identify the learning objectives, contents and material to use when running a programme or part of it.

The document also supports the European Mobility Programme (Task 6.2) component of the project in facilitating the identification of contents and learning activities that might be part of a transferrable element.

This document can also be adopted by trainers, teachers, education providers and the key players in the sector to obtain contents and information on ESSA learning programmes for in-demand software roles at different EQF levels.

1.7 ESSA Learning Resources

Learning materials developed under the ESSA project related to each Learning Programme/s designed for each Educational Profile and EQF level are available at the ESSA learning platform <https://learn.softwareskills.eu/>. For more information, please refer to Chapter 3. *Source of reference*.

2. ESSA educational profiles

This chapter presents details of the Educational Profiles designed by the Alliance to provide a full understanding of the related ESSA Learning Programmes.

The contents and information are organised as follows:

- A short presentation of the four roles in question (Developer, DevOps expert, Solution Designer, Test Specialist). Each role description is also accompanied by a short description focused on the specific EQF level (Junior Developer EQF 4/5, Developer EQF 6, Developer EQF 7, DevOps expert EQF 6, DevOps expert EQF 7, Solution Designer EQF 6, Solution Designer EQF 7, Test Specialist EQF 4/5).
- A detailed presentation of each of the eight Educational Profiles (EQF 4-7) relating to the ESSA Learning Programmes, in terms of: expected competences, deliverables to be mastered by learners, professional and educational perspectives, Programme Learning Outcomes (PLOs) and Learning Unit (LU) outcomes for each PLO.
- A Learning Programme Overview related to each of the eight Educational Profiles (EQF 4-7) relating to the ESSA Learning Programmes. This information is meant to provide a general overview (e.g., target groups, learning context, total of LUs, total duration/hours, etc.), but for the full Learning Programmes, consult the specific indicated Annexes.

DEVELOPER

Software developers build and create computer programs, including mobile applications, desktop applications, hybrid applications, or even sometimes operating systems. They may also be involved in other aspects of software development, including identifying user needs, software

design, new software testing, software implementation and system modifications. Software developers play a critical role in many professional fields, such as computer systems, manufacturing, finance and software publishing.

- **JUNIOR DEVELOPER EQF 4/5**

Junior developers support all aspects of software development stages: development, testing, implementation and maintenance of basic software solutions. They master the codebase, attend design meetings, write basic code and fix bugs. They have an inquisitive attitude, oversee consistency and work in an organised manner within clear boundaries.

- **DEVELOPER EQF 6**

Software developers at the Bachelor level develop, test, implement and maintain basic software solutions in accordance with customer needs. They may be also involved in the design of these applications. They account for others' development activities.

- **DEVELOPER EQF 7**

Software developers at the Master level develop, test, implement and maintain advanced/innovative software solutions in accordance with customer needs. They may also be involved in the design of the applications. Developers at the Master level have a deeper knowledge of one or more technologies, e.g. mobile computing, cloud technologies, Internet of Things, artificial intelligence and blockchain. They also oversee development and integration processes and projects and may initiate, plan and coordinate such processes and projects.

DEVOPS

DevOps experts create an efficient workflow and cooperation between software development and IT operations to accelerate delivery and enhance quality of solutions and services. Doing so reduces the time between committing a change to a system and the change being implemented in the production environment. DevOps experts strive for a continuous deployment and apply specific methods, practices and tools, such as agile ways of working, shared ownership, and workflow automation.

- **DEVOPS EXPERT EQF 6**

DevOps experts at Bachelor level develop, test and deploy solutions in close collaboration with the operations team and consider the multi-disciplinary nature of the context. They account for others' development activities.

- **DEVOPS EXPERT EQF 7**

DevOps experts at the Master level create and manage the integration and testing lifecycle of hardware, software, or subsystem components into an existing or a new system.

SOLUTION DESIGNER

Solution designers specify appropriate IT solutions for a specific business or organisation context based on a thorough understanding of the business, processes, technology and customer needs and requirements, translating the business requirements into IT solutions. Solution designers do this such that these solutions fit well in the business landscape (in line with the strategy, mission, organisation, needs, requirements, etc.) as well as ICT. Solution designers are well-informed about the latest developments and trends in the IT field, as well as services offered by the market. They work between business and IT.

- **SOLUTION DESIGNER EQF 6**

Solution designers at the Bachelor level are aware of the interests and needs of different stakeholders and carefully balance these in the proposal for an IT solution. They communicate and cooperate with customers, users and specialists, supporting them and guiding the IT solution through the different stages of development and implementation.

- **SOLUTION DESIGNER EQF 7**

Solution designers at the Master level oversee the bigger picture of the business, market and technology. They creatively develop innovative solutions, incorporating the latest trends and technologies if necessary and applicable. They combine a strategic vision with resource optimisation. They have an overview of different processes and projects and may initiate, plan and coordinate such processes and projects.

TEST SPECIALIST

Test specialists ensure that software applications and solutions comply with technical, and user needs and specifications. They design, execute, and record tests for software applications or services and report the results in a well-organised manner. They also interact with different stakeholders (e.g. developers and users) and know how to communicate their findings effectively.

- **TEST SPECIALIST EQF 4/5**

Test specialists at the entry level develop scenarios for the software. They choose an appropriate test form, such as unit test, integration test or acceptance test, as well as an appropriate testing method. They determine what is needed for testing, such as the test environment, resources and test data. They also perform the test(s), interpret the findings and draw conclusions. During the process, they proactively communicate with the parties involved. They have an inquisitive attitude, oversee consistency, and work in an organised manner within clear boundaries.

2.1 Junior Developer EQF 4/5¹

This educational profile belongs to the field of Software Engineering and is covered by relevant references in EN 16234-1:2019 (e-CF) and ISO/IEC/IEEE 90003:2018.

This profile aims at educating people, with or without previous ICT knowledge, to build and implement software components and applications based on specifications and designs using programming languages, tools, and platforms.

The profile has an EQF 4/5 level. No prior knowledge of the topic is required, but some basic background knowledge on the subject can constitute an advantage. This level requires:

- **Autonomy:** Work independently within specified boundaries and resolve issues that arise from project activities.
- **Context:** Structured/predictable context, well-defined, concrete, and abstract problems.
- **Content:** Common factual and theoretical knowledge that underpins the field of work or vocation in the local situation.

2.1.1 Competences

e-CF competences (incl. e-CF level)	General competences (incl. EQF level)
A.6. Application Design [e-2]	P. Profession-related competences (EQF5)
B.1. Application Development [e-2]	I.S. Interpersonal soft competences (EQF5)
B.2. Component Integration [e-2]	P.S. Personal soft competences (EQF5)
B.3. Testing [e-2]	F.O. Functioning in organisations (EQF5)
B.5. Documentation Production [e-2]	
C.4. Problem management [e-2]	

2.1.2 Deliverables

Learners should master the following deliverables:

- Simple relational database
- Code and related documentation
- Simple working software component/ application
- Modified existing software component/ application
- Installation report
- (Automated) test
- Test result documentation/ test report
- (Parts of) common technical documents

¹ The role profile is directly sourced from <https://softwareskills.eu/library/essa-educational-profiles-for-software-roles/>

- Solved incident
- Report on the application of a method, technique or tool related to a new technology
- Self-reflection report
- Report on functioning in an organisation

2.1.3 Professional perspectives

Upon completing this programme, the learner is eligible to apply for developer positions at Junior level for roles such as: Web Developer - Computer Programmer - Database Administrator - Software Developer - Software Engineer - Java Developer - Full-stack Developer - Font-end Developer - Back-end Developer.

2.1.4 Educational perspectives

The learner may continue in a Bachelor's Developer programme with a focus on more advanced application technologies and architectures.

The learner also has a proper base for further training and certification such as specific programming languages (e.g., Java, Python, C++) - Cybersecurity - Data analytics - Software architecture - Blockchain - Machine Learning/AI - DevOps - IoT/Automation/Robotics – Testing.

2.1.5 Programme Learning Outcomes (PLOs)

1. PLO Application Design [e-2]

The learner has demonstrated the capability

→ to interpret a design for a software application or component

Learning Unit outcomes	Explains and distinguishes basic principles and terminology of software design (e.g., phases in the design process, common techniques, deliverables)
	Describes principles of user interface design
	Reads design models and diagrams (e.g., ERD, UML)
	Interprets a basic database design
	Interprets a design for an application or software component

2. PLO Application Development [e-2]

The learner has demonstrated the capability

→ to systematically develop a simple software application or component

→ to propose modifications to an existing solution

→ to document the development activities

Learning Unit outcomes	Explains and distinguishes common software development methods (e.g., waterfall, iterative, agile), techniques (e.g., object-oriented) and tools (e.g., IDE, CASE; multimedia integration tools; app development tools)
	Describes common programming principles and terminology (e.g., secure programming)
	Explains concepts and principles of databases, data structures and query languages (e.g., SQL)

Participates in a development process and applies a common software development method (e.g., agile)
Creates a simple relational database
Writes code and related documentation to it, by using a common programming language and applying coding conventions (e.g., Java, Javascript, PHP, Python; clean coding principle)
Creates a simple working software component or application, taking into account architecture, design requirements and other possible constraints (e.g., installability) applying relevant tools and techniques (e.g., object-oriented programming; IDE, CASE; editors, compilers, version control tools)
Modifies an existing software application or component

3. PLO Component Integration [e-2]

The learner has demonstrated the capability

→ to integrate efficiently a software application or component into an existing system

