Methodology to define the eight proficiency levels

Translating each competence into sets of learning outcomes compatible to the 8 proficiency levels has been developed according to the methodology described below.

- We structured the updated **21 competences in eight levels of learning outcomes.**

- **Method followed to defined each proficiency level:**

  o **The levels were described through learning outcomes**, each description contained terms of knowledge, skills and attitudes. Knowledge, skills and competences/attitudes were described in one single descriptor for each level of each competence. This equals to 168 descriptors (8 x 21 learning outcomes).

  o The leverage were understood as **a ladder** in the sense that from level 1 to level 8 the associated learning becomes more complex and makes greater demands on the learner or worker. Nevertheless, each level describes the outcomes of learning rather than stages of progression, there is no assumption that one level will be achieved before another. The descriptors are written to sufficiently distinguish between descriptors from the level below or the level above and show, from the previous level, distinct progress in dimensions of change (e.g. complexity of knowledge). In order to keep the table and the text as clear as possible, repetitions were avoided.

  o In order to achieve continuity and discreteness, **keywords inspired by the European Qualification Framework (EQF) were identified and used to characterize levels each level** (see Table 1). This was also a specific recommendation from external reviewers. In this sense, these keywords can also be understood as indicators of threshold levels.

  o Level 7 and 8 remained highly specialised knowledge and they are described using very abstract language.

Level	Main key words
Level 1	Basic general Basic for simple tasks Direct supervision
Level 2	Basic factual Basic cognitive and practical for tasks and routine problems Supervision with autonomy
Level 3	(regular level of) knowledge Range of skills for tasks and problems Responsibility for tasks and adaptation to problems
Level 4	Factual and theoretical Range of skills for specific problems Self-management in predictable contexts, supervise routines of others and responsibility to evaluate and improve
Level 5	Comprehensive, specialised, factual and theoretical Comprehensive range of skills Management and supervision in unpredictable contexts Review and develop self and other
Level 6	Advanced and critical understanding Advanced skills Manage complexity and unpredictability; responsibility to develop others
Level 7	Highly specialised and critical awareness Specialised problem-solving Manage and transform in complexity and unpredictability and responsibility to review the performance of others
Level 8	Most advanced Most advanced and specialised Substantial authority, innovation, autonomy, scholarly, integrity and commitment

Method followed to formulate descriptors:

o The descriptors were deliberately written rather generic. To apply definite and concrete statements (e.g. avoiding terms like 'appropriate') and at the same time to be as simple and generic as possible.

o The descriptors reflected both specialisations and generalisations.

o One learning outcome descriptor was included at each level encompassing the required knowledge, skills and attitudes. The main reason is to simplify the resulting framework. Currently, each level is more than the sum of the three parts that make it up creating a narrative with meaning.

o We used only positive statements.

o We avoided jargon.

Method followed to produce learning outcomes:

- We started each learning outcome **with an action verb**, followed by the object of the verb followed by a phrase that gives the context: action verb + object + context.

- In order to **use correct action verbs**, we used Bloom's Taxonomy (Bloom et al., 1956, 1964) in the version revised by Anderson et al., (2001[1]).

- We used **only one verb per learning outcome**.

- We **avoided vague terms** like know, understand, learn, be familiar with, be exposed to, be acquainted with, and be aware of.

- We used **"unambiguous action verbs"** as defined by Fry et al (2000) and related with outcomes and not aims

- We try to include when possible learning outcomes that **include or combine the three domains** (cognitive, subjective and psychomotor).

- **We avoided complicated sentences**, using when necessary more one than one sentence to ensure clarity.

- We wrote **observable and measurable learning outcomes**, capable of being assessed.

Lastly, we have matched the levels with levels of the revised Bloom taxonomy (Anderson et al., 2001) in order to identify action verbs and key words for each level. The results are shown in the following grid (Table 2). This was used as a base to follow a systematic and homogeneous process to formulate the learning outcomes of each descriptor.

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[1] Anderson, L. W. and Krathwohl, D. R., et al (Eds..) (2001) *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Allyn & Bacon. Boston, MA (Pearson Education Group)

Table 2: Grid with correspondence between key words inspired by EQF and Revised Blossom's Taxonomy

