PRESENTATION OF WP4 TASKS & DELIVERABLES FOR THE CREATION OF

# CURRICULUM

D

4.1
4.2

# METVET

# JOINT HIGHER VET

# COURSE IN THE METAL SECTOR

## WP4 – Creation of Curriculum and Syllabus, Qualification standard, evaluation & certification (Vol. A)

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## ABOUT METVET

Metal, machinery and related trades workers are engaged in a range of skilled activities. Those workers need to understand work organization, and the specialist materials and tools to be used in their jobs, as well as of the nature and purpose the final product they are engaged in making.

According to Cedefop's European skills and jobs survey (ESJS), the **5 key skills** for metal, machinery and related trades workers are job-specific skills, problem solving, teamwork, learning and communication. These skills will support employees in this occupation to also tackle anticipated future skill challenges.

**METVET** project aims at a competence-based professional generic profile served as a basis for designing competence-based training programs. The underlying idea is that vocational education should enable trainees to acquire the competences needed in their future professions. While working as professionals, they should continue to develop competences in order to be able to react to and anticipate future developments in their work.

The project specifically aims at one hand designing, for **Aluminium & Metal Constructions technicians** including:

- **a professional (qualification) profile & a core curriculum (EQF 5)**
- **a corresponding VET program, including innovative teaching methods**
- **a qualification standard (according to ISO/IEC17024) for evaluation & certification.**

All the above will be achieved through the strengthening of the exchange of knowledge and practice between education and training institutions and the labor market. The METVET consortium complementarity will ensure a strong collaboration between the labor market (sectoral organizations) and the education and training institutions. The role of the sectoral organizations will be of ensuring that the developed training is in total adequacy with the employer's needs, supporting the implementation of the training for workers. The role of VET providers will be to develop an adapted, attractive and innovative VET program The EU umbrella organization will promote the training in the other EU countries.

The objective of this volume (Vol. A) is to present the first part of the METVET WP4 tasks, and more specifically the METVET Deliverables D4.1 "Curriculum for Aluminium & Metal Constructions technicians" and D4.2 "Systemic definition of the innovative teaching methodology".

**The Project Partners**

December 2019

# TABLE OF CONTENTS

# Wp4

# CURRICULUM

## Creation

# 1 ABOUT WP4 | CREATION OF CURRICULUM AND SYLLABUS, QUALIFICATION STANDARD, EVALUATION AND CERTIFICATION

The aim of this work package (METVET WP4) is to create the joint Curriculum-Deliverable D4.1 and define Systemic definition of the innovative teaching methodology-Deliverable D4.2 for the Vocational Educational Training for the EQF Level 5 Aluminium & Metal Constructions technicians. The objectives of METVET WP4 also include the creation of the Training Material (Syllabus)- D4.3, to set the Minimum Lab Requirements-D4.4 and the Minimum Traineeship / apprenticeship requirements-D4.5, the Creation of Examination / Evaluation mechanism for the acquired technicians' competencies -D4.6 and finally the formation of the qualification standard-D4.7. In this Volume (Vol. A), tasks pertaining METVET D4.1 and METVET D4.2 are presented, while the other Deliverables of METVET WP4 will be included in consecutive Volumes.

## 1.1 Description

The Curriculum for the Aluminium and Metal Constructions Technician at EQF Level 5, was created based on the Methodology presented in the following chapter and taking into account the respective Curricula from the countries participating in the METVET Project as well as from third countries. This bibliographic research, in order to find respective Curricula is also presented in the first chapter of this report.

Of prime importance, however, was to design the Curriculum in order to meet the skills defined in the list of joint skills that was created in METVET WP2 as well as to fulfill the requirements specified in the Profile of the Aluminium and Metal Construction Technician as presented in METVET WP3.