→ to document the installation activities

Learning Unit outcomes	Explains and distinguishes common methods, techniques and tools related to efficient integration
	Describes the interplay between and compatibility of system components
	Carries out installation and configuration activities, applying common methods, techniques and tools related to efficient integration (e.g., packaging and distribution, virtualisation, containerisation)
	Monitors and tests the connectivity of integrated systems
	Writes an installation report

4. PLO Testing [e-2]

The learner has demonstrated the capability

→ to test a software application or component

→ to document test outcomes

Learning Unit outcomes	Explains and distinguishes principles of software testing, common testing methods, techniques, and tools
	Writes an (automated) test on a piece of code
	Performs common test activities, applying testing and debugging techniques and tools
	Records and interprets test outcomes and writes test result documentation/ test report

5. PLO Documentation Production [e-2]

The learner has demonstrated the capability

→ to draft technical documentation

Learning Unit outcomes	Describes types of technical documentation
	Provides different (parts of) technical documents, using appropriate tools (e.g., software documentation tools)

6. PLO Problem management [e-2]

The learner has demonstrated the capability

→ to act systematically in handling incidents and problems

Learning Unit outcomes	Systematically resolves or escalates incidents and problems, resulting in a solved incident e.g., by applying techniques and tools for troubleshooting such as diagnostic tools
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7. PLO Profession related competences [EQF5]

The learner has demonstrated the capability

→ to apply profession related skills

Learning Unit outcomes	Masters common ICT knowledge
	Explains the principles, related concepts, advantages and disadvantages of a new technology. Applies and reports on basic methods, techniques and tools related to a new technology.
	Applies and reports on measures, methods, tools and techniques related to security
	Applies and reports on measures, methods, tools and techniques related to software lifecycle processes
	Is aware of basic ethical considerations and issues

8. PLO Soft competences [EQF5]

The learner has demonstrated the capability

→ to apply soft skills

Learning Unit outcomes	Works together with others in a team
	Communicates with peers, colleagues, supervisors and/or relevant others, appropriately to the context, using conventions that are relevant to professional practice. Explains and gives instruction.
	Masters the English language at level B2. Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation
	Distinguishes and analyses fairly complex and unpredictable problems. Solves these problems systematically and in a creative way, using existing procedures and guidelines and own solutions by identifying and using data.
	Exercises self-management within the guidelines of contexts that are usually predictable, but are subject to change. Is able to cope with limited change and to adapt to a certain level of variety in the workplace. Copes with pressure and stress setbacks and maintains composure. Shows some initiative and carries responsibility for the results of own activities, work and or study. Works correctly and carefully.
	Realises learning and personal development on request, where necessary with support, through self-reflection and external- and self-evaluation of own (learning) results.

9. PLO Functioning in organisations [EQF5]

The learner has demonstrated the capability

→ to function in an organisational context

Learning Unit outcomes	Explains the basics of organisation theory and behaviour
	Describes the relationship between business and IT
	Works in an organisational context under specific direction with limited autonomy and responsibility (e.g., at the level of a trainee, junior or assistant)
	Works in project settings, applies project management methods and tools
	Writes a report on functioning in the organisation

2.1.6 Learning Programme Overview

Three ESSA Learning Programmes were designed tailored for the target groups and specific situation of the learning providers involved in the pilot.

The following information provides a general overview, including:

- Learning context
- Target groups
- Learning providers
- Total of Learning Units
- Total duration (hours)
- Total ECTS
- Micro-credentials (when applicable)
- Requirements and recommendations on training environment and facilities (when applicable)

To consult the full ESSA Learning Programmes, please refer to **Annex I**.

Learning context

non-formal education

formal education

Target group/s

- Students/Learners with ICT background (students from Technical Institutes, university students and professionals committed to upskilling or reskilling paths);
- Unemployed adults and young people aged 16 to 29 years who are not currently working or studying;
- Workers (employed/unemployed) in Upskilling/reskilling paths.

Learning providers

Higher Education institutions

Training providers

Jr Developer EQF 4/5 (Annex I)						
Target groups	Total n. of LUs	Total duration (hours)	Total ECTS	Learning context	Micro-credentials	Requirements and recommendations on training environment and facilities
<i>Students/Learners with ICT background</i>	14	200	8	non formal education	n/a	Refer to the full Learning Programme
<i>Unemployed adults and young people aged 16 to 29 years who are not currently working or studying</i>	13	92	min 4	non formal education	n/a	Computer class with Win 11, RAM 8 GB, HDD 256 GB, if possible with two screens, MS Office (not compulsory).

						Software is open source (Visual Studio Code, XAMPP).
<i>Workers (employed/unemployed) in upskilling/reskilling paths</i>	13	min 212	min 8	non formal education + formal education	<p>A number of modules in this programme are suitable to be delivered as micro-credentials.</p> <p>While this specific programme is not accredited, should an academic institution wish to use it, those modules indicated in this guide identified as suitable for deliver as micro credentials could be taken through a relevant accreditation process.</p>	<p>Students' will be required to attend a number of in teaching hours at the designated University in addition to the online classes.</p> <p>Students' will require a laptop computer with adequate broadband and a working camera to participate in the programme.</p> <p>Students' will be provided access to the online teaching tool.</p>

2.2 Developer EQF 6²

This educational profile belongs to the field of Software Engineering and is covered by relevant references in EN 16234-1:2019 (e-CF) and ISO/IEC/IEEE 90003:2018.

This profile is for educating people, with or without previous ICT knowledge, to build and implement software components and applications based on specifications and designs using programming languages, tools, and platforms.

The profile has an EQF 6 level. No prior knowledge of the topic is required.

This level requires:

² The role profile is directly sourced from <https://softwareskills.eu/library/essa-educational-profiles-for-software-roles/>

- **Autonomy:** Works independently under broad direction to solve problems. Has a positive effect on team performance.
- **Context:** Structured – unpredictable context, vague problems, open approach and solution space.
- **Content:** Combination of multiple concepts for advancement and innovation in the local situation.

2.2.1 Competences

e-CF competences (incl. e-CF level)	General competences (incl. EQF level)
A.6. Application Design [e-3]	P. Profession-related competences (EQF6)
B.1. Application Development [e-3]	I.S. Interpersonal soft competences (EQF6)
B.2. Component Integration [e-2]	P.S. Personal soft competences (EQF6)
B.3. Testing [e-2]	F.O. Functioning in organisations (EQF6)
B.5. Documentation Production [e-3]	
C.4. Problem Management [e-3]	

2.2.2 Deliverables

Learners should master the following deliverables:

- Requirements and functional specifications
- Functional and data modelling diagrams
- Database design
- Simple system architecture and interfaces
- Design for an application or software (component)
- Overall plan for the design
- A structured dataset
- Code and related documentation
- Working software component/ application
- Modified existing software component/ application
- Installation report
- (Automated) test
- Test result documentation/ test report
- (Parts of) relevant technical documents
- Solved incident
- Impact assessment of failure
- Report on the application of a method, technique or tool related to a new technology
- Overall project plan for the design/development of an application or software component
- Self-reflection report
- Report on functioning in an organisation

2.2.3 Professional perspectives

Upon completing this programme, the learner is eligible to apply for junior developer positions such as Web Developer - Computer Programmer - Database Administrator - Software Developer - Software Engineer - Java Developer - Full-stack Developer - Front-end Developer - Back-end Developer.

2.2.4 Educational perspectives

After completing this programme, the learner may continue in a Master's Developer programme with a focus on more complex and specific application technologies and architectures.

The learner also has a proper base for more advanced training and certification such as Specific programming languages (e.g., Java, Python, C++) - Cybersecurity - Data analytics - Software architecture - Blockchain - Machine Learning/AI - DevOps - IoT/Automation/Robotics – Testing.

2.2.5 Programme Learning Outcomes (PLO)

1. PLO Application Design [e-3]

The learner has demonstrated capability

→ to specify a design for a software application or component that meets requirements

→ to organise the planning of the design of an application or software component

Learning Unit outcomes	Explains and distinguishes principles and terminology of software design (e.g., phases in the design process, techniques, deliverables)
	Describes principles of usability, UI/UX design, accessibility, privacy, security
	Identifies needs of customers, users, stakeholders and formulates requirements and functional specifications
	Creates functional and data modelling diagrams, using common languages and techniques (e.g., DFD, IDEFO, ERD, and UML)
	Creates a database design
	Designs a simple system architecture and interfaces using familiar technologies
	Compares alternatives for a design and selects the most promising alternative(s), optimising the balance between cost and quality
	Specifies a design for a software application or component, taking into account certain constraints/ requirements (e.g., the development environment, programming language, technology, requirements related to performance, security, accessibility, usability, privacy, ethics, safety, IS policy, cost, quality)

2. PLO Application Development [e-3]

The learner has demonstrated capability

→ to creatively develop software applications and components, by interpreting the software design

→ to optimise the application development

Learning Unit outcomes	Organises data and creates a structured dataset
	Writes code and related documentation to it, using programming languages (e.g., Java, Javascript, PHP, Python) and tools (e.g., GitHub), applying programming principles (e.g., clean coding, green coding, secure programming) and other relevant practices, principles, or constraints (e.g., privacy legislation, intellectual property law)
	Efficiently creates a working software component/ application taking into account design requirements and other relevant constraints (e.g., architecture, efficiency, cost, quality, energy consumption) and applying relevant tools and techniques (e.g., object-oriented programming; IDE, CASE; editors, compilers; version control management and tools; multimedia integration tools; app development tools; reuse of proved solutions)

