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ECQA Certified Engineering Literacy Teacher

Skills Set & Strategy Design

FINAL Version

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1 Introduction

1.1 Objective

The objective of this deliverable is to provide an introduction to European skills set strategies, to describe the applied skills definition model, and to apply this model to describe the Job Role.

1.2 Purpose of the Deliverable

The purpose of this deliverable is to define skills definitions of the ECQA Certified Engineering Literacy Teacher job role.

1.1 Scope of the Deliverable

The deliverable contains

- A chapter about Skill Sets, skills definitions
- A chapter about the content of the Job Role

The deliverable does not cover:

- Already course development, as this will be done after the skill definitions clearly outlined the set of required courses.

1.2 Acronyms and Definitions Used

Acronym	Description
APL	Accreditation of Prior Learning
ASQ	American Society of Quality
ECQA	European Certification and Qualification Association
ECTS	European Credit Transfer System
CREDIT	Franework Program Project as a starting point for ECQA certification
ECVET	European Community Vocational Educational Training

1.3 References

[1] *CREDIT Project*, Accreditation Model Definition, MM 1032 Project CREDIT, Version 2.0, University of Amsterdam, 15.2.99

[2] DTI - Department of Trade and Industry UK, British Standards for Occupational Qualification, *National Vocational Qualification Standards and Levels*

[3] R. Messnarz, et. al, *Assessment Based Learning centers*, in: Proceedings of the EuroSPI 2006 Conference, Joensuu, Finland, Oct 2006, also published in Wiley SPIP Proceeding in June 2007

[4] Richard Messnarz, Damjan Ekert, Michael Reiner, Gearoid O'Suilleabhain, *Human resources based improvement strategies - the learning factor* (p 355-362), Volume 13 Issue 4 , Pages 297 - 382 (July/August 2008), Wiley SPIP Journal, 2008

[5] European Certification and Qualification Association, *ECQA Guide*, Version 3, 2009, www.ecqa.org, Guidelines

[6] Richard Messnarz, Damjan Ekert, Michael Reiner, Europe wide Industry Certification Using Standard Procedures based on ISO 17024, in: Proceedings of the TAEE 2012 Conference, IEEE Computer Society Press, June 2012

2 Skill Sets and European Initiatives

2.1 ECQA – European Certification and Qualification Association

Europe Wide Certification

The ECQA is the result of a number of EU supported initiatives in the last ten years where in the European Union Life Long Learning Programme different educational developments decided to follow a joint process for the certification of persons in the industry.
Through the ECQA it becomes possible that you attend courses for a specific profession in e.g. Slovenia and perform a Europe wide agreed test at the end of the course. The certificate will then be recognized by European training organizations and institutions in 14 member countries.

Why is such a Certificate of Interest

European work forces are highly flexible and need to work for industries across Europe (Germany, France, …). Imagine that you are attending an e-security manager course at Real Security in Slovenia and that you perform and pass the test at the end of the course. The certificate will then be recognized by the German certification body ISQI (International SW Quality Institute) in Germany and ISQI collaborates with the largest Telecom and Automotive firms. This will automatically lead to a higher recognition of the certificate and higher chances of working for customers in an open European market.

Access to a Vast Pool of Knowledge

ECQA currently supports 30 professions in Europe and with the continuous support by European Projects (e.g. the EU Blueprint DRIVES for Automotive uses ECQA as a demonstrator) the pool is growing to 60 certified professions in Europe. ECQA offers certification for professions like Functional Safety Engineer/Manager, Automotive Quality Engineer, Innovation Manager, Leading in Sustainability Manager, Integrated Mechatronics Designer, InnoTeach Teacher and so forth.

The ECQA guide can be downloaded at www.ecqa.org -> Guidelines.

Defined procedures are applied for:

- Self-assessment and learning https://www.ecqa.org/fileadmin/documents/Self_Assessment/eucert-users-self-assessment-learning-guide-v5-doc.pdf
- Exam performance https://www.ecqa.org/index.php?id=161

2.2 Skill Set Strategy

Imagine that in the future Europeans will have a skill set like a card with a chip which stores your skill profile to fulfil specific professions, job roles, and tasks. It's working like an ID card. This future scenario requires -