Level	Knowledge	Skills	Competence	Main key words ADJECTIVES
Level 1	**Basic general** knowledge **Remembering- Factual**	**Basic** skills required to carry out **simple tasks** **Perception**	Work or study **under direct supervision** in a structured context **Awareness and attention (Receiving)**	Basic general Basic for simple tasks Direct supervision
Main Key words VERBS	List (specific) Arrange, collect, define, describe, duplicate, enumerate, examine, find, identify, label, list, memorise, name, order, outline, present, quote, recall, recognise, recollect, record, recount, relate, repeat, reproduce, show, state, tabulate, tell.	Choose, Describe, Detect, Differentiate, Distinguish, Identify, Isolate, Relate, select	ask, choose, describe, follows, gives, holds, identifies, locates, names, points to, selects, shows interest, sits, erects, replies, uses	
Level 2	**Basic factual knowledge** of a field of work or study **Remembering- Factual+Conceptual**	**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** **Guided response**	Basic factual Basic cognitive and practical for tasks and routine problems Supervision with autonomy
Main Key words VERBS	Recognise Arrange, collect, define, describe, duplicate, enumerate, examine, find, identify, label, list, memorise, name, order, outline, present, quote, recall, recognise, recollect, record, recount, relate, repeat, reproduce, show, state, tabulate, tell.		Copy, Trace, Follow, React, Repeat, Produce, Respond	
Level 3	**Knowledge of** facts, principles, processes and general concepts, in a field of work or study **Understanding - Factual + Conceptual+ Procedural**	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 **Active participation (responding)**	(regular level of) knowledge Range of skills for tasks and problems Responsibility for tasks and adaptation to problems

Main Key words VERBS	Summarise (specific) Classify (specific) Clarify (specific) Associate, change, clarify, classify, construct, contrast, convert, decode, defend, describe, differentiate, discriminate, discuss, distinguish, estimate, explain, express, extend, generalise, identify, illustrate, indicate, infer, interpret, locate, paraphrase, predict, recognise, report, restate, rewrite, review, select, solve, translate.		Accept responsibility. answers, assists, aids, complies, conforms, discusses, enjoy, greets, helps, labels, obey, performs, practices, presents, reads, recites, reports, selects, tells, writes.	
Level 4	**Factual and theoretical** knowledge in broad contexts within a field of work or study **Understanding - Factual + Conceptual+ Procedural + Metacogn**	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 **Mechanism**	Factual and theoretical Range of skills for specific problems Self-management in predictable contexts, supervise routines of others and responsibility to evaluate and improve
Main Key words VERBS	Predict (specific) Associate, change, clarify, classify, construct, contrast, convert, decode, defend, describe, differentiate, discriminate, discuss, distinguish, estimate, explain, express, extend, generalise, identify, illustrate, indicate, infer, interpret, locate, paraphrase, predict, recognise, report, restate, rewrite, review, select, solve, translate.		Assemble Construct Displays Fix Grind Heat Manipulate Measure Mend Mix organise	
Level 5	**Comprehensive, specialised, factual and theoretical** knowledge within a field of work or study and an awareness of the boundaries of that knowledge **Applying**	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 **Valuing**	Comprehensive, specialised, factual and theoretical Comprehensive range of skills Management and supervision in unpredictable contexts Review and develop self and other

Main Key words VERBS	Respond Provide Carry out Use Apply, assess, calculate, change, choose, complete, compute, construct, demonstrate, develop, discover, dramatise, employ, examine, experiment, find, illustrate, interpret, manipulate, modify, operate, organise, practice, predict, prepare, produce, relate, schedule, select, show, sketch, solve, transfer, use.		Associate with, assume responsibility, believe in, be convinced, completes, describe, demonstrates, differentiates, explains, follows, forms, have faith in, initiates, invites, joins, justifies, participate, proposes, reads, reports, selects, shares, studies, subscribe to, works.	
Level 6	**Advanced** knowledge of a field of work or study, involving a critical understanding of theories and principles **Evaluating**	**Advanced** skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study **Adaptation**	**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	Advanced and critical understanding Advanced skills Manage complexity and unpredictability; responsibility to develop others
Main Key words	Check Determine Judge Reflect Appraise, ascertain, argue, assess, attach, choose, compare, conclude, contrast, convince, criticise, decide, defend, discriminate, explain, evaluate, grade, interpret, judge, justify, measure, predict, rate, recommend, relate, resolve.	Adapt Alter Change Rearrange Reorganise Revise Varies	**Organising and prioritising**	
Level 7[3]	**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 **Creating**	**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 **Origination**	**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	Highly specialised and critical awareness Specialised problem-solving Manage and transform in complexity and unpredictability and responsibility to review the performance of others

Main Key words VERBS	Generate Assemble Design Create categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes	Arrange Build Combine Compose Construct Design Initiate Originate	Adhere to, alter, arrange, classify, combines, compares, completes, defends, establish, explains, form judgements, formulates, generalizes, identifies with, integrates, modifies, orders, organizes, prepares, relates, synthesizes, weigh alternatives **Internalising values**	
Level 8	Knowledge at the **most advanced frontier** of a field of work or study and at the interface between fields **Creating**	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	Most advanced Most advanced and specialised Substantial authority, innovation, autonomy, scholarly, integrity and commitment
Main Key words VERBS	Generate Assemble Design Create categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes		act, change behaviour, develop code of behaviour, develop philosophy, discriminate, display, influence, judge problems/issues, listen, modify, perform, practice, propose, qualify, question, revise, serve, show mature attitude, solve, verify.	