Modifies an existing software component/ application, in order to optimize it (e.g., to improve maintenance, performance, security)
Participates in a development process, selecting and applying appropriate methods and techniques (e.g., a software development method such as agile, prototyping)

3. PLO Component Integration [e-2]

The learner has demonstrated capability
 → to integrate efficiently a software application or component into an existing system
 → to document the installation activities

Learning Unit outcomes	Explains and distinguishes common methods, techniques and tools related to efficient integration
	Describes the interplay between and compatibility of system components
	Carries out installation and configuration activities, applying common methods, techniques and tools related to efficient integration (e.g., packaging and distribution, virtualisation, containerisation)
	Monitors and tests the connectivity of integrated systems
	Writes an installation report

4. PLO Testing [e-2]

The learner has demonstrated capability
 → to test a software application or component
 → to document test outcomes

Learning Unit outcomes	Explains and distinguishes principles of software testing, common testing methods, techniques, and tools
	Writes an (automated) test on a piece of code
	Performs common test activities, applying testing and debugging techniques and tools
	Records and interprets test outcomes and writes test result documentation/ test report

5. PLO Documentation Production [e-3]

The learner has demonstrated capability
 → to produce different technical documents, taking into account the needs of different populations

Learning Unit outcomes	Identifies the needs of different populations regarding software documentation.
	Provides (parts of) relevant technical documents, (e.g., required for designing, developing, and deploying applications and services), in line with identified needs of different audiences, using appropriate tools

6. PLO Problem management [e-3]

The learner has demonstrated capability
 → to systematically resolve incidents and problems
 → to optimise system performance
 → to appraise the impact of a failure on the business

Learning Unit outcomes	Monitors the software system (e.g., by using monitoring systems and analytical tools)
	Detects, analyses, and systematically resolves or escalates incidents and problems, resulting in a solved incident (e.g., by applying techniques and tools for troubleshooting such as diagnostic tools; interpreting incident and problem reports; by optimising overall system performance)
	Provides an impact assessment of a failure on the business
	Recommends actions to improve system or component performance

7. PLO Profession related competences [EQF6]

The learner has demonstrated capability
 → to apply profession related skills

Learning Unit outcomes	Masters common ICT knowledge
	Explains the principles, related concepts, advantages, disadvantages, limitations and possible societal, environmental, and ethical issues related to the application of a new technology. Applies and reports on basic methods, techniques and tools related to a new technology.
	Applies, evaluates, reports and provides advice on security standards, regulations, measures, methods, tools, and techniques
	Applies, evaluates and provides advice on appropriate methods, tools and techniques related to software lifecycle processes
	Applies, evaluates, reports and provides advice on sustainability standards, regulations, measures, and methods.
	Is aware of ethical considerations and issues and applies these in professional contexts and activities. Forms and communicates an opinion based on considerations of relevant social, professional, scientific and ethical aspects

8. PLO Soft competences [EQF6]

*The learner has demonstrated capability
→ to apply soft skills*

Learning Unit outcomes	Manages teamwork processes and facilitates collaboration to reach common objectives, e.g., handles conflicts, negotiates, motivates, and persuades.
	Communicates with peers, colleagues, supervisors and or relevant others, specialists and non-specialists, and clients, appropriately to the scientific and professional community, using conventions which are relevant. Applies communication to the objective and the target group.
	Masters the English language at level B2. Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation
	Related to the occupation and knowledge domain, critically collects detailed professional and/or scientific information on a limited range of basic theories, principles and concepts, as well as limited information on some important current issues and topics. Analyses, evaluates, and combines critically this information, knowledge and insights and presents this. Critically applies/ translates/ interprets results of research (possibly executed by others) to the own context (the occupation and/or knowledge domain). Executes applied and practice-oriented research.
	Identifies and analyses complex and unpredictable problems. Solves these problems in a tactical, strategic and creative way by selecting and using data and by using one's creativity, flexibility and inventiveness.
	Exercises self-management in complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts. Is able to cope with change (positive or negative) and to adapt to a considerable level of variety in the workplace. Handles pressure and setbacks and maintains composure. Shows initiative, creativity and some 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 on one's own initiative, by reflecting on and evaluating personal (learning) results. Selects and uses training/instructional methods and procedures appropriate for the situation when learning.

9. PLO Functioning in organisations [EQF6]

*The learner has demonstrated capability
→ to function in an organisational context*

Learning Unit outcomes	Explains the basics of organisation theory and behaviour
	Describes the relationship between business and IT
	Works in an organisational context under specific direction with limited autonomy and responsibility e.g., at the level of a trainee, junior or assistant
	Manages a project, selects appropriate project management methods and tools

Writes a report on functioning in organisation

2.2.6 Learning Programme Overview

Two ESSA Learning Programmes were designed tailored for the target groups and specific situation of the learning providers involved in the pilot.

The following information provides a general overview, including:

- Learning context
- Target groups
- Learning providers
- Total of Learning Units
- Total duration (hours)
- Total ECTS
- Micro-credentials (when applicable)
- Requirements and recommendations on training environment and facilities (when applicable)

To consult the full ESSA Learning Programmes please refer to **Annex II**.

Learning context

non-formal education

formal education

Target group/s:

- IT-oriented students
- People without ICT knowledge that want to reskill themselves quickly

Learning providers:

Higher Education institutions

Training providers

Developer EQF 6 (Annex II)						
Target groups	Total n. of LUs	Total duration (hours)	Total ECTS	Learning context	Micro-credentials	Requirements and recommendations on training environment and facilities
<i>IT-oriented students</i>	11	73,5	3	formal education	please refer to full Learning Programme	Refer to full Learning Programme

People without ICT knowledge that want to reskill themselves quickly	Min 4	Min 216	Min 8	non formal education	please refer to full Learning Programme	Refer to full Learning Programme
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2.3 Developer EQF 7³

This educational profile belongs to the field of Software Engineering and is covered by relevant references in EN 16234-1:2019 (e-CF) and ISO/IEC/IEEE 90003:2018.

This profile is for educating people with prior obtained ICT knowledge at EQF 6 level to implement processes and tools to successfully deploy advanced DevOps techniques across the entire solution development lifecycle.

The profile has an EQF 7 level. Specific ICT knowledge and skills related to the role of DevOps expert obtained at EQF 6 level are required. This level requires:

- **Autonomy:** Coordinates and directs. Addresses issues with many interacting factors.
- **Context:** Unstructured multidisciplinary and/or specialist context.
- **Content:** New concepts for deepening and innovation that are transferable to other situations.

2.3.1 Competences

e-CF competences (incl. e-CF level)	General competences (incl. EQF level)
B.2. Component Integration [e-4] B.3. Testing [e-4] B.6. ICT Systems Engineering [e-4]	P. Profession-related competences (EQF7) I.S. Interpersonal soft competences (EQF7) P.S. Personal soft competences (EQF7) F.O. Functioning in organisations (EQF7)

2.3.2 Deliverables

Learners should master the following deliverables:

- A process for continuous integration of an advanced/ innovative solution
- (Advisory) Report/ paper/ research article on integration of a solution or software application in an innovative/ advanced/ complex situation
- Process for continuous testing of an advanced/ innovative solution, software application or component

³ The role profile is directly sourced from <https://softwareskills.eu/library/essa-educational-profiles-for-software-roles/>

- (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
- Proposal for a cohesive and efficient system infrastructure
- Full DevOps pipeline
- Report with recommendations or an advice on a solution that involves the application of a new technology
- Critical reflection on a new technology
- Project plan for the design and development of an advanced/ innovative solution, application or software component
- Self-reflection report
- Report on functioning in organisation

2.3.3 Professional perspectives

Upon completing this programme, the learner is eligible to apply for developer positions such as DevOps engineer - ICT Change and Configuration Manager - ICT Quality Assurance Manager.

2.3.4 Educational perspectives

After completing this programme, the learner may continue in a related Master programme, in a Ph.D. programme, or an (in-service) postgraduate study programme. The learner also has a proper base for specialised training and certification such as Software Quality - Change Management in Cloud Computing - Cloud-native DevOps.

2.3.5 Programme Learning Outcomes (PLO)

1. PLO Component Integration [e-4]

The learner has demonstrated capability

→ to provide expert guidance or advice on integration of an advanced/ innovative solution, software application or component

Learning Unit outcomes	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)
	Writes a report/ advisory report/ paper/ research article on integration of a solution or software application in an innovative/ advanced/ complex situation (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)

2. PLO Testing [e-4]

The learner has demonstrated capability

→ to provide expert guidance or advice on testing of an advanced/ innovative solution, software application or component

Learning Unit outcomes	Creates and guides a process for testing 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)
	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)

3. PLO ICT systems engineering [e-4]

The learner has demonstrated capability

→ to propose and design a cohesive and efficient system infrastructure

Learning Unit outcomes	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)
	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

4. PLO Profession related competences [EQF7]

The learner has demonstrated capability

→ to apply profession related skills

Learning Unit outcomes	Advises on the application of a new technology. Given a certain situation or context, writes a report with recommendations or an advice on a solution that involves the application of a new technology. Reflects critically on a new technology.
	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
	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
	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

5. PLO Soft competences [EQF7]

The learner has demonstrated capability

→ to apply soft skills

Learning Unit outcomes	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. 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.

6. PLO Functioning in organisations [EQF7]

The learner has demonstrated capability
 → to function in an organisational context

Learning Unit outcomes	Explains organisation theory and behaviour
	Describes the relationship between business and IT
	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
	Leads a project
	Writes a report on functioning in organisation

2.3.6 Learning Programme Overview

Two ESSA Learning Programmes were designed tailored for the target groups and specific situation of the learning providers involved in the pilot.