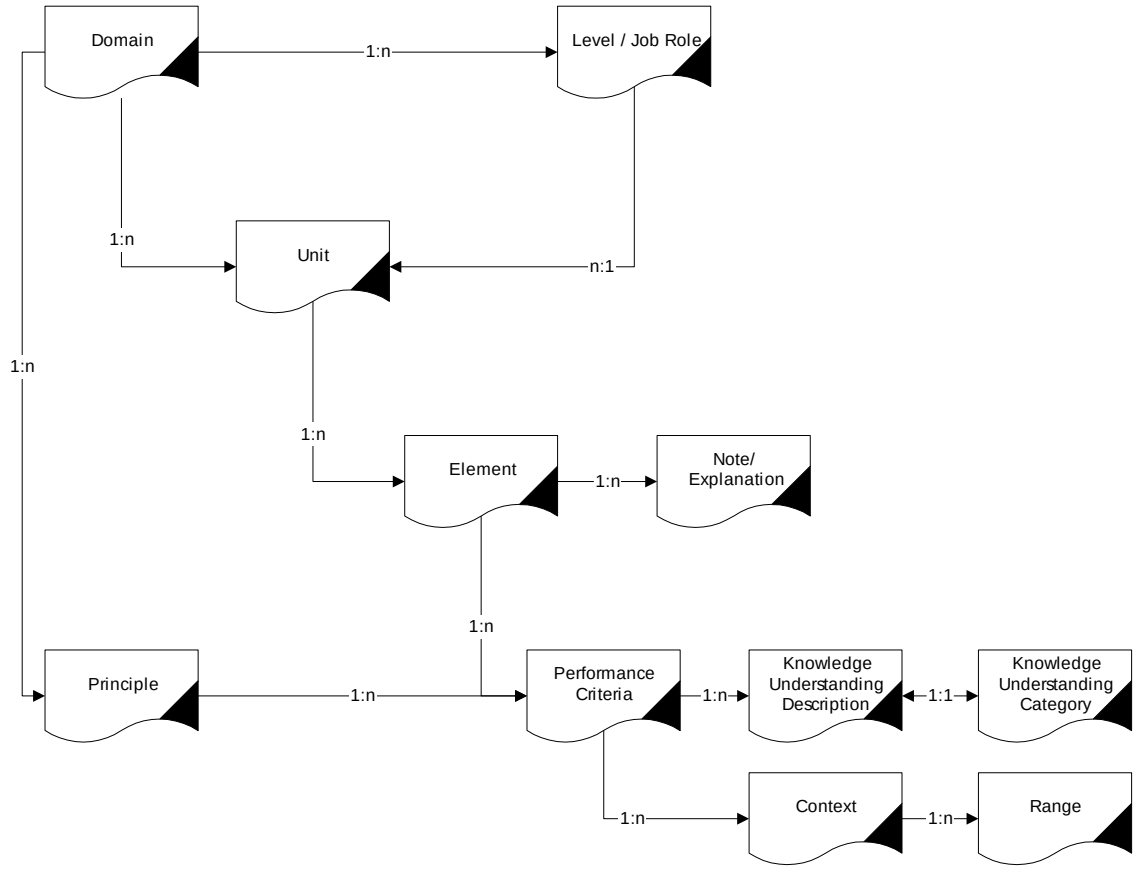
- A standard way to describe a skill set for a profession, job, or specific task.
- A standard procedure to assess the skill and to calculate and display skill profiles.

Such a common set of skill sets in Europe is needed due to the free mobility of workers, and e.g. software engineering companies in Germany employ software engineers from Ireland, etc. European countries such as UK, The Netherlands, and France have already well established open universities which support APL (Accreditation of Prior Learning). In APL the skills of students are assessed, already gained skills are recognised, and only for the skill gaps a learning plan is established. The skill assessment bases on defined skill units and a skill profile displaying how much of the skill units are covered.
In a previous project CREDIT (Accreditation of Skills via the Internet) [1] in which some of the project partners were involved such an Internet based skills assessment system has been built. Therefore another possible scenario of the future is that representative educational bodies per country in Europe maintain skill profiles in databases which can be accessed via defined ID codes for people.

2.3 Skills Definition Model

For developing the skill set of the Innovation Manager we base on the skills definition proposed by the DTI (Department of Trade and Industry) in the UK for the NVQ (National Vocational Qualification) standards. These models have been re-used and slightly modified by other countries when they started employing skill cards, and so we also base our work on these models [1], [2].

A skills definition contains the following items (see Picture 1):



Picture 1 : The Skill Definition Model (1:n = one to many relationship)

Context (UK standards): A category of ranges; it represents some terminology used in a performance criterion that consists of different context, conditions or circumstances. A participant must be able to prove competence in all the different circumstances covered by the context.

Domain: An occupational category, e.g. childcare, first level management or software engineering.

Element (UK standards): Description of one distinct aspect of the work performed by a worker, either a specific task that the worker has to do or a specific way of working. Each element consists of a number of performance criteria.

Evidence: Proof of competence.

Knowledge and understanding category (UK standards): A category of knowledge and understanding descriptions.

Knowledge and understanding description (UK standards): A description of certain knowledge and understanding. To be judged competent in a unit a participant must prove to have and to be able to apply all the knowledge and understanding attached to it.

NVQ (UK based): The National Vocational Qualification standard of England, Wales and N. Ireland.

Performance criterion (UK standards): Description of the minimum level of performance a participant must demonstrate in order to be assessed as competent. A performance criterion may have relevant contexts.

Principle (UK standards): A statement of good intentions; it underpins all competent domain practice.

Range (UK standards): Description of a specific circumstance and condition of a performance criterion statement.

Qualification: The requirements for an individual to enter, or progress within a certain occupation.

Job Role: A certain profession that covers part of the domain knowledge. E.g. domain = Innovation, job role = Innovation Manager.

