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Reference and Recognition Framework – Analysis

D 4.1.1 Open Automotive Skills and Quality Framework (OASQF)

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EXECUTIVE SUMMARY

The increasing speed to which today's technologies emerge and skills get obsolete is striking. The European automotive sector has been Europe's key driver of knowledge and innovation since many years and remains committed to address tomorrow's challenges. In order to deliver sector-specific skills solutions, the New Skills Agenda for Europe has launched the Blueprint for Sectoral Cooperation on Skills. The **DRIVES project, blueprint for cooperation on skills in the automotive sector**, is thus established to mitigate the lack of capacity to develop specific education programmes and ensure the acquiring of the new skills to prevent further relocation of business processes outside Europe.

This report provides an overview of basic concepts and requirements for skill brick classification to enable accommodation of several existing frameworks and certification schemata in the **DRIVES platform** (developed in WP4 of DRIVES project).

The document is the result of multiple workshops of the VET and certification experts of the DRIVES consortium to establish means for comparison and mutual acceptance of established training approaches. This initial mapping proposal by the project core partnership is geared towards the integration of project partnership frameworks and in a second step also third-party alliances. To that, aim the described skill brick classification approach will be refined and maintained based on feedback during application in Tasks 4.2 and 4.3 by partners and 4.4 by inputs received from third party contributors and partners.

Based on this report, practical actions and interventions will be taken, related to the establishment of the DRIVES platform in a sustainable and accepted manner across the automotive value chain.

Specifically, **the purpose of this report is** to provide:

- Analysis and Identification of related learning models, learning methods and benefits of the different variants
- Basic concepts for skills bricks classification/ comparison
- Classification attributes for mapping of skills taxonomies and skills bricks
- Generic open plug-in and specific ECQA integration strategies, as pilot mapping

The Report includes the following sections:

- Overview of learning concepts and education models
- Assessment of concepts for classification and comparison
- Generic strategy for mapping
- Strategy for population of DRIVES framework with pilot ECQA data
- Strategy for open plug-in mapping of external frameworks

Note:

This report depicts the **currently established strategy for analysis of learning models; classification and comparison of skill bricks; and mapping and integration of trainings into the DRIVES platform** (WP4 activities), but **will be elaborated continuously** throughout the remaining project duration (if required) **and potentially updated by related activities of task 4.3, 4.4, and partially 5.4.**

INTRODUCTION

The automotive market is of a highly competitive nature and it is currently being reorganized on a very broad front by new technologies. These complex technologies demand such a rapid knowledge growth and high associated knowledge change that has never experienced before in the history of human activity.

Furthermore, demographic change will further aggravate the already existing shortage of skilled workers. Progressive automation and new technologies will require a higher proportion of academically educated staff in the technical field and staff from the intermediate qualification area.

This is evident in the automotive industry, especially in the fields of automotive engineering and electrical engineering in vehicles.

The lack of engineers on the one hand and the personal life and career planning on the other hand bring this group of people into the focus of multiple training organisations and universities as a new target group. An extra-occupational course of lifelong training programs is required for the target group.

Well-trained skilled workers are an important prerequisite for maintaining the innovation and competitiveness of the European automotive industry. In view of demographic change, securing the demand for skilled workers is one of the major challenges in the coming years. Many benefits are expected, but the **nature of work will change, and millions of people will require new skills**. The new technologies make certain forms of human labour unnecessary or economically uncompetitive and **create additional demand for new skills**. Aside from this, the **increasing speed to which** today's technologies emerge and **skills get obsolete** is striking.

The **automotive sector** has been **Europe's key driver of knowledge and innovation** for many years and worldwide the second biggest R&D sector. Europe's automotive industry remains committed to addressing tomorrow's challenges. Thus, the entire industrial sector needs to evolve and adapt at a very fast pace to stay ahead of global competition. In order to deliver sector-specific skills solutions, the New Skills Agenda for Europe has launched the **Blueprint for Sectoral Cooperation on Skills**. The Blueprint is a new framework for strategic cooperation between key stakeholders in a given economic sector with the aim to develop concrete actions to satisfy short and medium term skills needs to support the overall sectoral strategy.

The **DRIVES project**, blueprint for cooperation on skills in the automotive sector, is thus challenged by involving the entire automotive value chain in Europe, mitigating the lack of capacity to develop specific education programmes and ensuring the acquiring of the new skills to prevent further relocation of business processes outside Europe.

This report provides an overview of basic concepts and requirements for skill brick classification to enable accommodation of several existing frameworks and certification schemata in the **DRIVES platform** (developed in WP4 of DRIVES project).

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1 OVERVIEW OF LEARNING CONCEPTS

The origins of learning and learning concepts may be traced back to the origins of humankind itself. **Human learning starts at birth and continues until death as a consequence of ongoing interactions between people and their environment**. Thus, ever since learning styles, methods and approaches have been changed and adapted for novel trends, research activities and mainstream mind-sets.

Learning styles refer to a range of competing and contested theories that aim to account for differences in individuals' learning. The theories share the proposition that individuals differ in how they learn best. The idea of individualized learning styles became very popular in the 1970s and has greatly influenced education. Recommendations include that teachers have to run a needs analysis to assess the different learning styles of their students and adapt their classroom methods to best fitting approach for the pupil and learning.

Therefore, teachers, trainers or practitioner entering the area of knowledge transfer have to establish the appropriate means of transferring knowledge within the given the volume, diversity and variants of possible methods, models and theories of learning and knowledge transfer. In 1990, De Bello[1] notes that for those working within an educational setting wishing to utilise learning style to promote learning that is more effective, there are too **many learning style models available and the best is hard to select**, depending on multiple variants. In addition, Curry[2] highlights the failure to identify and agree upon style characteristics most relevant to learners and instructional settings as a major concern in the field. She also identifies two further concerns relating to weaknesses in reliability and validity and confusion surrounding definitions and terminology.

Therefore, the **aim of this section of the report is not to provide a holistic overview or even propose a "golden model" approach for learning models, teaching concepts or training approaches**. Rather the fundamental assumption is that individual teachers, trainers and practitioner have selected the most suitable approach to transfer their knowledge.

Thus, **the aim is rather to highlight the different learning models and emphasis their different implications, effects and outcomes** that need to be kept in mind when establishing skills brick description and classification, quality, and application guidelines.

[1] De Bello, TC. 1990. Comparison of eleven major learning styles models: Variables, appropriate populations, validity of instrumentation and the research behind them, Journal of Reading, Writing, and Learning Disabilities, 6: 203–222.

[2] Curry, L. 1991. Patterns of learning styles across selected medical specialities, Educational psychology, 11: 247–278

1.1 EDUCATION MODELS

Fundamental education model groups defined by the OECD[3] are (a) **formal**, (b) **non-formal**, and (c) **informal** models. In this paragraph these education models, differences and benefits will be explained. The **different education models are applied in a mingled manner across companies** of the automotive value chain **and might result in an equivalent knowledge/skill transfer**. Table 1 summarises an overview of the key facts of the three learning forms.

Table 1 Fundamental forms of learning as defined by OECD

Learning Model	Formal	Non-formal	Informal
Structure	Institutions, education organisations		Unplanned
Learning Institution	Educational established	Training centres, workplace	Anywhere / everywhere
Focus	Curricula	Customer oriented	Individual
Learning Outcomes	Learning outcomes of modules, descriptors of qualification schemata		
Standardisation	Bologna processes (ECTS)	European qualification scheme (EQF)	

1.1.1 Formal learning

Trained teachers deliver formal learning in an (intentionally agreed) **systematic way within a school, higher education or university**. Formal learning focuses on an established curricula leading to an internationally acknowledge qualification or diploma.

The development of curricula is not an easy task; it is influenced by many factors. Thus, international ambitions in 1999 **led to the Bologna Process**[4] (0) **and** ultimately to the **European Qualifications Framework for Lifelong Learning (EQF)**[5] (2.2). Included in this process is the commitment of every nation to follow these guidelines, to put these agreements into practice, and to map them into their legislative bases. As a result, educational institutions must act in accordance with these bases and do so in varying degrees of autonomy and freedom of decision-making.

In the past, designing **study program at universities** focused on topics that students should know after the completion of their degree, in some cases these curricula **had a very teaching-centred focus** only describing subjects, topics, etc. taught, but leaving out the student centred view. Thus, only in rare cases did a University degree relate directly to a specific profession.

[3] Organisation for Economic Co-operation and Development, www.oecd.org
[4] https://ec.europa.eu/education/policies/higher-education/bologna-process-and-european-higher-education-area en
[5] http://www.cedefop.europa.eu/de/events-and-projects/projects/european-qualifications-framework-eqf

Developments since 2000's, however, have led to the **emergence of a different view concerning university education, reflecting the** changing world with its growing mobility, and the **necessity of transparency and comparability**[6].