*Figure 1: Overview of the process followed to create the Curriculum for the Aluminium and Metal Construction Technician at EQF Level 5.*

It shall be noticed at this point that METVET project does not aim to revise an existing curriculum for the Aluminium and Metal Construction Technician but to design a completely new Curriculum aiming to EQF Level 5. As it will be clear below, such a Curriculum does not exist at this point in Europe for the Aluminium and Metal Construction Technician of EQF Level 5.

Development of Curricula may come from either from a need to fill a gap, namely if a Curriculum does not exist, and/ or from a need to revise an existing Curriculum to meet new skills.

The Curriculum developed within the METVET Project treats both needs, since a Curriculum at EQF Level 5 does not exist and also to cover novel skills relating to energy saving and environmental protection, i.e. green skills.

It was therefore first needed to identify the new knowledge, skills and competencies needed, to match with industry requirements.

The success however of a Curriculum and the pertaining course is based also in additional factors, which will be discussed in following Volumes, but still need to be named here. These include:

- Industry and job market needs
- Implementation with training providers with job-oriented training
- Training providers with industry-experience
- Job-training (apprenticeship) shall be compulsory
- Job-training (apprenticeship) shall be also programmed and monitored

In all cases the relative industry, shall be engaged actively in this process and shall provide the necessary steering in order to maximize the results.

With regard to the latter, METVET Project is engaging the industry not only because the Hellenic Association of the Aluminium and Metal Construction Craftsmen is among the consortium, but also through the Thematic Workshops that have been scheduled for each step, from the phase to form the list of joint skills, to the phase in which the Professional Profile was developed, and to the phase where the Curriculum[1] was created.

[1] One short note regarding the Thematic Workshop in which the Curriculum was scheduled to be discuused with industrial and training providers stakeholders. This Workshop was originally scheduled to take place at Milan/Italy during the 23-24 March 2020. Unfortunately this period was the major outbreak of the Coronavirus (Covid-19) in the Region of Lombardia and the Workshop was postponed. This Workshop will take place after this otbreak is over, and the Curriculum will be discussed then.

# Creation of CURRICULUM Methodology

# 2 WP 4 | METHODOLOGY FOR THE CREATION OF CURRICULUM

The current chapter constitutes the introductory task of METVET WP4 (METVET Task 4.1). In the first part the general methodology for the definition of Curricula is presented with details on the process in Greece, in Germany and in Italy.

In the second part the background research on existing Curricula are depicted, as much as a collection of best practices and innovative teaching methods, for Aluminium and Metal Construction technicians. All METVET partners carried out a desktop and internet-based research, using data, elements, and statistics derived from public educational assessment bodies, public and private educational institutions, Ministries of education, and other national and regional educational bodies. The Curricula presented in this part, are the ones that are directly related to the occupation of the Aluminium and Metal Constructions Technician. As stated above in Greece, Germany and in Italy there is no Curriculum explicitly related to this occupation and for this EQF level and therefore the most related cases were chosen and presented herein.

## 2.1 Curriculum development methodology – How they are defined

The targets set by the Governments and the demands for green buildings, require new technical needs and new skills for the technicians on top of the traditional ones. These needs generate a mismatch between the market needs and the traditional profile of a technician. This mismatch can be quite wide in particular for the building sector as pointed out in the METVET WP2, where a comparison of the existing list of skills compared against the list of joint skills to meet the energy saving targets. New materials, new technical solutions, new demands for new calculation and technical parameters are some of the innovations that shall be encompassed in order to attain optimum energy performance for the Aluminium and Metal Constructions. A technician in this sector shall also be capable to understand the energy-related

particularities of a construction and apply the best technoeconomic solution, while at the same time to have well developed transversal skills. All these were thoroughly discussed in the METVET WP2 to create the list of joint skills and in METVET WP3 to develop the corresponding Professional (Qualification) Profile.

