Modular and Hierarchical Structure of Syllabus Elements

Analysing and describing educational and training modules, requires, in general, a structured language, consisting of descriptive keywords which can summarize knowledge areas. This can make the process of designing content for educational programmes easier and more concrete. The process of arriving at this language of syllabus elements is bi-directional, utilizing both existing educational material and the analysis of occupational profiles.

The systematic relation between new job profiles and the required skills has been addressed in the EDDIE Project by identifying a common language of syllabus elements. This can describe the required skills in a practical, complete, and universal way. The structure of syllabus elements is evaluated through the description of real cases of job requirements to examine the functionality and completeness of the common language. The identification and collection creating of trends in occupational profiles in the energy sector will validate and complement the common language for the syllabus elements, as well as create a database of occupational trends.

Modular and hierarchical structure of syllabus elements

At first, the focus was on identifying the main elements of syllabuses as the main keywords starting from the existing degrees of the task member institutions enriching them with EDDIE project partner contributions, grouping them into the predefined families ICT/DIGITAL, Other STEM, ENERGY, TRANSVERSAL.

Procedure → Main elements – body of knowledge:

- Select keywords and granularity (relate to synonyms, describe contents, use standard references);
- Grouped into families.

Specific tools for languages, systems and main elements by themselves or as complementary to main elements like mathematics were part of the analysis. For example: [Programming → Java + Python] and Mathematics + [Tools → Matlab + GAMS].

It's also worth noting the qualifiers/elements for transversal and/or functional skills where many groups found like teamwork, modelling, problem-solving, testing & validation, presentation, writing etc.

All the keywords were characterized with the skill attribute of basic functions and key words for functions that described them best.

Therefore, an output was a Modular and hierarchical structure of syllabus elements to be used for: Descriptions of new jobs, skills gaps definition, training requirements. The work identified the main elements of syllabuses as the main keywords starting from the existing degrees and grouped them in blocks that were identified as belonging to families ICT/DIGITAL, Other STEM, ENERGY, TRANSVERSAL. All the keywords were characterized with the skill attribute and a list of key elements.

Analysis of job profiles and skills demands due to digital innovation

In order to identify trends in occupational profiles and to describe the qualifications, skills and academic background needed, a common language, based on the syllabus elements identified through the first part of this initiative, as presented above.

As such, the energy sector was classified in 4 sub-sectors, consisting of ICT digital, Power, Heating & Cooling and Oil & Gas. Similarly, in this exercise, the same subsectors are utilized, aiming to cover the full spectrum of the energy sector, through job profiles.

The analysis of the job profiles in the Energy sector was conducted through online recruiting platforms, such as LinkedIn. Some of the major companies, operating in Europe, were selected from each sector, for example Schneider Electric, ABB and Siemens from Power sector, Shell and Equinor from Oil & Gas, SAP, Vodafone, Orange and Accenture from ICT Digital and Daikin from Heating & Cooling. Then, the account/profile of each company was reached, scanning the posted jobs and using filters to target the search.

This scanning procedure provided inputs for the analysis, while also identifying trends in occupations, related to the digital era of the energy system. The trends are considered to be the posted jobs with higher frequency of appearance in the search.

To organize the collection and categorization of the job profiles a template was created and an example can be seen in Figure 1 below:

Job profile	Degrees	Blocks	Keywords / Topics	Skills
R&D Senior Engineer Power Electronics Systems	MSc degree in electrical engineering with power electronics systems specialization	POWER_ELECTRONICS	Power electronics	Basic understanding
		CONTROL	Industrial automation, Industrial control (PLC, PID, etc.)	Basic understanding, Design, Modelling
		MODELLING_SIMULATION_OPTIMISATION	Simulation tools (Matlab, Labview, R)	Basic understanding, Design

Figure 1: Job profiles example

This procedure was performed for more than 100 job profiles that were identified, proving that the common language of syllabus elements provides a concrete set of descriptors for skills and profile requirements.

Job profile	DegreeS	Blocks	Keywords / Topics	Skills
Solution Architect	Master's in computing sciences or equivalent	PROGRAMMING_LANGUAGES	C, C++, Matlab, Python, Java	Development
		CLOUD_COMPUTING	DevOps	Development, Maintenance
		CLOUD_COMPUTING	Cloud Security	Maintenance
		PRIVACY	Data storage	Basic Understanding
Database administrator	Bachelor's degree in Computer Science or a related field	PROGRAMMING_LANGUAGES	C, C++, Matlab, Python, Java	Design, development
		INFORMATION_TECHNOLOGY	Networking, communication, and security	Design, development, maintenance
IT operations engineer		PROGRAMMING_LANGUAGES	C, C++, Matlab, Python, Java	Maintenance
		INFORMATION_TECHNOLOGY		Documentation
		INFORMATION_TECHNOLOGY	DevOps	Maintenance
		APP_DEVELOPMENT		Maintenance
Data Scientist	Bachelor's degree in Engineering, Maths, Physics or a related field	DATA_ANALYSIS_BIG_DATA	Data analysis, Data structures, algorithms	Basic understanding, design, development
		PROGRAMMING_LANGUAGES	C, C++, Matlab, Python, Java	Design, development
		BASIC_MATHS	Mathematics for engineering & technology	Basic understanding, design, development

Figure 2: Job profiles table extract

The job profile analysis led to the identification of some additional Keyword / Topics, that have been added to the syllabus elements list, and presented in Figure 2, along with the block family that they belong to.