Some instruments will be described in the following of this report to compare and differentiate training courses and outcomes. Some instruments are geared towards the type of course and the relation to the competences that should be transferred; this will be described as competence matrix (1.2). Others like the Bloom's Taxonomy (2.1) for comparing performance criteria (a.k.a. learning outcomes) of the course.

In **formal education** stringent curricular are established and trained teacher facilitate knowledge transfer on a regular basis, which lead to a formally recognized credential. These mostly classroom-based programs consider the students' standards, values and attitudes rather limited.

1.1.2 Non-formal learning

It is the second form of learning as defined by the OECD. **Non-formal learning** occurs in a planned but highly adaptable manner in institutions, organizations, and situations beyond the spheres of formal or informal education[7]. It shares the characteristic of being provide by education organisations with formal education, but the motivation for learning may be intrinsic to the learner.

Non-formal education strategy does not require student attendance in all variations, decreases the contacts between teacher and student and most activities take place outside the institution – e.g. at work places. This learning processes has am more flexible curricula and methodology, capable of adapting to the needs and interests of students.

An analysis of the existing non-formal systems reveals the constant presence of two features: (a) centralization of the process on the student (to his previously identified needs and possibilities) and (b) a certain immediate usefulness of the education for the student's personal and professional growth[8]. Non-formal systems can also be based on three educative processes (a) correspondence learning, (b) distance learning, and (c) open system.

Main features of **correspondence learning** include, that it is a planned and systematized activity, based on the preparation of printed educational materials, which are forwarded to students who are

[6] E. Brenner. „Competencies in higher education: Needs requiremetns for universities". He_leo, 2008.
[7] H. Eshach, „Bridging In-school and Out-of-school Learning: Formal, Non-Formal, and Informal Education", Journal of Science Education and Technology, Vol.16, No 2, DOI: 10.1007/s10956-006-9027-1 ,2006.
[8] C. Dib, "Formal, Non-formal and informal education: Concepts/Applicability", Cooperative Networks in Physics Education - Conference Proceedings 173, American Institute of Physics, New York, 1988, pgs. 300-315.

physically separated from the teachers. This allows students to proceed at their own pace; the teacher generally prepares the materials.

Distance learning is based on non-contiguous communication, because of the physical separateness of learners and teachers, and includes pre-produced course, as self-instructional as possible, and a constitutive element in most cases by assignments for submission for the students.

The instance of non-formal education, **open learning**. "Open learning systems are defined as those which offer students a measure of flexibility and autonomy, to study the programmes of their choice when and where they wish, and at a pace to suit their circumstances. "[9]

In **non-formal education,** attendance is inconsistent and a degree/diploma or certificate is not always included. However, it has the benefit of being flexible in organization and methods and acknowledging the importance of the education of the learner.

1.1.3 Informal learning

The other forms of learning defined by the OECD is **informal learning**, which typically takes place naturally as part of any other activity. Informal education is that learning which comes from other places than formal learning environments and can be seen as **the collective of learnings received from daily experience. It covers a vast array of learning in daily live situations** and covers activities related to individual and personal research on a subject or interests (by using books, libraries, country lore, the internet or other resources). Informal education also includes learning things without the learner realising that he learned it. This can be any kind of information that the learner picked up from the television, radio, conversations with friends and/or family.

Informal education is often used in formal or non-formal education as an additional method of teaching (e.g., when television programs, films or internet are used to illustrate points). **Informal education takes place anywhere and anytime and uses a wide variety of methods, throughout our lives**. The negative points related are: (a) it tends to be unpredictable, (b) learning media may have wrong information, and (c) the learning is not always evaluated.

[9] D. Butts, "Distance Learning and Broadcasting", in "Distance Learning and Evaluation" ed. F. Percival and H. Elligton (Kogan Page, London, 1981) p. 26

1.1.4 From broad ideas to tools with an economic focus

In an article related to EPALE (Electronic Platform for Adult Learning in Europe)[10] it is already highlighted that current changes in working life are related to the need for continuous adaptation and lifelong learning. Also **highlighted are new challenges for validation in context of the afore mentioned education models**. The concept of validation aims at making visible and valuing the full range of knowledge and competences held by an individual, irrespective of where or how they have been acquired. In this article, validation directly refers to the recognition of learning outcomes and competences that have been acquired through non-formal and informal learning.

However, if trying to relate validation as a process to non-formal and informal learning, it is not as easy or direct as expected. In Europe, in particular this can also be explained by the fact that each Member State has developed its own approach to valuing learning outside the formal education system.

Challenges mentioned in this context are especially related to:

- Lack of clarity in terminology – identified as a major obstacle in the current discussion
- Lack of collective recognition of the validity of validation - Validation is not yet collectively recognised (by individuals, stakeholders and social partners)
- Lack of agreement on how actually assess competences acquired - the assessment of the individual's learning outcomes towards competence-based assessment has been insufficiently realised
- A need for more reliable mechanisms to support career development and mobility - despite various attempts to develop relevant tools, there is still a marked need for more reliable mechanisms to recognise skills and competences acquired informally and non-formally.
- Not lose sight of the individual – trainees themselves are subject to recognition, validation and certification of competences, but a "positive reading" needs to be taken, whereby the intention must be to identify and value what the person has learnt throughout life.

10 https://epale.ec.europa.eu/en/blog/validation-non-formal-and-informal-learning-origins-and-upcoming-challenges

1.2 LEARNING METHODS

Various different teaching concepts have evolved over the centuries with lectures taking their place as one of the oldest forms of teaching. This concept of teaching alone is clearly not sufficient to describe teaching and interaction methods in all its variety. Numerous different formats evolved over the decades and are still applied including practical work, seminars, laboratory exercises, etc.

This section of the report is describing the differences between methods (workshop, lecture, etc.) and competence that can be transferred via this method. **Core of this section is the competence matrix depicted in Table 2**. This tool was introduced by Brenner and Niehs[11] in the process of curricula design and the mapping of courses and is enhanced by training methods requested by the automotive sector[12]. The central document for the study program is the "qualification profile" on which the authors present a template for curricula designers. Focusing on learning outcomes on course level, they introduce the "competence matrix" as tool for mapping competences to a specific type of course.
The authors claim that a much larger set of course-types and specification of teaching methods and interaction with students is required. Although the different teaching types are described in some short sentences in most curricula, they are still difficult to compare. As these descriptions present a wide range of teaching and learning methods, they implicitly reflect what the students acquire apart from pure knowledge. To that aim, a course type not only supports the acquiring of knowledge but also the understanding, comprehension or analysis required to transfer different skills.

As indicated in Table 2, lectures, laboratories and practical exercises can transfer the application of knowledge and understanding easily. While competences like communication and teamwork skills or interdisciplinary need to be taught by other approaches. Thus, the type of training will have a major influence on the type of knowledge that can be transferred and skills that will be acquired. This major factor needs to be considered in relation to the comparison and recognition of different training methods.

[11] E. Brenner & J. Niehs, „Curricula Development based on Learning Outcomes – An Austrian Case", he_leo, 2008.
[12] DRIVES Consortium, „D2.7 Forecasting Dissemination Report", 2019.

Table 2 Competence Matrix mapping competences to specific course types (extension to original work in green)

	Classroom based						Other			
			Practical courses / job based trainings							
	Lecture	Seminar	Design Exercise	Practical Exercise	Laboratory Exercise	Project	Immanent	Master thesis / mentoring	Blended learning	Online learning
Knowledge and under-standing	■	■						■	■	■
Applying knowledge and understanding			■	■	■			■	■	■
Making judgements		■				■	■			
Handle complexity; interdisciplinary			■			■		■		
Self-directed learning skills		■				■		■	■	■
Communication skills	■	■				■		■	■	
Social and ethical aspects							■		■	
Teamwork					■	■				
International context		■					■	■		■

In the following sections, course type groups will be described in more details. These course type groups:

- **lecture type courses**, also with practical exercises; traditional forms of ex cathedra teaching
- **seminar type courses**, also with project components; promote scientific work and discussion and should be an introduction to the discursive and argumentative process of the subject; written and oral presentations
- **practical type courses & job based trainings**; practical, design, laboratory, project; various aspects of practical skills are focused including paper-work, hands-on practical, design, experimental or projects including management and written and oral documentation

- **Immanent:** defined by the setup and context; working groups including teachers and/or colleagues from other countries, sources in different languages etc.; including working in groups within practical courses, projects…
- **Thesis and mentoring:** to a large extend individual work including all aspects; not as restricted as practical type courses, but with more agile adaptation and flexibility for the individual needs
- **Blended learning:** combines online educational materials and opportunities for interaction online with traditional place-based classroom methods; can also be used in professional development and training settings; highly context-dependent therefore a universal conception is hard to come by.
- **Online learning:** combines all principles of effective multimedia learning using electronic educational technology.