In order to bridge the gap described above, the market needs new industry-directed curriculum enabling a quick and credible transition into positions in green constructions. The process to develop or revise Curricula referred to as DACUM (Development of Curriculum) is an occupational analysis process to this end. (Allais, 2010)

The DACUM is a quick and reliable process to determine the knowledge, skills and competencies that should be addressed in a training curriculum for a specific occupation. The DACUM process is based on the following principles Parya, 2017):

- Expert workers can describe their job than anyone else
- Any job can be effectively described in terms of the tasks that successful workers in that occupation perform
- The specific knowledge, skills, competences and tools required by workers in order to correctly perform their tasks can be also described.

The DACUM process is actually a brainstorming, in a well-organized step-by-step operation (focus group). This entails a panel of 5 to 9 expert workers, a qualified facilitator and a recorder. The facilitator systematically guides the panel members through brainstorming and consensus-reaching discussions to describe their job in terms of main duties and specific tasks. The panel shall also agree on the relevant knowledge, skills and competences as well as the primary tools of the occupation. The outcome of a DACUM process is a chart or profile that shows the duties and tasks performed in the occupation.

The first DACUM process is referenced in 1966 as a new approach to curriculum development with the Iowa Job Corps in Clinton, Iowa, USA. Then it was used by the Nova Scotia New Start Inc, in 1968.

In the next paragraphs we briefly present the methodologies for the development of Curricula for the Vocational Training Education.

The METVET Project followed the basic principle of DACUM as might be seen in the following Table.

*Table 1. The DACUM principles in METVET Project*

| DACUM Principles | METVET Project |
|---|---|
| **Expert workers can describe their job than anyone else** | Expert were in-depth interviewed, and a brainstorming took place in the 2nd Thematic Workshop. (see details in the METET WP3 Report) |
| **Any job can be effectively described in terms of the competencies or tasks that successful workers in that occupation perform** | A list of joint skills was created during the METVET WP2. The Professional (Qualification) Profile described thoroughly the knowledge, skills and competencies in METVET WP3. |
| **The specific knowledge, skills, attitudes and tools required by workers in order to correctly perform their tasks can be also described.** | The specific skills for each task are analytically described in this Report (see below) |

### 2.1.1 Greece

According to law 4386/2016, the curricula of Epaggelmatika Lykeia (vocational upper secondary schools - EPAL) are drawn up by the Educational Policy Institute (IEP) and include the following[2]:

Explicitly stated learning outcomes sought after and being analyzed in knowledge, skills and competences, per subject, sector and specialization.

Teaching material being prepared in line with the learning outcomes sought after for each subject. The teaching material of laboratory education courses is accompanied by an annex, describing the laboratory equipment required for their implementation

Instruction guidelines including the teaching techniques, the teaching methods and the appropriate supervisory means.

The curricula in question are prepared in accordance with the guidelines of the European Credit System for Vocational Education and Training - ECVET.

The curricula are aligned on job profiles, which are themselves defined and certified by the National Organization for the Certification of Qualifications & Vocational Guidance (EOPPEP).

Timetables and curricula are assessed, evaluated and, if deemed necessary, renewed. Since school year 2016/17, day and evening EPALs are running the new program of studies for grades A and B, as specified by law 4386/2016. The implementation of the new structure for grades C and D of EPAL took place during school years 2017/18 and 2018/19 respectively.

The curriculum for evening EPAL is specified by ministerial decision Φ2/107972/Δ4/28-6-2018.

[2] https://eacea.ec.europa.eu/national-policies/eurydice/content/teaching-and-learning-vocational-upper-secondary-education-22_en

### 2.1.2 Germany

The statements made in the article on teaching and learning in primary education apply for the curricula and education plans for the vocational full-time schools. The responsibility for developing the curricula essentially lies with the Ministries of Education and Cultural Affairs of the Länder.[3]

Apart from the subjects offered at a Gymnasium, Berufliche Gymnasien have career-oriented subjects like business, technology, professional computer science, biotechnology, nutrition, agronomy, as well as health and social studies, which can be chosen in addition to general subjects as the intensified course and are examined in the Abitur. In some Länder, there are a limited number of schools providing further vocational courses and specializations. The subjects relating to such vocational courses and specializations may also be elected as subject at an increased level of academic standards. n double qualification courses of education, additional occupation-specific subjects are taught, which as a rule are also examination subjects for the final vocational examination. The total volume of periods in these courses is at least 118 hours per week in the gymnasiale Oberstufe.