The following information provides a general overview, including:

- Learning context
- Target groups
- Learning providers
- Total of Learning Units
- Total duration (hours)
- Total ECTS
- Micro-credentials (when applicable)
- Requirements and recommendations on training environment and facilities (when applicable)

To consult the full ESSA Learning Programmes please refer to **Annex III**.

Learning context

formal education

Target group/s:

- Developer full stack curriculum: Post graduate students with the purpose to upskill or reskill with developer full stack competences
- Developer database curriculum: Post graduate students with the purpose to upskill or reskill with developer full stack competences

Learning providers:

Higher Education institutions

Developer EQF 7 (Annex III)

Target groups	Total n. of LUs	Total duration (hours)	Total ECTS	Learning context	Micro-credentials	Requirements and recommendations on training environment and facilities
Developer full stack curriculum: Post graduate students with the purpose to upskill or reskill with developer full stack competences	24	min 300	min 12	formal education	please refer to full Learning Programme	Refer to full Learning Programme
Developer database curriculum: Post graduate students with the purpose to upskill or reskill with developer full stack competences	22	min 337,5	min 13,5	formal education	please refer to full Learning Programme	Refer to full Learning Programme

2.4 DevOps EQF 6⁴

This educational profile belongs to the field of Software Engineering and is covered by relevant references in EN 16234-1:2019 (e-CF) and ISO/IEC/IEEE 90003:2018.

This profile is for educating people, with or without previous ICT knowledge, to implement processes and tools to successfully deploy DevOps techniques across the entire solution development lifecycle.

The profile has an EQF 6 level. No prior knowledge on the topic is required. This level requires:

- **Autonomy:** Works independently under broad direction to solve problems. Has a positive effect on team performance.
- **Context:** Structured – unpredictable context, vague problems, open approach and solution space.
- **Content:** Combination of multiple concepts for advancement and innovation in the local situation.

2.4.1 Competences

e-CF competences (incl. e-CF level)	General competences (incl. EQF level)
B.1. Application Development [e-3] B.2. Component Integration [e-3] B.3. Testing [e-3] B.4. Solution Deployment [e-3] B.6. ICT Systems Engineering [e-3] C.2. Change Support [e-3]	P. Profession-related competences (EQF6) I.S. Interpersonal soft competences (EQF6) P.S. Personal soft competences (EQF6) F.O. Functioning in organisations (EQF6)

⁴ The role profile is directly sourced from <https://softwareskills.eu/library/essa-educational-profiles-for-software-roles/>

2.4.2 Deliverables

Learners should master the following deliverables:

- A structured dataset
- Code and related documentation
- Working software component/ application
- Modified existing software component/ application
- Integrated solution
- Installation report
- (Automated) test
- Configured test environment
- Test result documentation/ test report
- Release plan
- Data management/migration plan
- (Parts of) release documentation
- Proposal for improvements to an existing system infrastructure
- (Parts of) a DevOps pipeline
- Change request/proposal
- Report on the application of a method, technique or tool related to a new technology
- Overall project plan for the design/development of an application or software component
- Self-reflection report
- Report on functioning in an organisation

2.4.3 Professional perspectives

Upon completing this programme, the learner is eligible to apply for junior DevOps positions, for example as a DevOps team member.

2.4.4 Educational perspectives

After completing this programme, the learner may continue in a Master's Developer programme with a focus on more complex and specific application technologies and architectures.

The learner also has a proper base for more advanced training and certification such as Specific programming languages (e.g., Java, Python, C++) - Cybersecurity - Data analytics - Blockchain - Machine Learning/AI - IoT/Automation/Robotics - Testing.

2.4.5 Programme Learning Outcomes (PLO)

1. PLO Application Development [e-3]

The learner has demonstrated capability

→ to creatively develop software applications and components, by interpreting the software design

→ to optimise the application development

Learning Unit outcomes	Organises data and creates a structured dataset
	Writes code and related documentation to it, using programming languages (e.g., Java, Javascript, PHP, Python) and tools (e.g., GitHub), applying programming principles (e.g., clean coding, green coding, secure programming) and other relevant practices (e.g. continuous integration, test-driven development), principles or constraints (e.g., privacy legislation, intellectual property law)
	Efficiently creates a working software component/ application taking into account design requirements (e.g., scalability, availability) and other relevant constraints (e.g., architecture, efficiency, cost, quality, energy consumption) and applying relevant tools and techniques (e.g., object-oriented programming; IDE, CASE; editors, compilers; version control management and tools; multimedia integration tools; app development tools; reuse of proved solutions)
	Modifies an existing software component/ application, in order to optimise it (e.g., to improve scalability, maintenance, performance, security)

2. PLO Component Integration [e-3]

The learner has demonstrated capability
 → to integrate efficiently a software application or component into an existing system, compliant with standards and procedures
 → to document the installation activities

Learning Unit outcomes	Integrates a solution, software application or component applying relevant practices, methods, techniques and tools, compliant with appropriate standards and procedures (e.g. configuration management, version management, change control, packaging and distribution, virtualisation, containerisation)
	Monitors, verifies, and tests system capacity and performance, using appropriate techniques and tools
	Writes an installation report/ installation documentation

3. PLO Testing [e-3]

The learner has demonstrated capability
 → to construct and execute tests for solutions, software applications or components
 → to document test outcomes

Learning Unit outcomes	Writes (parts of) test related documentation (e.g. test plan, test strategy/approach, test case, test script, test scenario, test conditions)
	Constructs tests, by selecting appropriate test methods, techniques, and tools (e.g. test automation tools)
	Defines and configures a test environment
	Executes test cases and performs test activities related to different sorts of tests
	Records and interprets test outcomes and writes test result documentation/ test report

4. PLO Solution Deployment [e-3]

The learner has demonstrated capability
 → to implement solutions and services
 → to complete release documentation

Learning Unit outcomes	Writes a release plan (e.g., including solution verification and validation, documentation, supporting activities; deployment workflow and product roll-out activities)
	Writes a plan for data management/ migration
	Executes (parts of) a solution/ software release, applying appropriate methods, techniques, and tools (e.g., CI/CD tools; tools related to automated software release, software packaging and distribution)
	Writes (parts of) release documentation

5. PLO ICT Systems Engineering [e-3]

The learner has demonstrated capability
 → to create a system infrastructure that meets requirements
 → to ensure interoperability of system components

Learning Unit outcomes	Describes software and hardware components, tools and architectures, including network components, topologies, protocols and interconnections
	Analyses existing system infrastructures, applying appropriate methods, techniques, and tools (e.g. related to interoperability of components, security, energy consumption)
	Proposes improvements to an existing system infrastructure, to better meet requirements (e.g., cloud solutions, Infrastructure as Code, Containers as a Service, virtual machines, load balancers)
	Designs (parts of) a DevOps pipeline, by formulating a set of practices and tools that the development and operations teams may implement to build, test, and deploy software

6. Change support [e-3]

The learner has demonstrated capability
 → to oversee and control system changes
 → to take into account procedures, requirements and restrictions

Learning Unit outcomes	Describes, distinguishes, and applies change management methods, tools and techniques
	Proposes and applies appropriate and efficient practices, measures and procedures to handle change and to reduce the impact of change (e.g., based on ITIL Change management, DevOps)
	Writes a change request/ change proposal (for addition, modification or removal of a service or software application/component) (e.g., describing benefit, risk, and impact of change, taking into account requirements and restrictions such as information security regulations, budget, SLA, conditions for system integrity)

7. PLO Profession related competences [EQF6]

The learner has demonstrated capability
 → to apply profession related skills

Learning Unit outcomes	Masters common ICT knowledge
	Explains the principles, related concepts, advantages, disadvantages, limitations and possible societal, environmental, and ethical issues related to the application of a new technology. Applies and reports on basic methods, techniques and tools related to a new technology.
	Applies, evaluates, reports and provides advice on security standards, regulations, measures, methods, tools, and techniques
	Applies, evaluates and provides advice on appropriate methods, tools and techniques related to software lifecycle processes
	Applies, evaluates, reports and provides advice on sustainability standards, regulations, measures, and methods.
	Is aware of ethical considerations and issues and applies these in professional context and activities. Forms and communicates an opinion based on considerations of relevant social, professional, scientific and ethical aspects

8. PLO Soft competences [EQF6]

The learner has demonstrated capability
 → to apply soft skills

Learning Unit outcomes	Manages teamwork processes and facilitates collaboration to reach common objectives, e.g., handles conflicts, negotiates, motivates, and persuades.
	Communicates with peers, colleagues, supervisors and or relevant other, specialists and non-specialists, and clients, appropriately to the scientific and professional community, using conventions which are relevant. Applies communication to the objective and the target group.

	Masters the English language at a level B2. Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation
	Related to the occupation and knowledge domain, critically collects detailed professional and/or scientific information on a limited range of basic theories, principles and concepts, as well as limited information on some important current issues and topics. Analyses, evaluates, and combines critically this information, knowledge and insights and presents this. Critically applies/ translates/ interprets results of research (possibly executed by others) to the own context (the occupation and/or knowledge domain). Executes applied and practice-oriented research.
	Identifies and analyses complex and unpredictable problems Solves these problems in a tactical, strategic and creative way by selecting and using data and by using one's creativity, flexibility and inventiveness.
	Exercises self-management in complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts. Is able to cope with change (positive or negative) and to adapt to a considerable level of variety in the workplace. Handles pressure and setbacks and maintains composure. Shows initiative, creativity and some 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 on one's own initiative, by reflecting on and evaluating personal (learning) results. Selects and uses training/instructional methods and procedures appropriate for the situation when learning.