1.2.1 Lecture type courses

Lectures are one of the oldest forms of teaching, not only at universities – the instructor lectures or reads with minimal interaction. Obviously, this concept of teaching is not sufficient to describe teaching and interaction methods; hence, numerous different formats evolved such as practical, seminars, laboratory exercises, etc. In Austria the law only classified three basic concepts of interaction with the students, but all the universities had a much larger set of course-types, specifying in more detail the way of teaching and interacting with students. In addition, every study program defined its own course types within the curriculum. Although these types were described in some short sentences, they were difficult to compare. In 2004, for example, more than 40 different types could be identified in the curricula of Graz University of Technology. As a result, a process of discussion and restructuring started resulting in a reduction to about 10 different types of courses, all of them being described based on teaching concept and student-teacher interaction.

This process of defining course types depends very much on national and institutional traditions; every institution has to define its own set of course types. As these descriptions present a wide range of teaching and learning methods, they implicitly reflect what the students acquire apart from pure knowledge.

1.2.2 Seminar type courses

Seminars usually require students to work with literature and presented the research in oral form using slides or PowerPoint. The results also have to be presented in a written paper. Hence, this course type not only supports acquiring of knowledge but also understanding, comprehension or analysis. It requires and trains transferable skills such as presentation techniques or arguing in discussions. With a seminar a wide set of competences is connected.

1.2.3 Practical type courses & job based trainings

Some aspects cannot be covered in a specific course such as teamwork experiences. It is possible to include teamwork in practical oriented courses where students are required to work together with fellow students and the lecturer acting as a coach. Another influencing factor is the requirement of attendance or if students can freely elect specific course topics and timeline.

The ability to work in teams works well within laboratory exercises and project works, where students have to achieve a specific goal by working within a group. Intercultural understanding and awareness is gained through the work in international context.

In this context, job based trainings exclude apprenticeship (dual system) education models, since these efforts are covered by a report of its own in deliverable D5.2[13] and activities of task 4.4 and related deliverables.

1.2.4 Immanent

In terms of training for freely electable course structuring and timing, also immanent characters of exams, allow developing additional competences. In this context, students have the necessity to decide on how to complete a program according to a predefined schedule.

Supporting mentors should give advice and personal guidance to support the individual selection of free elective courses and to make sure that students choose courses so that they acquire the necessary and defined competences. This type guarantee individual work, solution-oriented approach and personal responsibility training to achieve all the competences required.

1.2.5 Thesis & mentoring

To complete the learning it is also required to establish a kind of individual and independent work, aka. master thesis, final project or complementary work (depending on the institution and degree). Important in this context is the changing role of the supervisor of the thesis from pure observation towards the role of a coach that supports the work, development and growth of the competences and abilities of the student. Particularly between professional oriented and academic programs, we find a

[13] DRIVES Consortium, „D5.2 Understanding the Marketplace“, 2019.

very wide gap in knowledge, being able to prepare papers and presentations, and deeper understanding.

1.2.6 Combination of traditional ways and modern approaches

All traditional ways of teaching that evolved over the centuries obviously still have their justification and added value. Nevertheless, in many cases only a new and additional approach result in optimal transfer of knowledge and skills. Additionally, the right combination of methods and concepts with their resulting outcomes should be considered to provide a good opportunity to learn. In the end, students should know what they have achieved and what it is good for. If that was not clear before, it should be after the learning process.

1.2.6.1 Blended learning

Blended learning combines online educational materials and interaction with traditional classroom methods and is recently used in multiple professional development and training settings. Blended learning is highly context-dependent and a consensus of description of the concept is not given. In general, blended learning as a mixture of online and in-person training, where the online portion replaces some of the face-to-face contact time for preparation and equalizing the knowledge base for the training. Online time is not intended for supplementing of the face-to-face contact, but rather enhancing it. Therefore, it also requires the physical presence of both teacher and student at the same time.

1.2.6.2 Online learning

Online learning covers multiple aspects of effective multimedia learning using electronic educational technology. It includes all forms of distance learning up to 100% virtual classes offered over the internet, offering the freedom of not requiring the physical presence of neither teacher nor student at any time or place (extreme case). Thus, the learning experience is typically asynchronous, but may also incorporate synchronous elements.

The vast majority of online courses support a learning platform simulating a virtual classroom or meetings by simultaneously mixing several communication technologies. So that participants can raise hands, answer polls or take quick questions to interact with the trainer. Virtual classrooms provide the opportunity for students to receive direct instruction from qualified teachers in an interactive environment. Learners can have direct and immediate access to their instructor for instant feedback and direction. Issues to overcome are related to unrealistic hypes and promises of new technologies. Technology, in and of itself, does not necessarily result in fundamental improvements to educational practice, inappropriate use of technology can even hinder it. Social relationships between pupil and trainer are important, but high-tech environments may compromise the balance of trust, care and respect between each other.

2 CONCEPTS FOR CLASSIFICATION AND COMPARISON

This section of the report gives a very brief overview of existing regulation frameworks and their guidelines. The comparison of these frameworks provides the basis for the mapping examples presented in Section 3 & 4. The following paragraphs present a brief overview of existing regulations, guidelines and restrictions for study programs given by various authorities.

2.1 BLOOM'S TAXONOMY FOR COMPARISON OF LEARNING OUTCOMES

In addition to specifying the content of training, it is also of the utmost importance to indicate the intended complexity and level of the knowledge that should be transferred.

The framework is the most commonly used taxonomy in education and is the original work of Benjamin Bloom[14]. It bases on the use of performance indicators as evidence to determine if students have met the learning goals that were set for them. These goals are typically called learning objectives.

The **levels of the Bloom's taxonomy are based on 'Levels of Cognition'** and can be used to further **detail learning outcomes of training**. In the original version of the taxonomy, the cognitive domain is broken into six levels of objectives, these levels have been further revised in the 2001 edition of Bloom's Taxonomy[15,16] to: **Remember, Understand, Apply, Analyse, Evaluate, and Create** (rather than Synthesize), as depicted in Figure 1.

This taxonomy of educational objectives, which is generally referred to as Bloom's Taxonomy, is a classification of the different objectives that educators set for students (learning objectives). The original taxonomy was proposed in 1956 by Benjamin Bloom, an educational psychologist at the University of Chicago.

[14] Bloom, B.S. (1956). Taxonomy of educational objectives: The classification of educational goals.New York, NY: Longmans, Green.
[15] P. Armstrong. Blooms taxonomy, 2016.
[16] Anderson, L.W. & Krathwohl, D.R. (2001). A taxonomy for teaching, learning, and assessing: Arevision of Bloom's taxonomy of educational objectives. New York, NY: Longman.

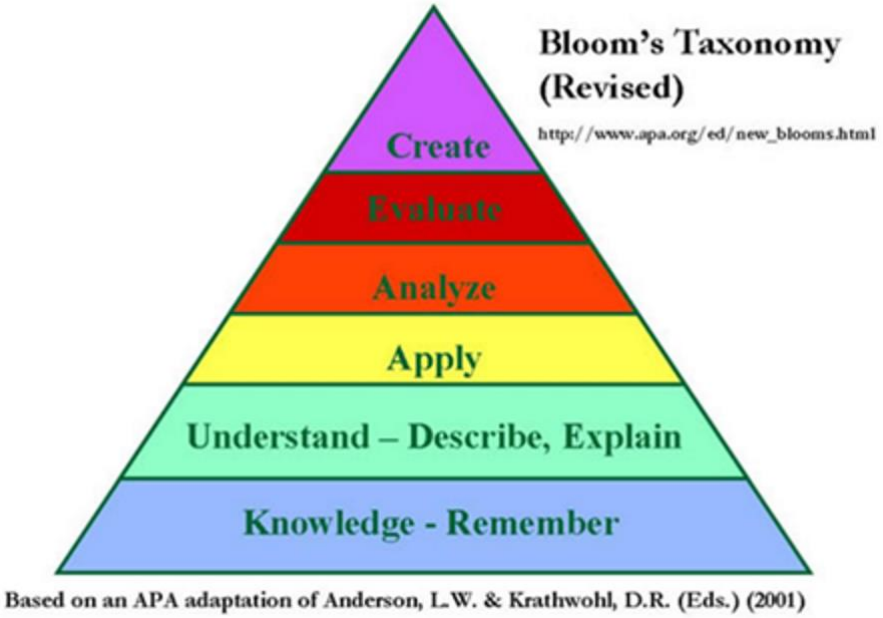

Figure 1 Bloom's Taxonomy (revised version from 2001)[17]

The **'Levels of Cognition'** are in rank order - from least complex to most complex:

- **Remember** - recall or recognize terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, etc.
- **Understand** - read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.
- **Apply** - know when and how to use ideas, procedures, methods, formulas, principles, theories, etc.
- **Analyse** - break down information into its constituent parts and recognize the relationship these have to one another and how they are organized.
- **Evaluate** - make judgements about the value of proposed ideas, solutions, etc., by comparing the proposal to specific criteria or standards.
- **Create** - putting parts or elements together in such a way as to reveal a pattern or structure that was not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn.