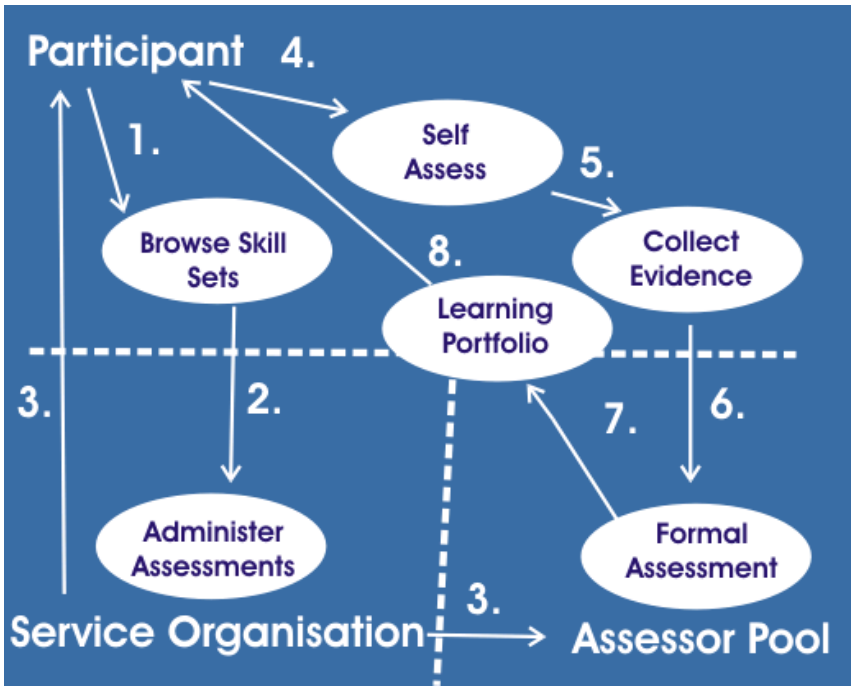
Unit (UK standards): A list of certain activities that have to be carried out in the workplace. It is the top-level skill in the UK qualification standard hierarchy and each unit consists of a number of elements.

2.4 Skills Assessment Model

Step 1 – Browse a Skills Set : You select a set of skills or competencies, which are required by your profession or job using national standards or your company standards. You browse different skills cards and select a job role you would like to achieve.

Step 2 – Register for Self Assessment with a Service Unit : This can be a service unit inside your own company (e.g. a personnel development department) or a skills card and assessment provider outside your company which offers skills assessment services. In case of the Innovation Manager Project the registration will automatically assign a predefined service unit.

Step 3 – Receive an Account for Self –Assessment and Evidence Collection : With the registration you automatically received an account to login to the working space in which you can go through the steps of online self assessment and the collection of evidences to prove that you are capable of certain performance criteria.



Picture 2: Basic steps of the skills assessment model

Step 4 – Perform Self Assessment: You log into the system , browse through the skills required and self assess performance criteria, whole elements or whole units with a standard evaluation scale of non-applicable, not adequate, partially adequate, largely adequate, and fully adequate. A skills gaps profile can be generated and printed illustrating in which areas your self assessment shows improvement potentials.

Testing of Skills (Addition to Step 4) – The system provides a multiple-choice test for each performance criteria so that you can check your capabilities as realistically as possible.

Step 5 – Collect Evidences: Before you want to enter any formal assessment you need to prove your skills by evidences. Evidences can be any electronic files (sample documents, sample graphics, results of some analysis, etc.) or any references with details (e.g. a certificate received from a certain institution). Evidences you can then link to specific performance criteria or whole elements of skills units.

Testing of Skills (Addition to Step 5) – In traditional learning schemes people have always needed to go to a learning institution (university, accreditation body, professional body, etc.) to take exams and they received a certificate if they pass. This traditional approach however is insufficient when it comes to measuring experience and (soft) skills learned on the job and fails to give recognition to skills gathered on the job. The APL (Accreditation of Prior Learning) approach, by contrast, collects so called evidences. Evidences can be certificates obtained in the traditional way, but also references from previous employers, materials from previous projects in which the person took ownership of results (e.g. a test plan) to prove their capability, as well as any kind of proof of competence gathered on the

job. The assessors will then evaluate the evidences provided and not only rely on certificates and exams.

Step 6 – Receive Formal Assessment: Formal assessors are assigned by the service unit to the skills assessment. Once formal assessors log into the system they automatically see all assigned assessments. They select the corresponding one and can see the uploaded evidences. They then formally assess the evidences and assess the formal fulfilment of performance criteria, whole elements or whole units with a standard evaluation scale of non-applicable, not adequate, partially adequate, largely adequate, and fully adequate. In case of missing competencies they enter improvement recommendations, a well as learning options.

Step 7 – Receive Advise on Learning / Improvement Options: After the formal assessment the participants log into the system and can see the formal assessment results from the assessors, can print skills gaps profiles based on the assessor results, and can receive and print the improvement recommendations and learning options. If required, the generation of learning options can also be automated through the system (independent from assessor advises).

2.5 Certificate Types offered by ECQA

In the standard test and examination procedures for levels of certificates are offered:

- Course Attendance Certificate
  - Received after course attendance
  - Modular per Element
- Course / Test Certificate
  - Test in a test system (European pool of test questions)
  - 67% satisfaction per element
- Summary Certificate
  - Overview of covered elements where the student passed the test, all elements shall be covered
  - Generation of certificate
- Professional Certificate
  - Uploading applied experiences for review by assessors
  - Rating by assessors
  - Observation of 2 years

The certificates show credited elements in comparison to all required.

2.6 Mapping to Learning Levels

2.6.1 Mapping based on NVQ Qualification Levels

Qualification / training levels: Five levels of qualification / training are defined by European legislation and this structure can be used for comparability of vocational qualifications from the different European countries.