At Berufsfachschulen (full-time vocational schools) instruction is given in general/cross-occupational and subject- or occupation-specific areas. In courses providing basic vocational training, teaching in both areas of learning together shall comprise a minimum of 30 periods per week. In courses leading to a qualification in a recognized occupation, instruction shall comprise a minimum of 32 periods per week. They offer a very wide range of courses. There are Berufsfachschulen for business occupations, occupations involving foreign languages, trade and technical occupations, crafts industry occupations, home-economics-related and social-work-related occupations, artistic occupations, the health sector occupations regulated by federal law etc. The division into subjects, fields of learning and projects is regulated by the Länder.

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[3] https://eacea.ec.europa.eu/national-policies/eurydice/content/teaching-and-learning-vocational-upper-secondary-education-20_en

Instruction at the FACHOBERSCHULE is given in the subjects German, foreign language, mathematics, natural sciences, economics and society as well as in field-specific subjects. Practical training takes place in grade 11, i.e. in the first year of this school type, as a relevant controlled placement in companies or equivalent institutions. The language and communication area of learning accounts for at least 480 lessons (240 each for German and a foreign language), the mathematics and natural sciences area of learning at least 320 lessons (mathematics 240, natural sciences 80) and the business and society area of learning at least 120 lessons in grades 11 and 12. Subject theory accounts for at least 440 lessons and practical experience 800 lessons in the first year in the subject-related field. The differentiation field accounts for at least 320 lessons, which can be used by the Länder to increase the subjects and areas of learning shown in the number of hours and to create further subjects.

In the BERUFSOBERSCHULE that pupils attend for two years, instruction covers a total of at least 2400 periods (approx. 30 periods a week). Pupils are taught German, a compulsory foreign language, social studies (with history, politics, economics), mathematics as well as specialized subjects (Profilfächer) in accordance with the chosen specialization, and natural sciences including information technology. The German and foreign language group of subjects' accounts for at least 720 to 800 lessons, the social studies area of learning at least 160 to 320 lessons, mathematics at least 400 to 560 lessons and the advanced level courses and natural sciences including information technology at least 800 to 1,040 lessons. For the Allgemeine Hochschulreife, knowledge of a second foreign language must also be proven which accounts for at least an additional 320 lessons. The Standing Conference of the Ministers of Education and Cultural Affairs (Kultusministerkonferenz – KMK) passed common standards in June 1998 regarding the requirement level for instruction in German, a compulsory foreign language and mathematics.

## Vocational education and training in the dual system

The curriculum at the part-time Berufsschule, like that of full-time vocational schools, breaks down into cross-occupational and vocational classes. Twelve periods a week are spent in class, eight of which generally cover material specific to the occupation in question.

The Rahmenlehrpläne (framework curricula) for vocational instruction at Berufsschulen, on the other hand, unlike the curricula for the vocational full-time schools, are worked out by the Länder in the Standing Conference and resolved in a coordinated procedure with the agreement of the Federation on the basis of the Ausbildungsordnungen (training regulations) for on-the-job training. They are structured in accordance with areas of instruction so as to support the acquisition of vocational knowledge, skills and competences. Areas of instruction contain a complex statement of objectives oriented around typical vocational acts, as well as references and time guidelines as regards content, i.e. references to the time of communication in the course of education as well as to the number of lessons. The knowledge, skills and competences to be attained in on-the-job training for professional qualification is set out in the training regulations. These regulations are issued for all anerkannte Ausbildungsberufe (recognised occupations requiring formal training) by the competent federal ministry with the assistance of the social partners and in agreement with the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung – BMBF). The coordination procedure ensures that the training regulations take account of what has been learnt from experiences in the working world and in the vocational schools, as well as the results of employment and occupational research and the results of pilot schemes of the Federal Institute for Vocational Education and Training (Bundesinstitut für Berufsbildung – BIBB).