[17] https://www.apa.org/ed/new_blooms.html

2.2 EUROPEAN QUALIFICATIONS FRAMEWORK (EQF)

The EQF system[18] acts as a translation device to make national qualifications more readable across Europe and promote workers' and learners' mobility between countries and facilitation of the lifelong learning approach. This approach shifts the focus from what is traditionally 'learning inputs' focused, such as the length of a learning experience, or type of institution to 'learning outcomes'.

The core of the EQF concerns eight reference levels describing what a learner knows, understands and is able to do. The levels of national qualifications are placed at one of the central reference levels, **ranging from basic (Level 1) to advanced (Level 8)**. Where **EQF level 6 is approximately equivalent to a bachelor degree, level 7 to a master degree, and level 8 to a PhD**.

Thus, EQF applies to all types of education, training and qualifications, from school education to academic, professional and vocational. It also encourages lifelong learning by promoting the validation of non-formal and informal learning. Aim of EQF is to give workers and employers a measure to better understand and compare the qualifications levels of different countries, different education and training systems. Since 2012, all new qualifications issued in Europe carry a reference to an appropriate EQF level. An example mapping of Irish National Framework of Qualifications (NFQ) to EQF is depicted in Figure 2. Additionally an overview from[19] is given in Table 3. As both depictions show EQF level 5 is equivalent to a short cycle track of QF-EHEA (Qualifications Framework for the European Higher Education Area), which is in most countries not equivalent to a bachelor's degree, but is supported by some higher education institutes.

[18] E. Commission. Descriptors defining levels in the european qualifications framework (EQF), 2005.
[19] https://en.wikipedia.org/wiki/European_Qualifications_Framework

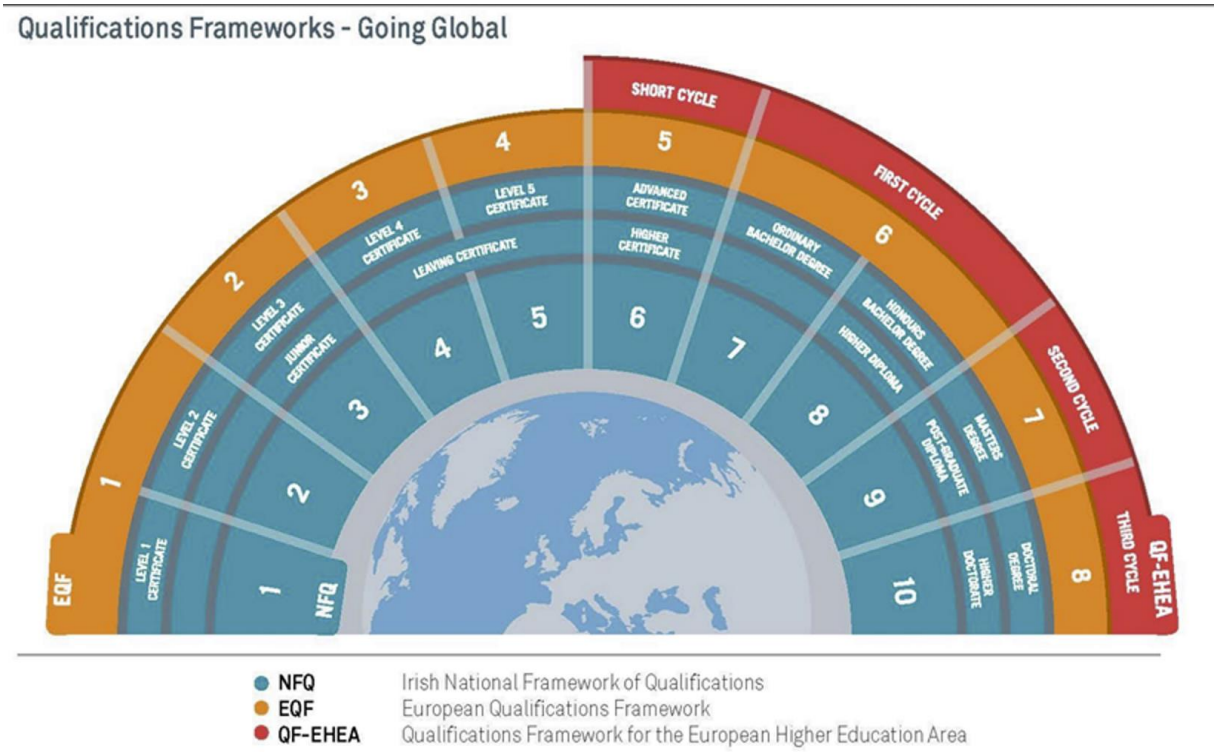

Figure 2 EQF mapping example on Irish national qualification framework

Table 3 Overview table of EQF levels

Level	Knowledge	Skills	Responsibility and autonomy
	Knowledge is described as theoretical and/or factual.	Skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).	responsibility and autonomy is described as the ability of the learner to apply knowledge and skills autonomously and with responsibility
Level 1	Basic general knowledge	basic skills required to carry out simple tasks	work or study under direct supervision in a structured context
Level 2	Basic factual knowledge of a field of work or study	basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	work or study under supervision with some autonomy
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	a range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	exercise self-management within the guidelines of work or study contexts that are usually predictable, but are

			subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities
Level 5 **(Bachelor)**	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	a comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others
Level 6 **Bachelor**	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study	manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups
Level 7 **Master**	Highly specialised 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	specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams
Level 8 **PhD**	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	the most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice	demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research

2.3 EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

ECTS[20] is a credit system designed for universities and to make it easier for students to move between different countries. The credits are more s**tudent-centred and based on the learning achievements and workload of a course**. Thus, students can transfer their ECTS credits from one university to another so they are added up to contribute to an individual's degree program or training. It is a **central tool in the Bologna Process**[21] and represents the workload and defined learning outcomes ("what the individual knows understands and is able to do") of a given course or program. **60 credits are the equivalent of a full year of study or work**. In a standard academic year, 60 credits would be usually broken down into several smaller components. Thus **1 ECTS point is equivalent 25 to 30 working hours** of an average student.

A typical "first cycle" (or **Bachelor's) Degree**, would **consist of 180 or 240 credits**, whereas a typical "second cycle" (or **Master's) Degree**, would **consist of 90 or 120 credits**, with at least 60 credits at second cycle level[22]. The use of ECTS at the "third cycle" (or Ph.D. level) varies. ECTS has been adopted by most of the countries in the European Higher Education Area.

2.4 EUROPEAN CREDIT SYSTEM FOR VOCATIONAL EDUCATION AND TRAINING (ECVET)

The ECVET system[23] is the **equivalent to the universities ECTS**, but for vocational education and training. The European Credit system for Vocational Education and Training[24] is directed at citizens, and is intended **to facilitate the recognition of their learning outcomes**, in a borderless lifelong learning process. The technical specifications of ECVET are based on practices already existing in some Member States. It is intended to complement and reinforce the existing mobility instruments relating to ECTS for higher education, Europass and EQF.

Since learning outcomes can be acquired through different learning pathways, modes (school-based, in-company, workplaces etc.), and in different learning contexts or settings the ECVET system groups learning outcomes to create units and assess them to constitute credits. These credits are the basis for enabling the transfer between learning contexts and for the accumulation of learning outcomes.

[20] S. Directorate-General for Education, Youth and C. E. Commission). ECTS users guide 2015. 2015.
[21] https://ec.europa.eu/education/policies/higher-education/bologna-process-and-european-higher-education-area_en
[22] E. Brenner. Competencies in higher education: Needs requiremetns for universities. he leo, 2008.
[23] http://www.ecvet-secretariat.eu/en/faq-page\#t1n966
[24] European Commision. Using ECVET to support lifelong learning, 2012.

ECVET does not provide a template or a taxonomy concerning the format for learning outcomes descriptions. Such templates or classifications may exist at national, regional or system level (for example as part of a national qualifications framework).

Allocation of ECVET points to a qualification is based on using a convention according to which **60 points are allocated to the learning outcomes expected to be achieved in a year of formal full time VET**.