- Level 1: semi-skilled assistant performing simple work
- Level 2: basic employee performing complex routines and standard procedures
- Level 3: skilled professional with responsibility for others and performing independent implementation of procedures
- Level 4: middle management & specialist performing tactical an strategic thinking
- Level 5: professional / university level

ECQA job roles have been mapped to ECTS and are taught at university and at the industry at the same time.

Find the example of the ECQA Certified Automotive Quality Engineer below.

Level	Knowledge	Lean Six Sigma	ECTS	AQUA	ECTS	CTM	Safety Manager	ECTS
Level 1	Basic general knowledge	-		-		-	-	
Level 2	Basic factual knowledge of a field of work or study	-		-		-	-	
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	Lean Six Sigma Yellow Belt						
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	Lean Six Sigma Orange Belt						
Level 5	Comprehensive, specialized, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	Lean Six Sigma Green Belt				CTM - Basic level		
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Lean Six Sigma Black Belt		AQUA - Automotive Quality Integrated Skills - presentations / theory	3	CTM - Advanced level	Safety manager Skills - presentations / theory	3
Level 7	- Highly specialized knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research - Critical awareness of knowledge issues in a field and at the interface between different fields	Lean Six Sigma Master Black Belt		AQUA - Automotive Quality Integrated Skills - with exercises to apply on nan example (e.g. ESCL)	4	CTM - Specialisations (Automotive, Health, International Organisations)	Safety Manager Skills - with exercises to apply on nan example (e.g. ESCL)	4
Level 8	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	-		AQUA - Automotive Quality Integrated Skills - implementation in a research at PhD level / with link to a real project	5	-	Safety Manager Skills - implementation in a research at PhD level / with link to a real project	5

Picture 3 : Example ECTS Mapping

One ECTS represents a certain hours effort at university to teach the subject.

Also ECQA job roles are napped to ECVET system points where usually each job role is worth around 30 ECVET points.

2.6.2 Typical ECQA Implementations

Two typical cases are implemented in ECQA:

Option 1: Job Role Levels

For the same job role different qualification levels are defined. Usually each level relates to a specific Blloms, EQF, or NVQ level. Each level expands the lower level and adds more leraning elements (knowledge areas).

Option 2: Learning levels

The same set of skills areas can go through different leraning levels. E.g. There might be on all levels of an IT Security Manager education the element „application security" but different levels of knowledge ae required based on the seleced learning level.

3 Skills Definition for the Job Role “Engineering Literacy Teacher”

3.1 The Skills Hierarchy

Using the terminology outlined in the skills definition model and including the skills identified during the demand analysis at the beginning of the project, the following skills hierarchy for the job role <job role name> has been designed.

ELIC.U1	Introduction Automotive Engineering	ELIC.U1.E1	Introduction Automotive Engineering	This element gives an overview of the didactical concept of a MOOC, includes an outline of engineering literacy and pedagogical approaches to improving this literacy. This element also introduces engineering principles applied in the modern car industry.
ELIC.U2	Case Studies	ELIC.U2.E1	Battery Systems	This element deals with Lithium Ion battery systems.
		ELIC.U2.E2	Lighting Systems	This element deals with lighting systems.
		ELIC.U2.E3	Combustion Engine	This element deals with combustion systems.
		ELIC.U2.E4	E-Motor	This element deals with e-motor systems.
ELIC.U3	Hot Topics in Engineering	ELIC.U3.E1	Energy Management	This element explains how energy is created, stored, transported and used to recharge batteries in cars.
		ELIC.U3.E2	Cybersecurity	This element deals with cybersecurity topics in cars.
		ELIC.U3.E3	Autonomous Driving	This element deals with self-driving cars.

Picture 4 : The Skills Set for ECQA Certified Engineering Literacy Teacher

3.2 The Skills Descriptions – Job Role ECQA Certified Engineering Literacy Teacher

Domain Acronym: Engineering

Domain title: Engineering Literacy

Domain Description:

Teachers of different natural sciences need to interlink to explain engineering solutions which are combining different subjects to find a solution. In Austria and Germany there is a MINT program and in general there is the concept of STEM teachers.

In this ELIC project we focus towards Automotive engineering solutions that can be used as an example to teach an engineering problem of Automotive based on the view from mathematics, physics, biology, informatics, chemistry, etc.

Job Role Acronym: ELIC

Job Role Title: ECQA Certified Engineering Literacy Teacher

Description:

The Skill card comprises the following thematic learning units

1. Introduction Automotive Engineering
2. Automotive Case Studies
3. Hot Topics in Engineering

3.3 Unit ELIC.U1 Introduction Automotive Engineering

Acronym: ELIC.U1

Title: Introduction Automotive Engineering

Description:

This unit provides an introduction to engineering literacy in the context of automotive.

3.3.1 Unit ELIC.U1 - Element 1: Introduction Automotive Engineering

Acronym: ELIC.U1.E1

Element Title: Introduction Automotive Engineering

Element Note:

This element gives an overview of the didactical concept of a MOOC, includes an outline of engineering literacy and pedagogical approaches to improving this literacy. This element also introduces engineering principles applied in the modern car industry.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U1.E1.PC1	Understanding the principles of systems engineering.
ELIC.U1.E1.PC2	Knowing systems engineering examples in the car industry integrating different disciplines into mechatronics.

Table 1: Performance Criterias Example for the Element ELIC.U1.E1

3.4 Unit ELIC.U2 Automotive Case Studies

Acronym: ELIC.U2

Title: Automotive Case Studies

Description:

This unit presents different automotive case studies designed to support teachers in promoting engineering literacy.