Vocational education and training is particularly affected by digitization and its repercussions for working, production and business processes. The teaching objective is increasingly the acquisition of competence in the use of digital tools and techniques. Apart from an understanding of digital processes, this also calls for an investigation of the direct effects of ever-increasing digitization, e.g. with respect to work organization and communicative aspects in, in some cases, globally networked production, supply and service chains.

### 2.1.3 Italy

**Curriculum**

In Italy the curricula of technical education are defined in National Guidelines for the first two-year period (Ministerial Directive n. 57/2010) and for the last three years of study (Ministerial Directive no. 4/2012).[4]

In these documents the specific knowledge and skills a student is expected to acquire, are defined, for each sector and branch of specialization. In addition to knowledge and skills necessary for building the competencies of students, the documents also include the student's educational, cultural and professional profile (PECUP), representing what a student should know and be able to do at the end of upper secondary education.

The curriculum also includes the teaching of 'Citizenship and Constitution' that schools must include it in their educational offer Plan (PTOF). 'Citizenship and Constitution' is not a separate subject and its contents are developed by individual schools through teaching projects included in the history and geography subject areas.

[4] https://eacea.ec.europa.eu/national-policies/eurydice/content/teaching-and-learning-vocational-upper-secondary-education-24_en

Through their educational offer plan (PTOF), schools can offer additional courses that must be consistent with the Educational, Cultural and Professional Profile (Pecup) of each technical and vocational study plan. Such courses are optional for students. Once a student has chosen an optional course, attendance is compulsory, and performance is assessed on a par with all compulsory subjects in the study plan.

Optional teachings are included in the student's digital curriculum, which collects also all data on the student's course of studies, the acquired competences, traineeship experiences and all extra-curricular activities (culture, arts, sport, voluntary service).

For technology courses at technical institutes, the annual teaching time also includes laboratory lessons taught by two teachers. The number of hours dedicated to laboratory lessons varies according to the study path.

Students attending the last three years of upper secondary education carry out traineeship activities called 'Paths for transversal skills and guidance' (Percorsi per le competenze trasversali e per l'orientamento). The aim is to deepen students' knowledge and competences in order to increase their job opportunities and to facilitate their choice of further study.

Traineeship activities engage students for at least 150 hours in technical institutes and for 210 hours in vocational institutes. Apart from the minimum number of hours, the organization and methods of carrying out these activities are the same as for general upper secondary education (licei).

**Subjects and number of hours**

The timetables for each branch of study in technical and vocational pathways show the compulsory number of teaching hours for each subject. The weekly timetable is calculated on an average of 33 weeks/year. Lessons last 60 minutes. Schools can decide to have shorter lessons, providing that the compulsory annual amount of teaching time for each subject is met.

Timetables for technical institutes are published in the Annexes B and C of the DPR no. 88/2010. Timetables for vocational institutes are published in the Annexes 3A to 3M of the Ministerial Decree n. 92/2018.

**Regional vocational education and training (IFP)**

Three-year and four-year IFP courses do not refer to national study programs that are specific to the different subjects.

The main IFP offer, which is an alternative to the school offer, is organized in two large areas: courses organized and run by training agencies accredited by the Regions and courses organized and run by upper secondary vocational institutes in partnership with training agencies. In the second case, schools follow the guidelines of their Regions for the organization of these courses.

Training providers prepare teaching projects based on the tasks and skills that are specific to the relevant professional profiles. Generally, teaching projects are modular and cover basic, transversal and technical or vocational skills.

The first two years of IFP courses correspond to the last two years of compulsory education. So, as in mainstream general and vocational upper secondary education, the curricula include key competencies for citizenship, which learner should have acquired by the end of compulsory education (please see above). In courses organized by vocational upper secondary institutes, schoolteachers usually teach general subjects and technical and vocational subjects are usually taught by trainers from partner training agencies. Conversely, trainers on courses organized by training agencies, including those specializing in key competences, are mainly recruited by the training agencies themselves, according to the criteria set for the accreditation of agencies.