9. PLO Functioning in organisations [EQF6]

*The learner has demonstrated capability
→ to function in an organisational context*

Learning Unit outcomes	Explains the basics of organisation theory and behaviour
	Describes the relationship between business and IT
	Works in an organisational context under specific direction with limited autonomy and responsibility e.g., at the level of a trainee, junior or assistant
	Manages a project, selects appropriate project management methods and tools
	Writes a report on functioning in organisation

2.4.6 Learning Programme Overview

Three ESSA Learning Programmes were designed tailored for the target groups and specific situation of the learning providers involved in the pilot.

The following information provides a general overview, including:

- Learning context
- Target groups
- Learning providers
- Total of Learning Units
- Total duration (hours)
- Total ECTS
- Micro-credentials (when applicable)

- Requirements and recommendations on training environment and facilities (when applicable)

To consult the full ESSA Learning Programmes please refer to **Annex IV**.

Learning context

non-formal education

formal education

Target group/s:

- People with ICT knowledge in need of reskilling to become DevOps expert
- IT-oriented students
- Students and professionals in need of upskilling/reskilling

Learning providers:

Higher Education institutions

Training providers

DevOps EQF 6 (Annex IV)						
Target groups	Total n. of LUs	Total duration (hours)	Total ECTS	Learning context	Micro-credentials	Requirements and recommendations on training environment and facilities
<i>People with ICT knowledge in need of reskilling to become DevOps expert</i>	2	168	min 6	non formal education	please refer to full Learning Programme	Refer to full Learning Programme
<i>IT-oriented students</i>	9	13,5	1	formal education	please refer to full Learning Programme	Refer to full Learning Programme
<i>Students and professionals in need of upskilling/reskilling</i>	15		min 10	non formal education	Micro-credentials can be successfully used for (e.g. reskilling and upskilling) DevOps expert EQF6. For reskilling students with no prior knowledge of the topic, to guarantee a comprehensive integrated understanding of the software development process, the duration of study of the initial study should be no less than 60 ECTS)	A limited number of participants is recommended. Hands-on approach is most suitable for such content and ensuring that everyone can get the lecturers attention and help would bring the best results.

2.5 DevOps EQF 7⁵

This educational profile belongs to the field of Software Engineering and is covered by relevant references in EN 16234-1:2019 (e-CF) and ISO/IEC/IEEE 90003:2018.

This profile is for educating people with prior obtained ICT knowledge at EQF 6 level to implement processes and tools to successfully deploy advanced DevOps techniques across the entire solution development lifecycle.

The profile has an EQF 7 level. Specific ICT knowledge and skills related to the role of DevOps expert obtained at EQF 6 level are required. This level requires:

- **Autonomy:** Coordinates and directs. Addresses issues with many interacting factors.
- **Context:** Unstructured multidisciplinary and/or specialist context.
- **Content:** New concepts for deepening and innovation that are transferable to other situations.

2.5.1 Competences

e-CF competences (incl. e-CF level)	General competences (incl. EQF level)
B.2. Component Integration [e-4] B.3. Testing [e-4] B.6. ICT Systems Engineering [e-4]	P. Profession-related competences (EQF7) I.S. Interpersonal soft competences (EQF7) P.S. Personal soft competences (EQF7) F.O. Functioning in organisations (EQF7)

2.5.2 Deliverables

Learners should master the following deliverables:

- A process for continuous integration of an advanced/ innovative solution
- (Advisory) Report/ paper/ research article on integration of a solution or software application in an innovative/ advanced/ complex situation
- Process for continuous testing of an advanced/ innovative solution, software application or component
- (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
- Proposal for a cohesive and efficient system infrastructure
- Full DevOps pipeline
- Report with recommendations or an advice on a solution that involves the application of a new technology

⁵ The role profile is directly sourced from <https://softwareskills.eu/library/essa-educational-profiles-for-software-roles/>

- Critical reflection on a new technology
- Project plan for the design and development of an advanced/ innovative solution, application or software component
- Self-reflection report
- Report on functioning in organisation

2.5.3 Professional perspectives

Upon completing this programme, the learner is eligible to apply for developer positions such as DevOps engineer - ICT Change and Configuration Manager - ICT Quality Assurance Manager.

2.5.4 Educational perspectives

After completing this programme, the learner may continue in a related Master programme, in a Ph.D. programme, or an (in-service) postgraduate study programme. The learner also has a proper base for specialised training and certification such as Software Quality - Change Management in Cloud Computing - Cloud-native DevOps.

2.5.5 Programme Learning Outcomes (PLO)

1. PLO Component Integration [e-4]

The learner has demonstrated capability

→ to provide expert guidance or advice on integration of an advanced/ innovative solution, software application or component

Learning Unit outcomes	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) Writes a report/ advisory report/ paper/ research article on integration of a solution or software application in an innovative/ advanced/ complex situation (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)
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2. PLO Testing [e-4]

The learner has demonstrated capability

→ to provide expert guidance or advice on testing of an advanced/ innovative solution, software application or component

Learning Unit outcomes	Creates and guides a process for testing 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) 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)
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3. PLO ICT systems engineering [e-4]

The learner has demonstrated capability

→ to propose and design a cohesive and efficient system infrastructure

Learning Unit outcomes	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
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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)
 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

4. PLO Profession related competences [EQF7]

*The learner has demonstrated capability
 → to apply profession related skills*

Learning Unit outcomes	Advises on the application of a new technology. Given a certain situation or context, writes a report with recommendations or an advice on a solution that involves the application of a new technology. Reflects critically on a new technology.
	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
	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
	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

5. PLO Soft competences [EQF7]

*The learner has demonstrated capability
 → to apply soft skills*

Learning Unit outcomes	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. 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.

6. PLO Functioning in organisations [EQF7]

*The learner has demonstrated capability
 → to function in an organisational context*

Learning Unit outcomes	Explains organisation theory and behaviour
	Describes the relationship between business and IT
	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
	Leads a project

Writes a report on functioning in organisation

2.5.6 Learning Programme Overview

The ESSA Learning Programme was designed tailored for the target groups and specific situation of the learning providers involved in the pilot.

The following information provides a general overview, including:

- Learning context
- Target group
- Learning provider
- Total of Learning Units
- Total duration (hours)
- Total ECTS
- Micro-credentials (when applicable)
- Requirements and recommendations on training environment and facilities (when applicable)

To consult the full ESSA Learning Programmes please refer to **Annex V**.

Learning context

formal education

Target group

- University students and professionals: graduates of Software Engineering Undergraduate Programmes

Learning provider

Higher Education Institutions

DevOps EQF 7 (Annex V)							
Target groups	Total n. of LUs	Total duration (hours)	Total ECTS	Learning context	Micro-credentials	Requirements and recommendations on training environment and facilities	
						Required	Recommended
<i>University students and professionals: graduates of Software Engineering Undergraduate Programmes</i>	13	min 375	min 15 (no less than 4 ECTS)	formal education	<p>Micro-credentials can be successfully used for (e.g. reskilling and upskilling) DevOps expert EQF7. Having in mind that graduates of software engineering undergraduate programs are the target group, the course structure and content can be tailored to build upon their existing foundational knowledge. The course focuses on enhancing skills in areas such as complex system architecture, advanced programming methodologies, and innovative solution development strategies. It would also emphasize the application of theoretical knowledge in real-world scenarios, encouraging students to tackle contemporary challenges in software engineering and design. Possible setups of a programme using micro credentials, besides autonomous, individual Learning Units, include the following combinations of PLOs:</p>	<p>Access to market research tools and databases to study trends and client needs. A virtual learning platform for hosting interactive sessions, webinars, and discussions.</p> <p>Advanced software tools for modelling and designing software architecture. Simulation software to test and analyze the efficiency of designs.</p> <p>A creative and collaborative online environment. Tools for prototyping and testing new ideas, such as design thinking software or innovation management platforms.</p> <p>Advanced programming environments, version control systems, and software development tools. Access to online libraries and resources for advanced learning.</p> <p>Case studies and organizational analysis tools. Access to management software to understand organizational</p>	<p>Workshops or hackathons to apply creative thinking in real-world scenarios. Partnerships with tech companies for exposure to cutting-edge technologies and practices.</p> <p>Regular assignments and projects to apply technical knowledge. Peer review mechanisms to foster collaborative learning and feedback.</p> <p>Role-playing scenarios and simulations to practice soft skills in a safe environment. Mentorship programs for personalized guidance and development.</p> <p>Interactive sessions with business leaders and managers to gain insights into organizational dynamics. Group projects that mimic real organizational challenges.</p>
					<p>1. Systems Development and Integration Expert:</p> <ul style="list-style-type: none"> • Needs Identification: Understanding and analyzing user and market needs for effective software solutions. • Component Integration: Learning the intricacies of integrating various software components into a cohesive system. • Testing: Mastering various testing methodologies to ensure the reliability and efficiency of software systems. 		