3.4.1 Unit ELIC.U2 - Element 1: Battery Systems

Acronym: ELIC.U2.E1

Element Title: Battery Systems

Element Note:

This element deals with the overview of battery systems and their elements in automotive applications.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U2.E1.PC1	Understanding the system engineering concept of the Lithium Ion battery system in cars.
ELIC.U2.E1.PC2	Knowing how physics experiments and knowledge taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC3	Knowing how chemistry experiments and knowledge taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC4	Knowing how mathematics taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC5	Knowing how informatics taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC6	Knowing how biology and environmental issues taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC7	Knowing how ethics taught in schools can be mapped onto the battery system.

Table 2: Performance Criterias for the Element ELIC.U2.E1

3.4.2 Unit ELIC.U2 - Element 2: Lighting Systems

Acronym: ELIC.U2.E2

Element Title: Lighting Systems

Element Note:

This element deals with lighting systems.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U2.E2.PC1	Understanding the system engineering concept of the lighting systems in cars.

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U2.E2.PC2	Knowing how physics experiments and knowledge taught in schools can be mapped onto the lighting system.
ELIC.U2.E2.PC3	Knowing how chemistry experiments and knowledge taught in schools can be mapped onto the lighting system.
ELIC.U2.E2.PC4	Knowing how mathematics taught in schools can be mapped onto the lighting system.
ELIC.U2.E2.PC5	Knowing how informatics taught in schools can be mapped onto the lighting system.
ELIC.U2.E2.PC6	Knowing how biology and environmental issues taught in schools can be mapped onto the lighting system.
ELIC.U2.E2.PC7	Knowing how ethics taught in schools can be mapped onto the lighting system.

Table 3: Performance Criterias Example for the Element ELIC.U2.E2

3.4.3 Unit ELIC.U2 - Element 3: Combustion Engine

Acronym: ELIC.U2.E3

Element Title: Combustion Engine

Element Note:

This element deals with combustion systems.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U2.E3.PC1	Understanding the system engineering concept of the combustion engine in cars.
ELIC.U2.E3.PC2	Knowing how physics experiments and knowledge taught in schools can be mapped onto the combustion engine system.
ELIC.U2.E3.PC3	Knowing how chemistry experiments and knowledge taught in schools can be mapped onto the combustion engine system.
ELIC.U2.E3.PC4	Knowing how mathematics taught in schools can be mapped onto the combustion engine system.

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U2.E3.PC5	Knowing how informatics taught in schools can be mapped onto the combustion engine system.
ELIC.U2.E3.PC6	Knowing how biology and environmental issues taught in schools can be mapped onto the combustion engine system.
ELIC.U2.E3.PC7	Knowing how ethics taught in schools can be mapped onto the combustion engine system.

Table 4: Performance Criterias Example for the Element ELIC.U2.E3

3.4.4 Unit ELIC.U2 - Element 4: E-Motor

Acronym: ELIC.U2.E4

Element Title: E-Motor

Element Note:

This element deals with e-motor systems.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U2.E4.PC1	Understanding the system engineering concept of the e-motor in cars.
ELIC.U2.E4.PC2	Knowing how physics experiments and knowledge taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC3	Knowing how chemistry experiments and knowledge taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC4	Knowing how mathematics taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC5	Knowing how informatics taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC6	Knowing how biology and environmental issues taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC7	Knowing how ethics taught in schools can be mapped onto the e-motor in cars.

Table 5: Performance Criterias Example for the Element ELIC.U2.E4

3.5 Unit ELIC.U3 Hot Topics in Engineering

Acronym: ELIC.U3

Title: Hot Topics in Engineering

Description:

This unit presents a selection of current 'hot topics' in and around automotive engineering.

3.5.1 Unit ELIC.U3 - Element 1: Energy Management

Acronym: ELIC.U3.E1

Element Title: Energy Management

Element Note:

This element explains how energy is created, stored, transported and used to recharge batteries in cars.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U3.E1.PC1	Understanding the system engineering concept of energy management connected with the car industry.
ELIC.U3.E1.PC2	Knowing how physics experiments and knowledge taught in schools can be mapped onto energy management.
ELIC.U3.E1.PC3	Knowing how chemistry experiments and knowledge taught in schools can be mapped onto energy management.
ELIC.U3.E1.PC4	Knowing how mathematics taught in schools can be mapped onto energy management.
ELIC.U3.E1.PC5	Knowing how informatics taught in schools can be mapped onto energy management.
ELIC.U3.E1.PC6	Knowing how biology and environmental issues taught in schools can be mapped onto energy management.
ELIC.U3.E1.PC7	Knowing how ethics taught in schools can be mapped onto energy management.

Table 6: Performance Criterias Example for the Element ELIC.U3.E1

3.5.2 Unit ELIC.U3 - Element 2: Cybersecurity

Acronym: ELIC.U3.E2

Element Title: Cybersecurity

Element Note:

This element deals with cybersecurity topics in cars.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U3.E2.PC1	Understanding the system engineering concept of cybersecurity in cars.
ELIC.U3.E2.PC2	Knowing how informatics taught in schools can be mapped onto cybersecurity design.
ELIC.U3.E2.PC3	Knowing how ethics taught in schools can be mapped onto cybersecurity design.