In most Regions, guidance activities are incorporated and spread across the years of study, with a concentration of career guidance time in the third year. In other Regions, individual courses include an additional block of time for guidance and teachers decide how to tailor this time to the specific needs of individual learners.

Learning and training objectives refer to the technical and professional standards set for 26 three-year vocational qualifications and 29 four-year vocational qualifications. These standards are organized into work processes/activity and the acquisition of the competencies that are typical of the professional qualification. Competencies are described in terms of skills and knowledge.

The 26 three-year vocational courses lead to the qualification of 'worker+'. The 29 four-year courses lead to the qualification of 'technician+' (Agreement 1° August 2019).

The purpose of three and four-year vocational training courses (IFP) is to qualify 14/17-year old who wish to enter the labor market after a short period of training. However, these courses ensure that students acquire the key competencies and skills required on completion of compulsory education.

## 2.2 Background research on existing curricula

In the next sections short description of the most relevant Curricula from Greece, Germany and Italy are depicted.

### 2.2.1 Greece

In Greece there is one Curriculum specifically applicable for the Aluminium and Metal Construction technicians. A short description of this Curriculum is provided in Table 2. This Curriculum was developed in 2015 and there was one class of students attended this course, as organized by IME-GSEVEE. Approximately 250 persons were followed this course.

*Table 2. Curriculum for Metal-Aluminum Fabricator in Greece*

| Curriculum for Metal-Aluminum Fabricator (IME-GSEVEE) | |
|---|---|
| **Curriculum 's purpose and scope** | The purpose of the technical training program is to train and educate employees on modern issues that are directly linked to their daily work.<br>Improving the competitive position of both the trainees and the businesses in which they work, as well as enhancing the social as a whole by improving the quality of the products produced.<br>In addition, trainees will receive the impetus to change culture and to adopt a new way of organizing, working and implementing new practices and tools.<br>The scope is the creation of an appropriately trained - specialized human resource in the aluminum & metal construction sector, which will be the driving force of companies' development in the coming years in a highly competitive business environment that is formed daily.<br>Moreover, the acquisition of the necessary technical knowledge, skills and competences for the construction and installation of aluminum and iron products.<br>Trainee familiarization with new developments and changes in the aluminum and iron constructions (energy saving, product safety-CE marking etc.) |
| **Country in which the Curriculum is applicable** | Greece |
| **Type of Organization using the Curriculum** | Small companies |

| | |
|---|---|
| **Corresponding EQF level** | Not available |
| **Number of credit points (ECVET)** | Not available |
| **Statutory and regulatory requirements applicable** | Not available |
| **Prerequisites** | Middle level |
| **Learners characteristics** | Workers in the aluminum & metal construction sector |
| **Conditions for attendance (requirements, assiduity, assessment, certification, qualification, payment and financing conditions)** | Relevant experience in the sector |
| **Learning outcomes:**<br>• **Consistent with the Curriculum 's scope**<br>• **Described in terms of competence acquired by learners after curriculum's completion**<br>• **Including level indications for competences to be achieved**<br>• **Specific, measurable, achievable, relevant and time-bound (S.M.A.R.T.)** | • Improve existing skills and add green ones as well<br>• Adaptation to future needs |
| **Training mode and format (elearning, blended, f-to-f)** | Blended (70% theory & 30% practice) |
| **Pedagogical methods (including best practices, innovative teaching methods)** | • Demonstration<br>• Work groups<br>• Case studies (plenty of them) |

| | |
|---|---|
| **Learning activities:**<br>• **Suitable to proposed pedagogical methods**<br>• **Appropriate for ensuring achievement of learning outcomes**<br>• **S.M.A.R.T.** | • S.M.A.R.T. |
| **Assessment criteria & methods (prior, during & after training)** | Written exams after graduation. The trainee must achieve 60% of the multiple-choice questions to gain certification. |
| **Program content (including modules & sequences)** | Training program is divided structure in four basic vertebras:<br>• Preparation of Aluminum structures<br>• Manufacture of Aluminum Systems<br>• Installation of Aluminum structures<br>• Iron constructions |
| **Training schedule (Length)** | 50 hours / 2 Months |
| **Language** | Greek |
| **Educational resources (including infrastructure, hardware, software, documentation)** | Small laboratory space where samples of materials and products will be available to explain technical details. |