ECVET allocates points to qualifications and not to education and training programmes. ECVET points provide information about the qualification and the units credit designates the learning outcomes the learner has achieved

ECVET Credit is a different concept than ECVET points. Credit refers to the fact that the learner has achieved the expected learning outcomes, which have been assessed positively, and the outcome of the assessment was documented in a personal transcript. Based on this documentation, other institutions can recognise learners' credit. Credit transfer is the process through which learning outcomes achieved in one context can be taken into account in another context. Credit transfer is based on the processes of assessment, validation and recognition.

2.5 EUROPEAN SKILLS, COMPETENCES, QUALIFICATIONS AND OCCUPATIONS (ESCO)

ESCO[25] is a European multilingual classification scheme for skills, competences, qualifications and occupations. The ESCO data base[26] can be consulted free of charge and works like a dictionary, describing, identifying and classifying professional occupations, skills, and qualifications relevant for the EU labour market, education and training. The **intention of ESCO is to have a common reference terminology**, which helps to make the European labour market more effective and integrated in terms of communication and exchange. The ESCO classification is composed of modules that contain elements such as occupations, knowledge, skills and competences, qualifications, and the International Standard Classification of Occupations (ISCO) hierarchy.

ESCO is organised in three pillars: (a) **the occupations pillar**; (b) **the knowledge, skills and competences pillar**; and (c) the **qualifications pillar**. These three pillars, when combined and interrelated, make up the ESCO classification.

ESCO skill descriptions are intended for multiple sectors and are thus relatively generic in their description. Additionally, an application for sector specific usage requires a tailoring of the ESCO definition model. Figure 3 depicts the general structure as tailored for DRIVES.

[25] European Commission. ESCO: Connecting education and training with the labour market. Publications Office of the European Union, 2017.
[26] https://ec.europa.eu/esco/portal/

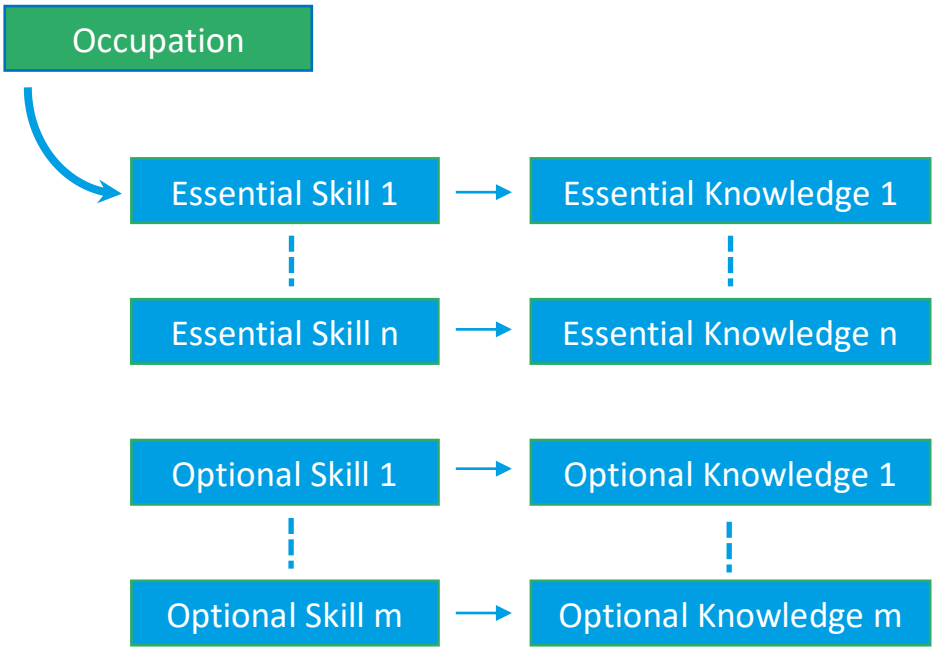

Figure 3 ESCO definition model tailored for DRIVES perspective

The ESCO structure template consists of the following elements:

- **Occupation**: An occupation is a 'set of jobs roles whose main tasks and duties are characterised by a high degree of similarities'. A **job role** is a 'set of tasks and duties carried out, or meant to be carried out, by one person for a particular employer, including self-employment'.
- **Essential Skill/Competence**: are skills and competences that are relevant for an occupation, independent of the work context, employer or country. Competences are the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations, and in professional and personal development. The terms skill and competence can be distinguished according to their scope. The term skill refers typically to the use of methods or instruments in a particular setting and in relation to defined tasks. The term competence is broader and refers typically to the ability of a person to use and apply knowledge and skills in an independent and self-directed way.
- **Essential Knowledge**: comprises the knowledge, skills and competences that are usually relevant for an occupation, independent of the work context, employer or country. Knowledge is described as theoretical and/or factual, and is the outcome of the assimilation of information through learning.
- **Optional Skill/Competence**: comprises the skills and competences that may be relevant or can be developed when working in an occupation depending on the employer, working context or country. Competences are the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations, and in professional and personal

development. Skill are the ability to apply knowledge and use know-how to complete tasks and solve problems.

- **Optional Knowledge**: comprises the knowledge that may be relevant when working in an occupation depending on the employer, working context or country. Again, knowledge is the body of facts, principles, theories and practices that is related to a field of work or study.

3 REFERENCE AND RECOGNITION FRAMEWORK

This section provides meta-model and approach to reference and recognition framework for the Automotive Sector.

3.1 BACKGROUND

For the simplest and most generic mapping, as depicted in Figure 4, the prerequisites, insides and outcomes of a training need to be analysed.

In terms of **prerequisites**, the prior knowledge and skills that trainees need to be possessed need to be analysed and aligned. Also possible domain expertise, experiences, and certificates have to be taken into consideration to ensure an adequate and equalized prior knowledge of trainees.

This supports the transfer of learning that shall be covered by the course (**course insides**). A proper definition of the training type, duration, efforts involved, and definition of the skill and knowledge level transferred ensures comparability and attractiveness for participation of (future) trainees.

Finally, the **output of the training** affects most and gives the most prominent indications for comparison and mapping. Expertise levels after the participation, competence lists and certificates are the most well-known indictors to estimate the impact of the training on (job) life and thus most frequently the value for money indicators.

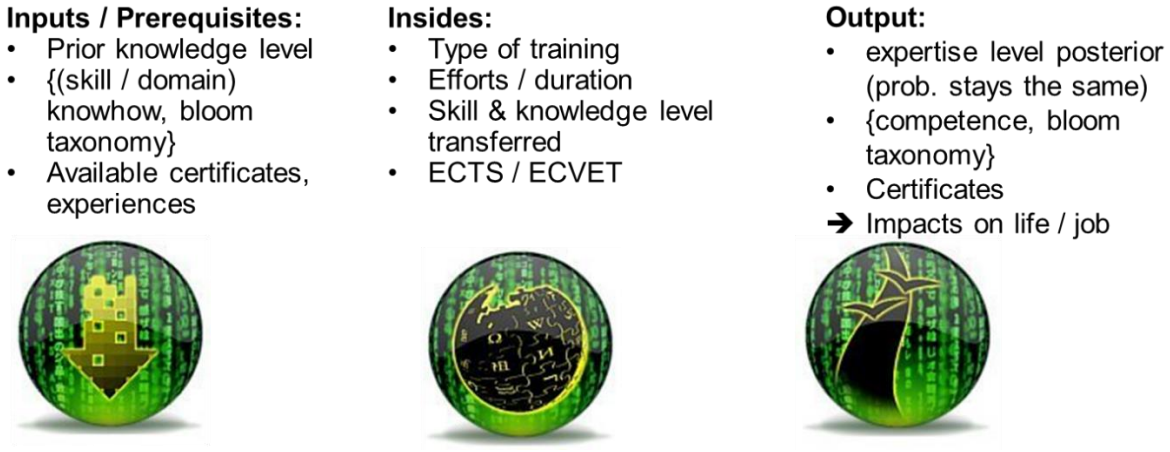

Figure 4 Generic mapping approach for training

3.2 STRUCTURE

Based on the state of the play introduced in section 1 and 2, DRIVES project proposes following mapping approach (see figure 5).