				<p>This combination is suitable for students who want to specialize in the development and integration of complex software systems, ensuring they meet user needs and are robust and reliable.</p> <p>2. Comprehensive ICT Systems Specialist:</p> <ul style="list-style-type: none"> • ICT Systems Engineering: Deep diving into the technical aspects of information and communication technology systems. • Profession-Related Competences: Gaining advanced skills specific to ICT systems, such as network management, data security, or cloud computing. • Functioning in Organisations: Understanding how to effectively function within and contribute to organizational structures and dynamics. This pathway suits those aiming to become experts in ICT systems, focusing on both the technical and organizational aspects of system design and implementation. <p>3. Leadership and Soft Skills in Technology:</p> <ul style="list-style-type: none"> • Interpersonal Soft Competences: Developing skills like communication, teamwork, and leadership essential for technology professionals. • Personal Soft Competences: Focusing on personal development skills such as time management, problem-solving, and adaptability. • Functioning in Organisations: Learning to navigate and excel within organizational settings, including understanding corporate culture and change management. 	workflows and project management.	
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2.6 Solution Designer EQF 6⁶

This educational profile belongs to the field of Software Engineering and is covered by relevant references in EN 16234-1:2019 (e-CF) and ISO/IEC/IEEE 90003:2018.

This profile is for educating people with or without previous ICT knowledge to propose and design ICT-solutions taking into account business requirements and ICT architecture.

The profile has an EQF 6 level. No prior knowledge of the topic is required. This level requires:

- **Autonomy:** Works independently under broad direction to solve problems. Has a positive effect on team performance.
- **Context:** Structured – unpredictable context, vague problems, open approach and solution space.
- **Content:** Combination of multiple concepts for advancement and innovation in the local situation.

2.6.1 Competences

e-CF competences (incl. e-CF level)	General competences (incl. EQF level)
D.11. Needs Identification [e-3] A.5. Architecture Design [e-3] A.6. Application Design [e-3] A.9. Innovating [e-3] E.3. Risk management [e-2] A.8. Sustainability Management [e-3] D.10. Information and Knowledge Management [e-3]	P. Profession-related competences (EQF6) I.S. Interpersonal soft competences (EQF6) P.S. Personal soft competences (EQF6) F.O. Functioning in organisations (EQF6)

2.6.2 Deliverables

Learners should master the following deliverables:

- Functional and non-functional requirements
- Solution design description
- (Relevant parts of) an IT architecture design, related to IT solution
- Functional and data modelling diagrams
- Simple system architecture and interfaces
- Design for an application or software (component) (e.g., UI/UX design)
- Overall plan for the design
- Idea proposal
- Documented idea generation process

⁶ The role profile is directly sourced from <https://softwareskills.eu/library/essa-educational-profiles-for-software-roles/>

- Risk analysis
- Proposed actions to handle risks/ (parts of) a risk management plan
- Analysis of ICT solutions in terms of sustainability
- Recommendations on sustainable options
- Analysis of business processes and information
- Recommendations and technical solutions on effective handling of information and knowledge
- Report on the application of a method, technique or tool related to a new technology
- Overall project plan for the design/development of an application or software component
- Self-reflection report
- Report on functioning in an organisation

2.6.3 Professional perspectives

Upon completing this programme, the learner is eligible to apply for junior positions related to the combination between business & IT, such as Junior Solution designer - Junior Business & IT Consultant.

2.6.4 Educational perspectives

The learner may continue in a Master’s Developer programme with a focus on more complex and specific application technologies and architectures. The learner also has a proper base for more advanced training and certification such as IT management.

2.6.5 Programme Learning Outcomes (PLO)

1. PLO Needs identification [e-3]

The learner has demonstrated capability
 → to translate customer needs into requirements
 → to propose different ICT solutions

Learning Unit outcomes	Analyse a business context, by using common methods and tools (e.g., SWOT)
	Identify, clarify and analyse customers’ needs and formulate functional and non-functional requirements, applying appropriate methods, tools and techniques (e.g., customer needs analysis techniques, communication techniques)
	Propose different, relatively common, ICT solutions in a well-considered manner, resulting in a solution design description (e.g., make-or-buy; by comparing different alternatives, considering relevant conditions; costs, benefits, risks)

2. PLO Architecture Design [e-3]

The learner has demonstrated capability
 → to identify and align relevant ICT technology and specifications

Learning Unit outcomes	Describe architecture frameworks and standards such as TOGAF
	Explain system architecture requirements (e.g., performance, maintainability, extendibility, scalability, availability, security, accessibility)
	Align an IT solution with a certain architecture and formulate (relevant parts of) an IT architecture design, for a relatively straightforward situation applying common design techniques and tools

3. PLO Application Design [e-3]

The learner has demonstrated capability

→ to specify a design for a software application or component that meets requirements

→ to organize the planning of the design of an application or software component

Learning Unit outcomes	Explains and distinguishes principles and terminology of software design (e.g., phases in the design process, techniques, deliverables)
	Describes principles of usability, UI/UX design, accessibility, privacy, security
	Creates functional and data modelling diagrams, using common languages and techniques (e.g., DFD, IDEF0, ERD, and UML)
	Designs a simple system architecture and interfaces using familiar technologies
	Compares alternatives for a design and selects the most promising alternative(s), optimising the balance between cost and quality
	Specifies a design for a software application or component, taking into account certain constraints/ requirements (e.g., the development environment, programming language, technology, requirements related to performance, security, accessibility, usability, privacy, ethics, safety, IS policy, cost, quality)
	Designs and organises the overall plan for the design of an application or software component

4. PLO Innovating [e-3]

The learner has demonstrated capability

→ to propose ideas on the application of novel technologies

→ to document the idea generation process

Learning Unit outcomes	Explains and distinguishes innovation and idea generation practices, processes, techniques, and tools
	Describes new technological developments and implications for businesses and organisations
	Proposes ideas on the application of novel technologies in a practical context – formulates an idea proposal, applying appropriate innovation and idea generation practices, processes, techniques, and tools
	Documents idea generation process
	Analyses different vendor solutions related to a certain novel or emerging technology or tool

5. PLO Risk management [e-2]

The learner has demonstrated capability

→ to apply risk management principles

→ to perform common risk analysis of ICT solutions and services

→ to propose actions to handle risks

Learning Unit outcomes	Applies practices, principles, methods, tools and techniques related to risk management
	Performs a risk analysis with identification and assessment of risks of IT solutions and services
	Proposes appropriate actions to handle risks and/or formulates (parts of) a risk management plan

6. PLO Sustainability management [e-3]

The learner has demonstrated capability

→ to analyse different IT solutions in terms of sustainability

→ to recommend sustainable options

Learning Unit outcomes	Explains and distinguishes concepts related to sustainability as well as different metrics and indicators related to sustainable ICT operation and development (e.g., green IT, carbon footprint, environmental regulations and standards)
	Performs analysis of ICT solutions in terms of sustainability, e.g., energy consumption, waste treatment and environmental policy
	Provides recommendations on sustainable options in IT development, operations, services, and solutions

7. PLO Information and knowledge management [e-3]

The learner has demonstrated capability

→ to identify relevant information and knowledge

→ to propose practices and means for an effective use of information and knowledge

Learning Unit outcomes	Makes an analysis of business processes and identifies associated information, applying common tools and techniques
	Provides recommendations and technical solutions on effective handling of information and knowledge (exploitation, storing, retrieval, and sharing), taking into account relevant practices, methods, standards, tools, and regulations (e.g., GDPR, IPR; collaboration principles, tools for communication and information sharing, FAIR principles)
	Makes an analysis of business processes and identifies associated information, applying common tools and techniques

8. PLO Profession related competences [EQF6]

The learner has demonstrated capability

→ to apply profession related skills

Learning Unit outcomes	Masters common ICT knowledge
	Explains the principles, related concepts, advantages, disadvantages, limitations and possible societal, environmental, and ethical issues related to the application of a new technology. Applies and reports on basic methods, techniques and tools related to a new technology.
	Applies, evaluates, reports and provides advice on security standards, regulations, measures, methods, tools, and techniques
	Applies, evaluates and provides advice on appropriate methods, tools and techniques related to software lifecycle processes
	Applies, evaluates, reports and provides advice on sustainability standards, regulations, measures, and methods.
	Is aware of ethical considerations and issues and applies these in professional context and activities. Forms and communicates an opinion based on considerations of relevant social, professional, scientific and ethical aspects

9. PLO Soft competences [EQF6]

The learner has demonstrated capability

→ to apply soft skills

Learning Unit outcomes	Manages teamwork processes and facilitates collaboration to reach common objectives, e.g., handles conflicts, negotiates, motivates, and persuades.
	Communicates with peers, colleagues, supervisors and or relevant other, specialists and non-specialists, and clients, appropriately to the scientific and professional community, using conventions which are relevant. Applies communication to the objective and the target group.
	Masters the English language at a level B2. Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation
	Related to the occupation and knowledge domain, critically collects detailed professional and/or scientific information on a limited range of basic theories, principles and concepts, as well as limited information on some important current issues and topics. Analyses, evaluates, and combines critically this information, knowledge and insights and presents this. Critically applies/ translates/ interprets results of research (possibly executed by others) to the own context (the occupation and/or knowledge domain). Executes applied and practice-oriented research.
	Identifies and analyses complex and unpredictable problems Solves these problems in a tactical, strategic and creative way by selecting and using data and by using one's creativity, flexibility and inventiveness.

Exercises self-management in complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts. Is able to cope with change (positive or negative) and to adapt to a considerable level of variety in the workplace. Handles pressure and setbacks and maintains composure. Shows initiative, creativity and some 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 on one's own initiative, by reflecting on and evaluating personal (learning) results. Selects and uses training/instructional methods and procedures appropriate for the situation when learning.