Table 7: Performance Criterias Example for the Element ELIC.U3.E2

3.5.3 Unit ELIC.U3 - Element 3: Autonomous Driving

Acronym: ELIC.U3.E3

Element Title: Autonomous Driving

Element Note:

This element deals with self-driving cars.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U3.E3.PC1	Understanding the system engineering concept of self-driving cars.

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U3.E3.PC2	Knowing how informatics taught in schools can be mapped onto self-driving cars.
ELIC.U3.E3.PC3	Knowing how ethics taught in schools can be mapped onto self-driving cars.

Table 8: Performance Criterias Example for the Element ELIC.U3.E3

4 Overall Task Measurement

The below table shall illustrate the size of the achievements made in this intellectual output

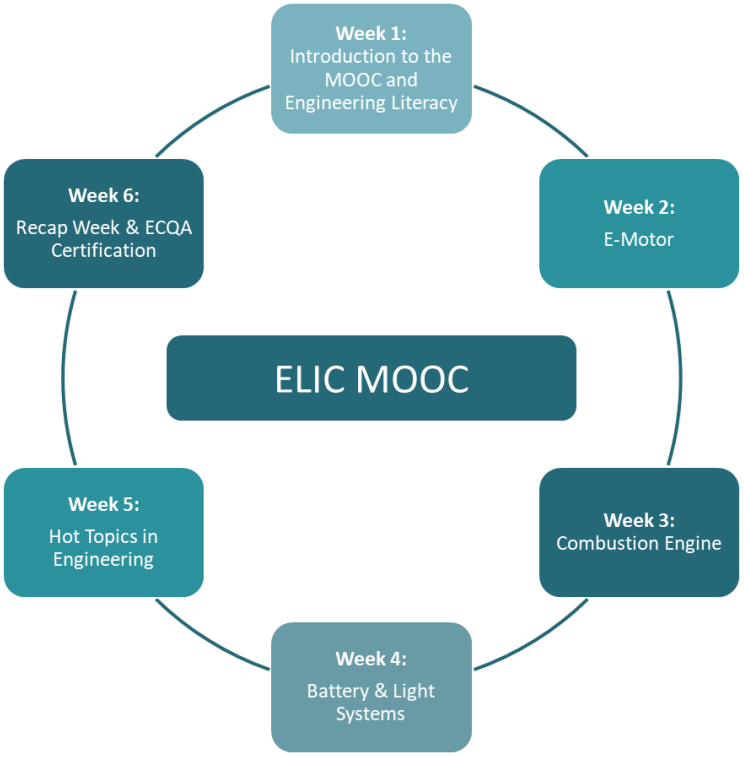
Job Role	Number Units	Number Elements	Number Performance Criteria
ECQA Certified Engineering Literacy Teacher	3	10	69

Table 9: Number of units, elements and performance criteria

5 Strategy Design

At this stage in the development of the IO2, it was essential to define the strategy of implementation of the skills defined in the skill card. Therefore, it can be said that the strategy design is based on the skill card and the training curriculum IO3 is based on the outputs created in IO2, the skill card and the strategy design. So all these outputs are dependent on each other.

In terms of the strategy design, it can be stated that the IO leaders of IO2 and IO3 as well as the coordinator got together in order to define the most suitable teaching methods used in the frame of the MOOC. Further, given the frame of the ELIC MOOC, a minimum of 30 hours of training will be implemented during the following modules/weeks:



What can be seen in the graph above is that the focus will definitely lay on the content modules which are implemented during week 2 to 4. Week 1 and week 6 can be seen as introduction weeks. Therefore, the introduction week and the recap week will consume around 8 hours of training in the MOOC and the other four modules/weeks will be represented with minimum of 22 hours of training/teaching in the frame of the MOOC. What also needs to be stated in this connection is the fact that given the MOOC framework, the modules will be implemented online. So there will not be any face-to-face session that participants can attend.

The following means got selected. A detailed description on how these means of teaching together with the provided content will be incorporated in the MOOC can be found in IO3 – training curriculum.

The mix of means of teaching will be applied for the implementation of the skills defined in the skill card. In the end it will be responsibility of each of the module/week facilitators to decided which means of teaching are the most appropriate ones. Generally, video tutorials, simulations as well as case studies and team exercises will be used often as this can be easily transferred to teaching secondary school pupils in the area of STEM.

6 Derive Learning Objectives

The ELIC Skill set contains on the lowest level performance criterions. Performance criterions describe the minimum level of performance a participant must demonstrate in order to be assessed as competent. Performance criteria can be considered also as learning outcomes as defined in the Recommendation of the European Parliament and of the Council on the establishment of the EQF, and in a similar ECVET Recommendation. Performance criteria define also what a participant should know, understand and is able to do on completion of a learning process (see also the Guidelines for the Description of Learning Outcomes available at: http://www.ecvet-toolkit.eu/sites/default/files/Zoom_Guidelines_for_the_Description_of_Learning_Outcomes.pdf).

The performance criteria form the basis for deriving learning objectives, which are used to developed training content as part of a training course. The development of training content is part of IO3.