Reference Framework on the left side of the figure serves as definition of commonly agreed job roles and its competences/skills and knowledge. It is mapped to ESCO definition of occupations and competences/skills and knowledge. The mapping is ensured from the side of the reference framework on the level of job roles and occupation, as well as on the level of competences, its skills and knowledge

to competences/skills and knowledge in ESCO. This assures usage of ESCO definitions on occupation level brought closer to industry needs in terms of job roles definitions and its required competences, skills, and knowledge. Job roles is term, which is commonly used in the industry. This allows straightforward use in the industry for reference recognition of job roles description and its competences, skills, and knowledge. **This set of Automotive sector specific job roles and competences, skills, and knowledge would allow simple recognition and coherence throughout EU job vacancies as well as training and education offer, while ensuring it mapping and coherence with EU frameworks, such as ESCO, ECTS/ECVET, EQF.**

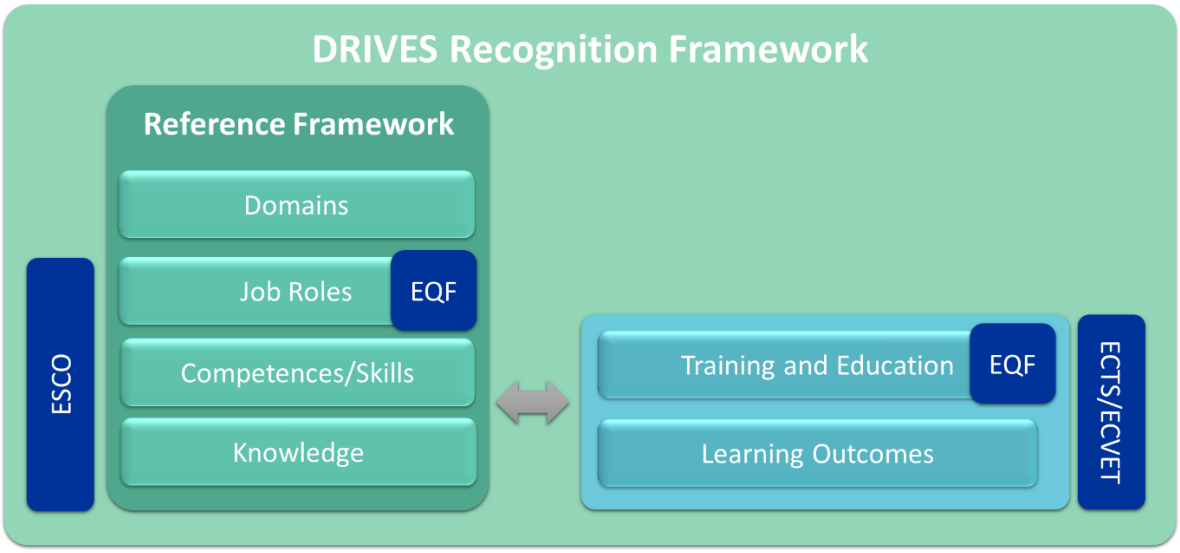

Figure 5 DRIVES Reference and Recognition Framework – Basic structure

The structure of the Reference framework (Figure 5) is following:

- **Domain** defines categories to which the job roles are structured. Domains follows automotive value chain and main area/topics. Job role could be linked with more than one domain.
- The **job roles** defined in the reference framework are linked to respective level in EQF framework to indicate on which level the job role is desired. Each job role has its description, which is assigned to one or many domains. Each job role has apart of its description linked required competences, skills, and knowledge on desired level (levels are described in section 3.3)
- **Competences, skills and knowledge** provides overview of automotive sector specific competences, skills and knowledge. The framework allows distinction to competence, which has skills and knowledge, or to competence/skill and knowledge. The second option follow the structure defined by ESCO. Based on the stakeholder feedback and acceptance there will be selected a final approach. Competences/skills and knowledge is directly linked to ESCO's

definition. Reference framework might also define more detailed and automotive domain specific competences/skills and knowledge that are not in such a detail described in ESCO. Those can be mapped to more generic ones in ESCO or provide an input for ESCO description updates.

On the right side of Figure 5 are **Trainings and Educations** offered across EU and related to automotive sector. It contains:

- All the trainings and education on all its levels and types (public or private). The trainings and educations are following EQF framework to state on which level it is provided.
- Learning outcomes are statements of what a learner knows, understands and is able to do on completion of a learning process, defined in terms of knowledge, skills and competences[27]. This is essential part of training or education and its mapping to ECTS and ECVET systems.

Practically the framework provides the possibility to map and compare the trainings or education based on its mapping toward reference definitions for automotive sector. The next section provides more details about the specific mapping.

3.3 MAPPING OF COURSES TO REFERENCE DEFINITIONS

As described in previous section, mapping between the reference definition and training and education will be provided. For this purpose, **three levels of maturity** were elaborated. In section 2 of the report, several more complex maturity mappings for skills and competences are mentioned. In order to ease the mapping for providers, the users community and the industry in automotive sector, solely three levels of maturity mappings are defined by DRIVES÷

- **Expert:** an expert knowledge or competence/skill ability to develop and apply procedures and activities as an individual and/or provide his qualified opinion to a team. Recognized specialist and advisor in the generation of solutions and ideas, including methods, tools, techniques, guiding or leading others in best practice use of the specific knowledge and skill.
- **Practitioner:** strong understanding of the knowledge, experience in the competence/skill. Able to apply knowledge, experience of the competence/skill and share with others including tools and techniques, define and use the most appropriate for the solution.
- **Awareness:** understands the background of the knowledge, competence/skill and its implications to be able to understand how it is applied in the environment

[27] ESCOpedia - https://ec.europa.eu/esco/portal/escopedia/Learning_outcomes

These three levels define the **maturity** of the Competence/Skills and knowledge needed for particular Job Role. The same levels are applied to **mapping of Trainings and Education to Competence/skills and knowledge** provided by the Trainings or Education courses, as it is depicted in Figure 6.

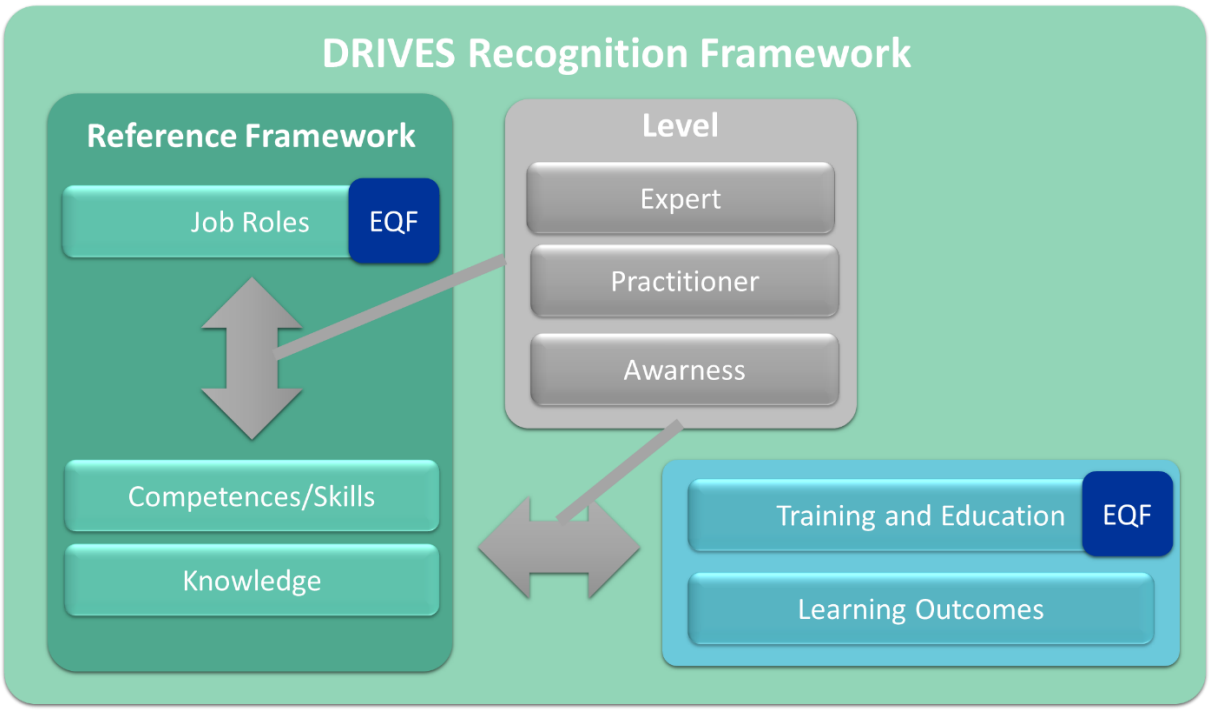

Figure 6 DRIVES Reference and Recognition Framework – Levels

The proposed mapping provides possibility to **map the training**, following its learning outcomes**, to specific competences/skills on offered level** (Awareness, Practitioner, and Expert) on reference side.