10. PLO Functioning in organisations [EQF6]

The learner has demonstrated capability

→ to function in an organisational context

Learning Unit outcomes	Explains the basics of organisation theory and behaviour
	Describes the relationship between business and IT
	Works in an organisational context under specific direction with limited autonomy and responsibility e.g., at the level of a trainee, junior or assistant
	Manages a project, selects appropriate project management methods and tools
	Writes a report on functioning in the organisation

2.6.6 Learning Programme Overview

The ESSA Learning Programme was designed tailored for the target groups and specific situation of the learning providers involved in the pilot.

The following information provides a general overview, including:

- Learning context
- Target group
- Learning provider
- Total of Learning Units
- Total duration (hours)
- Total ECTS
- Micro-credentials (when applicable)
- Requirements and recommendations on training environment and facilities (when applicable)

To consult the full ESSA Learning Programmes please refer to **Annex VI**.

Learning context

formal education

Target group

- IT-oriented students

Learning provider

Higher Education Institutions

Solution Designer EQF 6 (Annex VI)						
Target groups	Total n. of LUs	Total duration (hours)	Total ECTS	Learning context	Micro-credentials	Requirements and recommendations on training environment and facilities
<i>IT-oriented students</i>	22	min 48	min 3	formal education	please refer to full Learning Programme	Refer to full Learning Programme

2.7 Solution Designer EQF 7⁷

This educational profile belongs to the field of Software Engineering and is covered by relevant references in EN 16234-1:2019 (e-CF) and ISO/IEC/IEEE 90003:2018.

The profile is for educating people, with prior obtained ICT knowledge at EQF 6 level to propose and design ICT-solutions taking into account business requirements and ICT architecture.

The profile has an EQF 7 level. Specific ICT knowledge and skills related to the role of solution designer obtained at EQF 6 level are required. This level requires:

- **Autonomy:** Coordinates and directs. Addresses issues with many interacting factors.
- **Context:** Unstructured multidisciplinary and/or specialist context.
- **Content:** New concepts for deepening and innovation that are transferable to other situations.

2.7.1 Competences

e-CF competences (incl. e-CF level)	General competences (incl. EQF level)
D.11. Needs Identification [e-4] A.5. Architecture Design [e-4] A.9. Innovating [e-4]	P. Profession-related competences (EQF7) I.S. Interpersonal soft competences (EQF7) P.S. Personal soft competences (EQF7) F.O. Functioning in organisations (EQF7)

2.7.2 Deliverables

Learners should master the following deliverables:

- Advisory report: creative proposal with possible solutions to specific business need(s), considering advanced/innovative methods and technologies

⁷ The role profile is directly sourced from <https://softwareskills.eu/library/essa-educational-profiles-for-software-roles/>

- Architecture design for an innovative/ advanced solution or technology
- Technology roadmap
- Idea proposal and idea evaluation
- Product innovation plan
- Proof of Concept
- Report with recommendations or advice on a solution that involves the application of a new technology
- Critical reflection on a new technology
- Project plan for the design and development of an advanced/ innovative solution, application, or software component
- Self-reflection report
- Report on functioning in the organisation

2.7.3 Professional perspectives

Upon completing this programme, the learner is eligible to apply for positions related to the combination between business & IT, such as: Solution designer - Business & IT Consultant - Business & IT Engineer.

2.7.4 Educational perspectives

The learner may continue in a related Master’s programme, in a PhD programme or in an (in-service) postgraduate study programme.

2.7.5 Programme Learning Outcomes (PLO)

1. PLO Needs Identification [e-4]

The learner has demonstrated capability

→ to propose different creative solutions for complex problems and

→ to advise the customer

Learning Unit outcomes	Guides the process of identification of customer needs in line with the overall business (e.g, market, strategy, value proposition)
	Writes an advisory report with a creative proposal with possible solutions to specific business need(s), considering advanced/innovative methods and technologies (e.g. by comparing and analysing different solutions/ suppliers, weighing costs/benefits, clarifying value proposition)
	Guides the process of identification of customer needs in line with the overall business (e.g, market, strategy, value proposition)

2. PLO Architecture design [e-4]

The learner has demonstrated capability

→ to propose a coherent architecture design

→ to specify a structured approach to implement an ICT solution

Learning Unit outcomes	Proposes a coherent architecture design for an innovative/ advanced solution or technology, taking into account relevant business and technological issues (e.g., business evolution and needs, budget and other resources; current technology, obsolescent equipment)
	Develops a technology roadmap; an approach or strategy to implement a solution or technology (e.g., identifies change requirements, components affected/ involved by the implementation of specific solutions/ services)

3. PLO Innovating [e-4]

The learner has demonstrated capability

→ to propose and evaluate creative ideas on the application of novel technologies

→ to develop a product innovation plan

→ to design a Proof of Concept

Learning Unit outcomes	Applies idea generation and evaluation techniques to propose and evaluate creative ideas on the application of novel technologies – formulates an idea proposal and idea evaluation
	Writes a product innovation plan on the exploitation of technological advances to introduce a new business, product or service.
	Designs and executes a Proof of Concept to check feasibility of product innovation

4. PLO Profession related competences [EQF7]

The learner has demonstrated capability

→ to apply profession related skills

Learning Unit outcomes	Advises on the application of a new technology. Given a certain situation or context, writes a report with recommendations or an advice on a solution that involves the application of a new technology. Reflects critically on a new technology
	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
	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
	Is continuously aware of ethical considerations and issues and applies these in professional contexts 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

5. PLO Soft competences [EQF7]

The learner has demonstrated capability

→ to apply soft skills

Learning Unit outcomes	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. 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.

6. PLO Functioning in organisations [EQF7]

The learner has demonstrated capability

→ to function in an organisational context

Explains organisation theory and behaviour
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Learning Unit outcomes	Describes the relationship between business and IT
	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
	Leads a project
	Writes a report on functioning in organisation

2.7.6 Learning Programme Overview

The ESSA Learning Programme was designed tailored for the target groups and specific situation of the learning providers involved in the pilot.

The following information provides a general overview, including:

- Learning context
- Target group
- Learning provider
- Total of Learning Units
- Total duration (hours)
- Total ECTS
- Micro-credentials (when applicable)
- Requirements and recommendations on training environment and facilities (when applicable)

To consult the full ESSA Learning Programmes please refer to **Annex VII**.

Learning context

formal education

Target group/s

- University students interested in advanced tech studies
- Professionals seeking upskilling/reskilling opportunities

Learning provider

- Higher Education institutions

Solution Designer EQF 7 (Annex VII)							
Target groups	Total n. of LUs	Total duration (hours)	Total ECTS	Learning context	Micro-credentials	Requirements and recommendations on training environment and facilities	
						Required	Recommended
University students interested in advanced tech studies and professionals seeking upskilling/reskilling opportunities	16	min 100	min 4	formal education	<p>Micro-credentials are successfully used for (reskilling and upskilling) Solution Designer EQF7. Having in mind that graduates of software engineering undergraduate programs are the target group, the course structure and content can be tailored to build upon their existing foundational knowledge.</p> <p>The course focuses on enhancing skills in areas such as complex system architecture, advanced programming methodologies, and innovative solution development strategies. It would also emphasize the application of theoretical knowledge in real-world scenarios, encouraging students to tackle contemporary challenges in software engineering and design.</p> <p>Possible setups of a programme using micro credentials, besides autonomous, individual Learning Units, include the following combinations of PLOs:</p>	<p>Access to market research tools and databases to study trends and client needs. A virtual learning platform for hosting interactive sessions, webinars, and discussions.</p> <p>Advanced software tools for modelling and designing software architecture. Simulation software to test and analyze the efficiency of designs.</p> <p>A creative and collaborative online environment. Tools for prototyping and testing new ideas, such as design thinking software or innovation management platforms.</p> <p>Advanced programming environments, version control systems, and software development tools.</p> <p>Access to online libraries and resources for advanced learning.</p> <p>Case studies and organizational analysis tools.</p> <p>Access to management software to understand organizational workflows and project management.</p>	<p>Workshops or hackathons to apply creative thinking in real-world scenarios.</p> <p>Partnerships with tech companies for exposure to cutting-edge technologies and practices.</p> <p>Regular assignments and projects to apply technical knowledge.</p> <p>Peer review mechanisms to foster collaborative learning and feedback.</p> <p>Role-playing scenarios and simulations to practice soft skills in a safe environment.</p> <p>Mentorship programs for personalized guidance and development.</p> <p>Interactive sessions with business leaders and managers to gain insights into organizational dynamics. Group projects</p>
					<p>1. Innovation and Design Specialist:</p> <ul style="list-style-type: none"> • Needs Identification: Understanding client needs and market trends to identify software solutions. • Architecture Design: Developing robust and scalable software architectures. • Innovating: Applying creative thinking to develop innovative software solutions. <p>This combination is suitable for students interested in leading innovative software</p>		

				<p>projects, focusing on the creative and design aspects of solution development.</p>	<p>that mimic real organizational challenges.</p>
				<p>2. Technical Leadership and Management Pathway:</p> <ul style="list-style-type: none"> • Profession Related Competences: Advanced technical skills specific to solution design. • Functioning in Organisations: Understanding organizational dynamics and operational structures. • Soft Competences: Developing leadership, communication, and team management skills. <p>This setup suits students aiming for managerial or team leadership roles, balancing technical prowess with essential management skills.</p>	
				<p>3. Organizational Strategist and Innovator:</p> <ul style="list-style-type: none"> • Needs Identification: Recognizing and analyzing organizational and market needs. • Innovating: Applying innovation to meet identified needs creatively. • Functioning in Organisations: Navigating and contributing effectively within an organizational structure. <p>This combination is tailored for individuals looking to drive innovation within organizations, focusing on aligning innovative solutions with organizational goals.</p>	

2.8 Test Specialist EQF4/5⁸

This educational profile belongs to the field of Software Engineering and is covered by relevant references in EN 16234-1:2019 (e-CF) and ISO/IEC/IEEE 90003:2018.