Example how performance criteria are used to derive training content:

In Chapter 3.4.4 Unit ELIC.U2 - Element 4: E-Motor the performance criteria for knowledge and understanding of an e-motor are defined:

Performance Criterion	Evidence Check: The student can demonstrate
ELIC.U2.E4.PC1	Understanding the system engineering concept of the e-motor in cars.
ELIC.U2.E4.PC2	Knowing how physics experiments and knowledge taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC3	Knowing how chemistry experiments and knowledge taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC4	Knowing how mathematics taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC5	Knowing how informatics taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC6	Knowing how biology and environmental issues taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC7	Knowing how ethics taught in schools can be mapped onto the e-motor in cars.

This performance criteria are used to derive the learning objectives for the training content for the Module e-Motor (see IO3 Training curriculum).

CURRICULUM

Module 4: E-Motor

a) E-Motor
b) Electric Drive
c) Hybrid Drive

GENERAL DESCRIPTION OF THE MODULE

Reference to ELIC Skill Card: ELIC.U2.E4

The goal of the module 4 is to introduce the teachers to how electric motors are used in cars and to provide a system engineering understanding which alows teachers to assign experiments at school and content learned at school to specific Automotive functionalities.

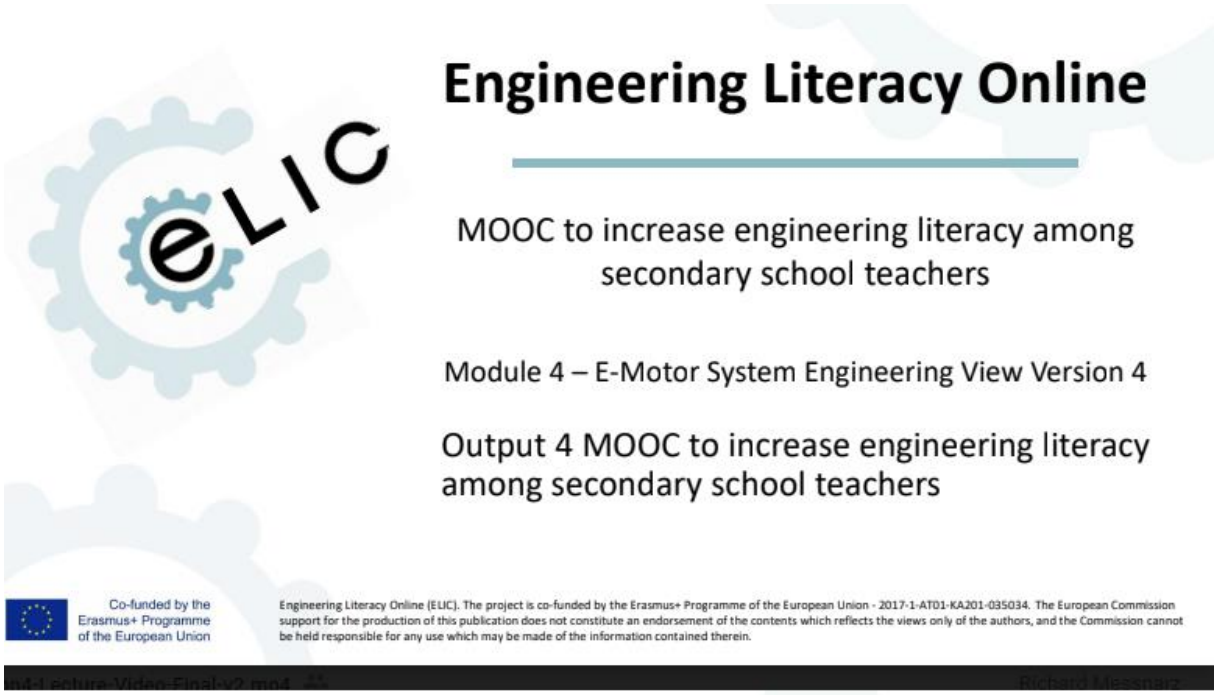
LEARNING OBJECTIVES AND DESIRED COMPETENCES OF THE MODULE

The aim of the module is to introduce the teachers to some system componenents, system elements and interfaces in powertrain solutions in cars where e-motor concepts are used. It gives hints on how the components work in cars and offering hints about how to assign specific knolwedge leraned at schools to those vehicle functions and components.
ELIC is appying the ECQA (European Certification and Qualification Association) and EQF (European Qualification Framework) schema to describe necessary skills.

Reference to ELIC Skill Card: Performance Criteria (What a leraner is able to perform)

ELIC.U2.E4.PC1	Understanding the system engineering concept of the e-motor in cars.
ELIC.U2.E4.PC2	Knowing how physics experiments and knowledge taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC3	Knowing how chemistry experiments and knowledge taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC4	Knowing how mathematics taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC5	Knowing how informatics taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC6	Knowing how biology and environmental issues taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC7	Knowing how ethics taught in schools can be mapped onto the e-motor in cars.