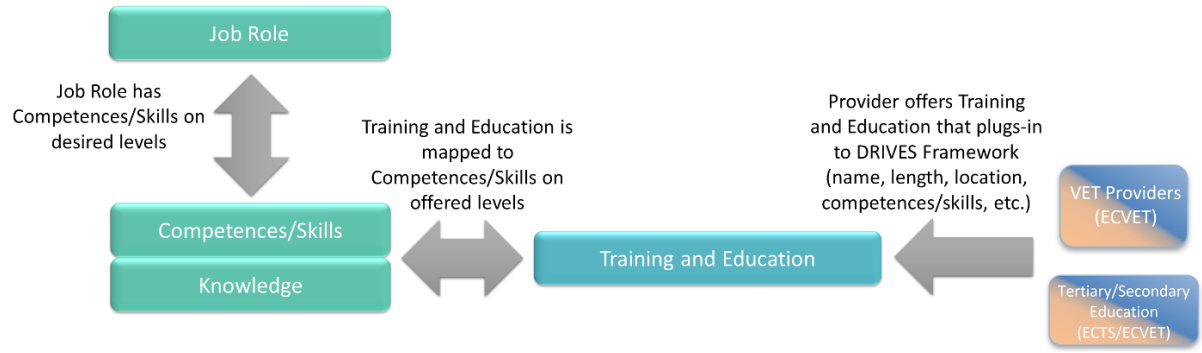

Figure 7 DRIVES Reference and Recognition Framework – Detail of mapping

This mapping between reference definition and training offer creates basic structure for possible EU **recognition of levels of competence/skill and knowledge achieved** by the person. This could be

supported by a certificate/badge for the competence/skill and knowledge achieved, which would allow mutual recognition around EU and mobility of automotive workforce.

3.4 USAGE OF THE FRAMEWORK

The proposed structure of the framework allows possibilities to create "**learning path" for person** by assessing its skills in comparison to reference definition. By that, see the "gap" between assessed level and desired job role and its competences/skills and knowledge levels. The gap shows that the person needs to upgrade its following competences/skills and knowledge to specific level. The framework then by this structure allows to see the possible trainings or education linked to those levels, and by that create "learning path" for the person. This could be adjusted according the specific needs, such as location, language, duration, prices, etc.

The structure of the framework stimulates **modular training and education**. By defining the reference definition of job roles and its levels of competence/skills and knowledge and the mapping of existing training and education there would be simple visible, which competences/skills and knowledge and its levels are well covered from different perspectives, such as geographical location, language, duration, as well as if there exist specific training or education or it is a part of others. Then the providers are naturally stimulated to create specific modular offer to demanded level of competence/skills or knowledge.

All those possible features will be elaborated by DRIVES Partnership in DRIVES Framework, which is based on this proposed structure and released in separate deliverable D 4.2.1 Deliverable 4.2.1 European Recognition Framework for Automotive (available at DRIVES project website[28]).

[28] https://www.project-drives.eu/en/results

4 MAPPING GUIDELINES FOR QUALIFICATION FRAMEWORKS

The mapping guidelines for qualification frameworks are split in **2 main sections**:

1. **Pilot - first fill-in of DRIVES framework with data from WP3 and ECQA**
2. **Plug-in approach for new training providers and established frameworks to the DRIVES platform**

(1) DRIVES WP3 work on skill cards shall be reflected in the DRIVES framework and by that, a creation of a best practice pilot for ECQA plugin will be supported as defined in the DRIVES project (ECQA used as a pilot, defined by DRIVES project content outputs).

(2) Integration of new providers related to any certification body willing to offer trainings via DRIVES platform will be ensured and provided in a very open and pragmatic manner.

As a proof of concept related to the fulfilment of the pilot implementation (1), **3 mapping strategies for ECQA and one open and lean approach** have been developed and will be detailed in the following sections. These pilot strategies will be evaluated, eventually enhanced, and can be then reused for other providers willing to join the DRIVES framework as well.

4.1 PILOT MAPPING OF DRIVES FRAMEWORK WITH ECQA DATA

For the integration of WP3 skills sets into the WP4 Framework 3 mapping strategies have been **developed to ensure best fitting mapping and the creation of a best practice for ECQA plugin**:

1. **Mapping Strategy 1 - Consistency Model for Skills Sets**
2. **Mapping Strategy 2 - Integrating Knowledge and Skills in one**
3. **Mapping Strategy 3 – Simple Conversion Mechanism by Key Words**

The level of detail for the mapping will be checked to apply the same structuring principles, as depicted in Figure 8.

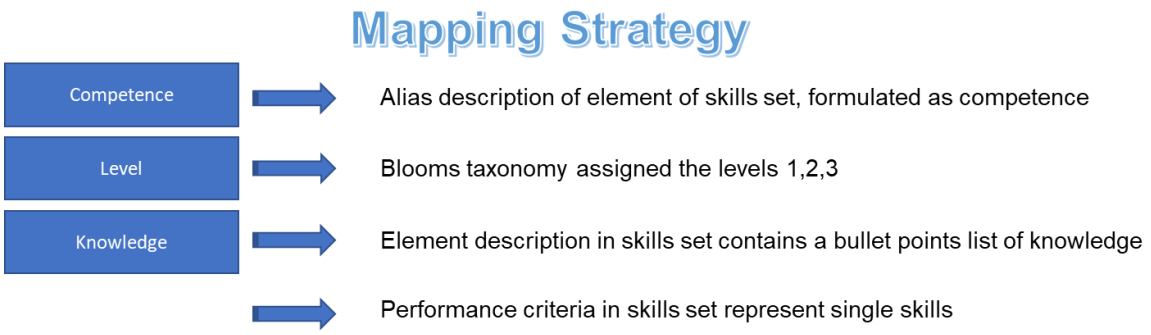

Figure 8 ECQA Mapping strategy building blocks

4.1.1 Mapping Strategy 1 - Consistency Model for Skills Sets

Mapping strategy 1 contains an example where **the skills set description would be reviewed and the element description and performance criteria would be re-formulated** to fit with WP4. As depicted in Figure 9, competences will be combined with the related level (as described in 3.3) and related knowledge and skills will be provided. The knowledge and skills blocks are related to the competence block and related level both highlighted in green.

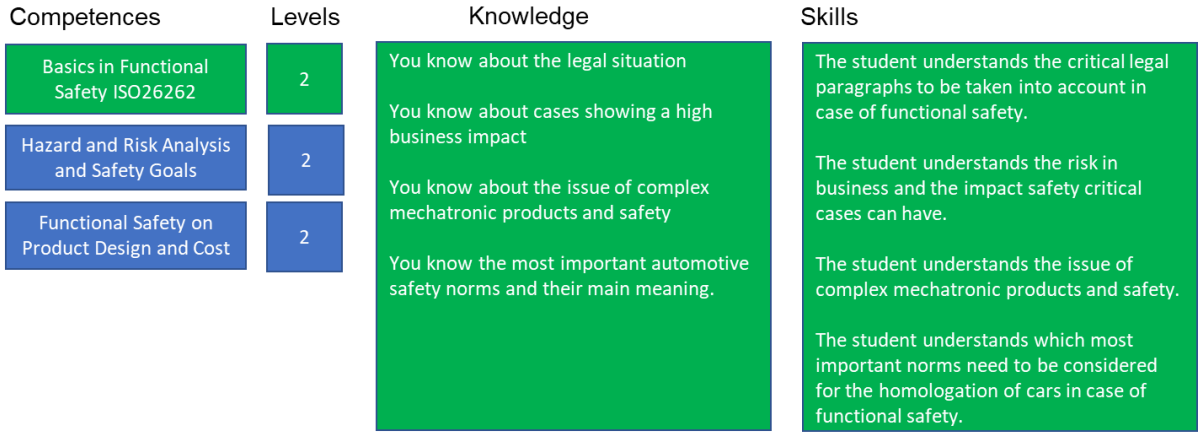

Figure 9 Mapping Strategy 1 Example for Functional Safety Manager Corporate Level

4.1.2 Mapping Strategy 2 - Integrating Knowledge and Skills in one

Mapping strategy 2 contains an example where the WP3 team has **no separation of skills and knowledge**. Figure 10 shows again a competence (highlighted in green) combined with the related level (as described in 3.3 and highlighted in green) and a related knowledge and skill block.