This profile is for educating people with or without previous ICT knowledge who can (support the) design of tests and perform testing plans in order to ensure delivered or existing products, applications or services comply with technical and user needs and specifications.

The profile has an EQF 4/5 level. No prior knowledge of the topic is required. This level requires:

- **Autonomy:** Works independently within specified boundaries and resolves issues which arise from project activities.
- **Context:** Structured – predictable context, well-defined concrete, and abstract problems.
- **Content:** Common factual and theoretical knowledge that underpins the field of work or vocation in the local situation.

2.8.1 Competences

e-CF competences (incl. e-CF level)	General competences (incl. EQF level)
B.2. Component Integration [e-2] B.3. Testing [e-2] B.4. Solution Deployment [e-2] B.5. Documentation Production [e-2] E.3 Risk Management [e-2]	P. Profession-related competences (EQF5) I.S. Interpersonal soft competences (EQF5) P.S. Personal soft competences (EQF5) F.O. Functioning in organisations (EQF5)

2.8.2 Deliverables

Learners should master the following deliverables:

- Test cases, test scripts, test conditions, and test plans
- Automated testing task(s)
- Configured test environment
- Test result documentation/ test report
- Integration test result report
- (Part of) release documentation
- (Parts of) different (common) technical documents
- Risk analysis
- Appropriate actions to handle risk
- (Parts of) a risk-based testing results report
- Report on the application of a method, technique or tool related to a new technology

⁸ The role profile is directly sourced from <https://softwareskills.eu/library/essa-educational-profiles-for-software-roles/>

- Self-reflection report
- Report on functioning in an organisation

2.8.3 Professional perspectives

Upon completing this programme, the learner is eligible to apply for junior test specialist positions, such as Software tester - ICT system tester - ICT integration tester - ICT accessibility tester - ICT usability tester - Digital games tester - Test automation engineer.

2.8.4 Educational perspectives

The learner may continue in a Bachelor programme with a focus on more advanced tools, technologies and architectures. The learner has a proper base for further training and certification on testing process and test management, be skilled at advanced testing techniques, or gain an understanding of core technical testing concepts, such as structure-based testing and other analytical testing techniques.

2.8.5 Programme Learning Outcomes (PLO)

1. PLO Component Integration [e-2]

The learner has demonstrated capability

→ to integrate efficiently a software application or component into an existing system

→ to document the installation activities

Learning Unit outcomes	Explains and distinguishes common methods, techniques and tools related to efficient integration
	Describes the interplay between and compatibility of system components
	Selects the relevant integration testing techniques, to ensure the system meets requirements
	Monitors and tests the connectivity of integrated systems
	Writes an integration test result report

2. PLO Testing [e-2]

The learner has demonstrated capability

→ to test a software application or component

→ to document test outcomes

Learning Unit outcomes	Explains and distinguishes principles of software testing, common testing methods, techniques, and tools
	Designs test cases, test scripts, test conditions, and test plans for given requirements
	Automates repeatable testing tasks
	Configures a test environment
	Performs manual and automated test activities, applying testing and debugging techniques and tools
	Records and interprets test outcomes and writes test result documentation/test report

3. PLO Solution deployment [e-2]

The learner has demonstrated capability

→ to implement (parts of) a solution or software application or component

→ to provide (part of) release documentation

Learning Unit outcomes	Executes relevant tests during and after a solution/ software release, applying appropriate methods, techniques, and tools
	Writes (parts of) release documentation related to the verification and validation of solutions and services

4. PLO Documentation Production [e-2]

The learner has demonstrated capability

→ to draft technical documentation

Learning Unit outcomes	Describes types of technical documentation
	Provides different (parts of) common technical documents, using appropriate tools (e.g. software documentation tools)

5. PLO Risk management [e-2]

The learner has demonstrated capability

→ to apply risk management principles to perform common risk analysis of ICT solutions and services

→ to propose actions to handle risks

Learning Unit outcomes	Applies practices, principles, methods, tools and techniques related to risk-based testing
	Performs a risk analysis with identification and assessment of risks of IT solutions and services
	Proposes appropriate actions to handle risks, taking into account relevant conditions (e.g., risk/security exceptions, risk acceptance)
	Writes (parts of) a risk-based testing results report

6. PLO Profession related competences [EQF5]

The learner has demonstrated capability

→ to apply profession related skills

Learning Unit outcomes	Masters common ICT knowledge
	Explains the principles, related concepts, advantages and disadvantages of a new technology. Applies and reports on basic methods, techniques and tools related to a new technology.
	Applies and reports on measures, methods, tools and techniques related to security
	Applies and reports on measures, methods, tools and techniques related to software lifecycle processes
	Is aware of basic ethical considerations and issues

7. PLO Soft competences [EQF5]

The learner has demonstrated capability

→ to apply soft skills

Learning Unit outcomes	Works together with others in a team
	Communicates with peers, colleagues, supervisors and or relevant other, appropriately to the context, using conventions that are relevant to professional practice. Explains and gives instruction.
	Masters the English language at a level B2. Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation
	Distinguishes and analyses fairly complex and unpredictable problems. Solves these problems systematically and in a creative way, using existing procedures and guidelines and own solutions by identifying and using data.
	Exercises self-management within the guidelines of contexts that are usually predictable, but are subject to change. Is able to cope with limited change and to adapt to a certain level of variety in the workplace. Copes with pressure and stress setbacks and maintains composure. Shows some initiative and carries responsibility for the results of own activities, work and or study. Works correctly and carefully.
	Realises learning and personal development on request, where necessary with support, through self-reflection and external- and self-evaluation of own (learning) results.

8. PLO Functioning in organisation [EQF5]

*The learner has demonstrated capability
→ to function in an organisational context*

Learning Unit outcomes	Explains basics of organisation theory and behaviour
	Describes the relationship between business and IT
	Works in an organisational context under specific direction with limited autonomy and responsibility e.g., at the level of a trainee, junior or assistant
	Works in project settings, applies project management methods and tools
	Writes a report on functioning in the organisation

2.8.6 Learning Programme Overview

The ESSA Learning Programme was designed tailored for the target groups and specific situation of the learning providers involved in the pilot.

The following information provides a general overview, including:

- Learning context
- Target group
- Learning provider
- Total of Learning Units
- Total duration (hours)
- Total ECTS
- Micro-credentials (when applicable)
- Requirements and recommendations on training environment and facilities (when applicable)

To consult the full ESSA Learning Programmes please refer to **Annex VIII**.

Learning context

non-formal education

Target group/s

- University students
- Professionals on upskilling or reskilling pathways

Learning providers

Higher Education institutions

Training providers

Test Specialist EQF 4/5 (Annex VIII)

Target groups	Total n. of LUs	Total duration (hours)	Total ECTS	Learning context	Micro-credentials	Requirements and recommendations on training environment and facilities
University students and professionals in upskilling/reskilling path	17	min 120	min 5	non formal education	please refer to full Learning Programme	Refer to full Learning Programme

3. Source of Reference

The ESSA platform (<https://learn.softwareskills.eu/>) has been implemented to support the delivery and use of the ESSA Learning materials developed for each Educational Profile addressed by the ESSA project, consistent with each ESSA Learning Programme.

The ESSA platform was developed using Wordpress, because it is a user-friendly Open Source CMS (Content Management System).

The available information for each Educational Profile and related EQF level, are the following:

- A short introduction to each profile, including the related Programme Learning Outcomes
- A link to the ESSA Learning materials developed for each Learning Unit and concerned with each Programme Learning Outcome envisaged in the related Educational Profile

Further, the following documents produced within the ESSA project should also be consulted, since they are closely tied to the proposed ESSA Learning programmes:

- *ESSA Educational Profiles*

The ESSA Educational Profiles developed within the project are available on the project website at <https://www.softwareskills.eu/library/essa-educational-profiles-for-software-roles/>.

The eight Educational Profiles are presented here, covering four software roles at different qualification levels (EQF 4-7). Each profile is described in terms of expected competences, deliverables to be mastered by learners, professional and educational perspectives, Programme Learning Outcomes (PLOs) covered by proposed Learning Programmes, Learning Unit outcomes for each PLO and related assessment methods.

- *Deliverable 11 “Learning programme pilots”*

The report discusses how these pilot programmes are being carried out in eight European countries (France, Estonia, Greece, Ireland, Italy, Netherlands, Poland, Slovenia), from August 2023 to June 2024, evaluated, and serve as a key tool to experiment and optimise the materials and resources developed by the ESSA Alliance (<https://www.softwareskills.eu>)

➤ *Deliverable 12: “ESSA Work-based Learning”*

The document describes the primary types of WBL, elucidating the way these components are described and integrated into the ESSA learning programmes (Task 4.3). It categorizes WBL components according to ESSA profiles, offering an overview of the most frequently used ones. Furthermore, the document provides recommendations on designing WBL components and elucidates the best practises to follow in ESSA learning programmes (<https://www.softwareskills.eu>).

➤ *Deliverable 13: “ESSA Train the Trainer Programme”*

The document provides teachers, educators and trainers working in formal and non-formal Learning contexts with the information necessary to implement the designed ESSA Learning Programmes. It implies eight annexes, one for each software role developed at specific EQF level (<https://www.softwareskills.eu>).

www.softwareskills.eu



Co-funded by the
Erasmus+ Programme
of the European Union

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