Figure 1: Training Curriculum with learning objectives and performance criteria



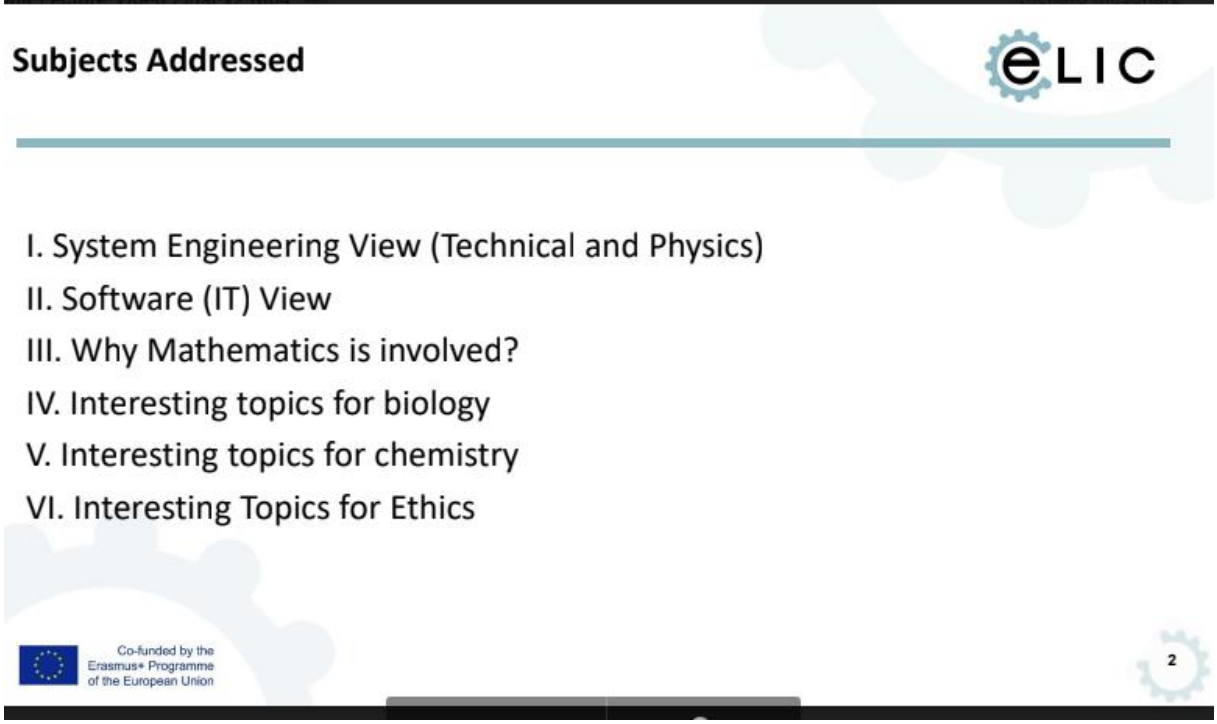


Figure 2: Training Content covering learning objectives and performance criteria

Example

The performance criteria **ELIC.U2.E4.PC1 Understanding the system engineering concept of the e-motor in cars** is covered in the training module **Module 4 – E-Motor System Engineering View.** The participant is taught in the module how electric motors are controlled in cars.

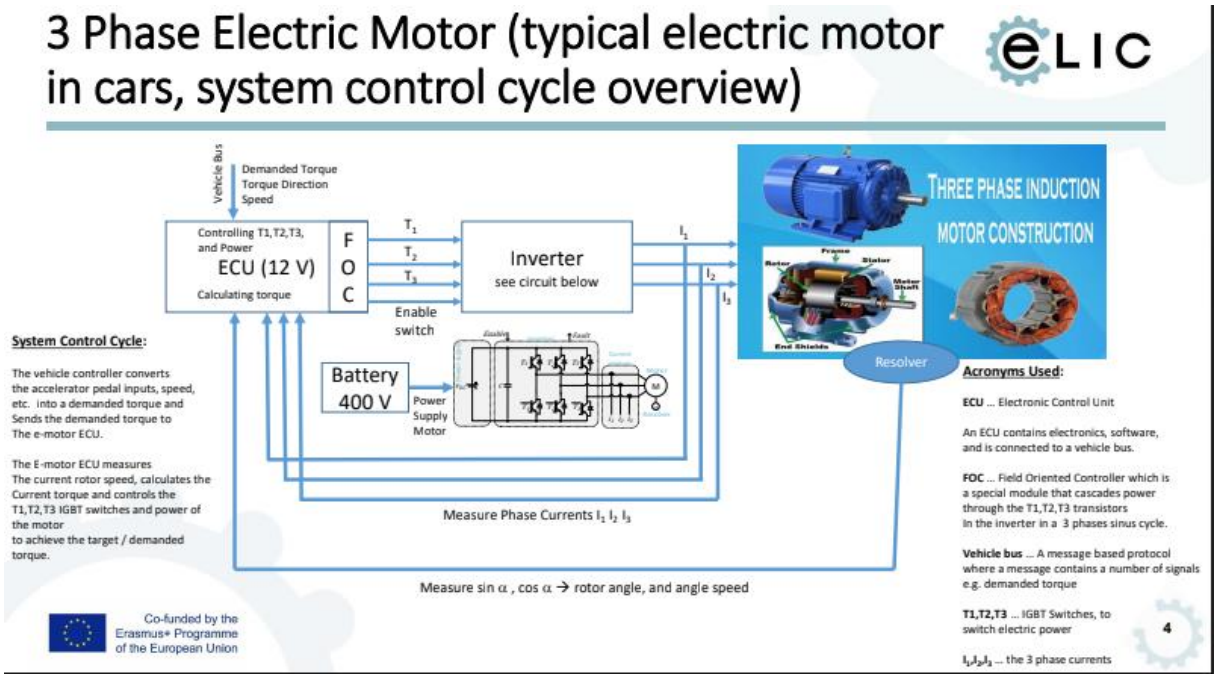


Figure 3: Training Content covering ELIC.U2.E4.PC1.