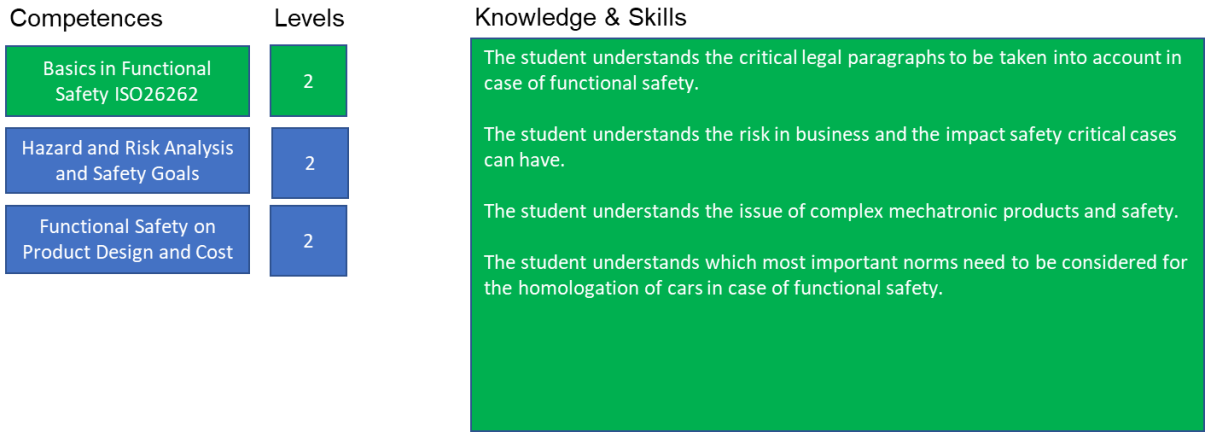

Figure 10 Mapping Strategy 2 Example for Functional Safety Manager Corporate Level

4.1.3 Mapping Strategy 3 – Simple Conversion Mechanism by Key Words

Mapping strategy 3 represents a **straightforward conversion algorithm**. Based on the assumption that a performance criterion has a certain language different from knowledge (e.g. “knows”, “understand”, “recall” etc. is knowledge and other terms are skills). With such a conversion algorithm, the skills sets do not need to be reworked and can automatically converted in a simple manner.

Figure 11 depicts such **an automatic mapping** for the example of a functional safety manager corporate level competence.

Figure 11 Mapping Strategy 3 Example for Functional Safety Manager Corporate Level

4.1.4 ECQA Mapping Overview

The plug-in concept is depicted In Figure 12, to clearly **highlight the relations between the DRIVES framework** (highlighted in dark-blue), **ECQA qualification framework** (demonstration context for WP3 activities, indicated via boxes with black corners and green boxes) **and training providers** (highlighted in blue on top right side).

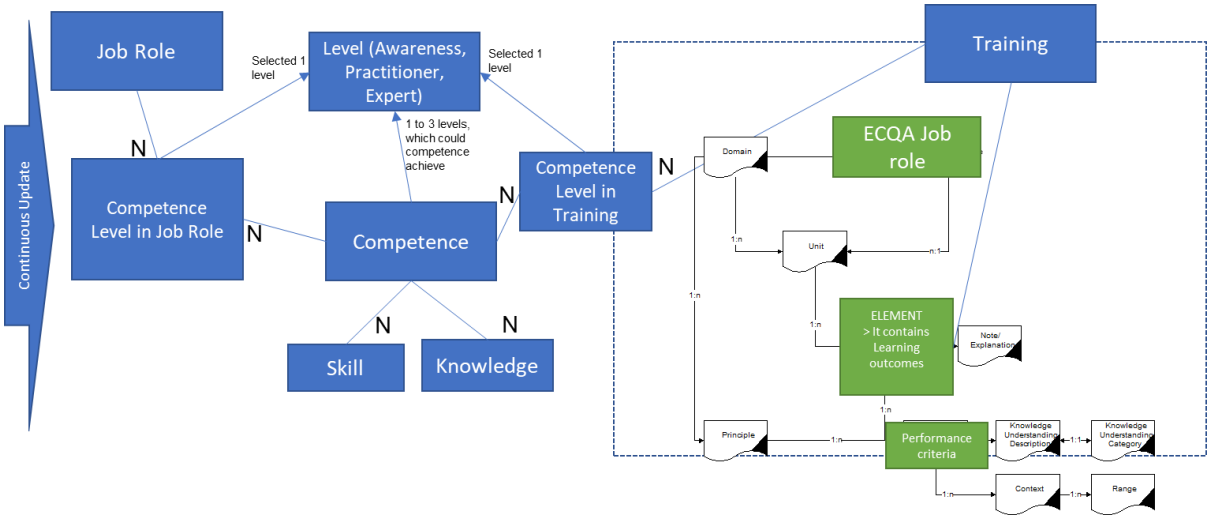

Figure 12 Depiction of the Relation between DRIVES framework, ECQA qualification framework, and training providers

The **DRIVES reference framework** works with defined job roles, its linked competences (skills/knowledge) on defined levels.

The **ECQA qualification framework** defines skills by job roles, elements, and performance criteria, skill levels are assigned to elements in order to certify people against the job role. ECQA has an ISO 17024 mapping for certification of persons.

NOTE: Training is separate, since according to the EU free market principle there can be n training providers and n training materials compliant with same job role.

For **training providers**, both frameworks allow many training providers and many training materials to be compliant with same skills/job roles.

NOTE: ISO 17024 requires a separation of qualification framework and training provider and training materials.

As soon as the DRIVES framework is reviewed and agreed by the industry, **based on the latest feedback** there will be a **selection of the appropriate mapping strategy**, on how to fill in the data to the DRIVES framework.

4.2 PROPOSED OPEN PLUG-IN MAPPING FOR NOVEL FRAMEWORKS

The open plug-in mapping is geared **for integration of novel frameworks into the DRIVES framework**. Providers related **to any certification body willing to offer trainings via DRIVES platform** will be ensured and provided in a very **open and pragmatic manner**. To that aim, training institution need to select existing competences and levels from the DRIVES Framework database that will be transferred by the training. If the competence is not found, a possibility to propose new competence (skills and knowledge) to the DRIVES framework will be given. The approval process for continuous update will thus be similar to "wiki" and working groups. The general plug-in concept is depicted in Figure 14, using the same colour coding as the previous depictions (dark-blue for DRIVES framework and green for training/certification providers internal structure).

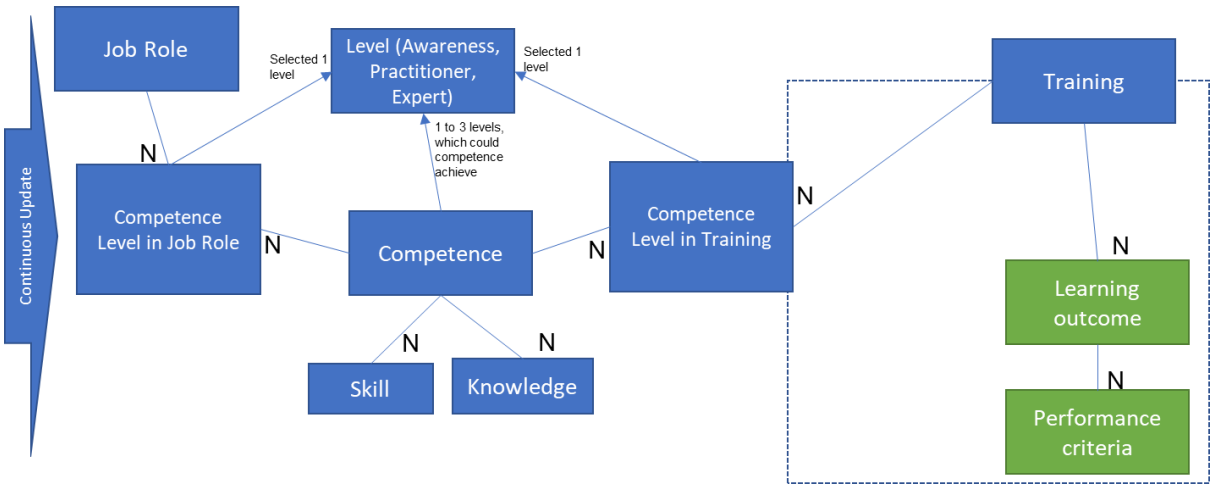

Figure 13 Depiction of the general plug-in concept

CONCLUSION

This report provides an overview of basic concepts and requirements for skill brick classification to enable accommodation **of several existing frameworks and certification schemata in the DRIVES platform** (developed in WP4 of DRIVES project).

The document serves as state of the play for proposal definition of reference and recognition framework for the automotive sector. The framework aims at providing basic structure for reference recognition of job roles and its competences/skills and knowledge, as well as the mapping to existing training courses available on the market.

The document is the result of multiple workshops of the VET and certification experts of the DRIVES consortium to establish means for comparison and mutual acceptance of established training approaches. This initial mapping proposal by the project core partnership is **geared towards the integration of project partnership frameworks and in a second step also third-party alliances**. To that aim, the described skill brick classification approach will be refined and maintained based on feedback during application in Tasks 4.2 and 4.3 by partners and 4.4 by inputs received from third party contributors and partners.

Based on this report, practical actions and interventions will be taken, related to the establishment of the DRIVES platform in a sustainable and accepted manner across the automotive value chain.

Note:

This report depicts the **currently established strategy for analysis of learning models; classification and comparison of skill bricks; and mapping and integration of trainings into the DRIVES platform** (WP4 activities), but **will be elaborated continuously** throughout the remaining project duration (if required) **and potentially updated by related activities of task 4.3, 4.4, and partially 5.4.**