### 2.2.2 Germany

In Germany there is no Curriculum specially for the Aluminium and Metal Construction Technician. The three most relevant Curricula found in the research that took place are presented below in Table 3 for the skilled metal worker specialized in structural engineering, in Table 4 for the state-recognized Construction mechanic and in Table 5 for the Metalworker specialized in structural engineering.

*Table 3. Curriculum Skilled metal worker specialized in structural engineering*

| Curriculum Skilled metal worker specialized in structural engineering | |
|---|---|
| **Curriculum 's purpose and scope** | Skilled metal workers specializing in structural engineering predominantly work for companies which manufacture metal components or constructions |
| **Country in which the Curriculum is applicable** | Germany |
| **Type of Organization using the Curriculum** | Partners in vocational education: Vocational schools, companies practicing apprenticeships |
| **Corresponding EQF level** | EQF 3 |
| **Number of credit points (ECVET)** | Not available |
| **Statutory and regulatory requirements applicable** | • National Vocational training act<br>• Ordinance on Initial Vocational Education and Training in the Occupation of Skilled metal worker specializing in structural engineering of 04/02/2013 (Federal Law Gazette, Part I, p 628) Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany, KMK, of 22.03.2013) |
| **Prerequisites** | Nine years of general education |
| **Characteristics of the learners** | Workers in the aluminum and metal construction sector |

| | |
|---|---|
| **Conditions for attendance (requirements, assiduity, assessment, certification, qualification, payment and financing conditions)** | Final examination administered by the competent body:<br>1. after completion of dual training in a company and at part-time vocational school (normal procedure)<br>2. after retraining in a recognized training occupation<br>3. as an external examination for working people without formal vocational qualifications or persons who have been trained at full-time vocational schools or other vocational training institutions |
| **Learning outcomes:**<br>• **Consistent with the Curriculum 's scope**<br>• **Described in terms of competence acquired by learners by completing the curriculum**<br>• **Including level indications for the competences to be achieved**<br>• **Specific, measurable, achievable, relevant & time-bound (S.M.A.R.T.)** | • Produce, assemble & dismantle metal constructions<br>• Set up sheet metal, pipes and sections in accordance with drawings and templates<br>• Join components using thermal &mechanical procedures<br>• Thermal pre- and post-treatment of metal workpieces<br>• Visual inspection of welded and soldered connections<br>• Prepare and protect surfaces<br>• Manual, machine and thermal reforming and separation of sheet metals, pipes or sections<br>• Select tools & machines in accordance with materials<br>• Carry out quality assurance measures<br>• Cooperate with upstream and downstream divisions |
| **Training mode and format (e-learning, blended, f-to-f)** | **Training in the "dual system":** Teaching of the knowledge, skills & competences needed for an occupation is based on the typical requirements of work and business processes, preparing trainees for a specific job. **Training is provided in companies and part-timely at vocational schools**: In company, trainees acquire practical skills in a real working environment. One or two days per week, trainees attend part-timely a vocational school, where they gain knowledge related to their training occupation. |

| | |
|---|---|
| **Pedagogical methods (including best practices, innovative teaching methods)** | • Demonstration<br>• Teaching-in-4-steps<br>• Work groups<br>• Plenty of case studies |
| **Learning activities are:**<br>• **Suitable to the proposed pedagogical methods Appropriate for ensuring achievement of the learning outcomes**<br>• **S.M.A.R.T.** | • Working in company in real-time-projects<br>• Step by step taking responsibility for results |
| **Assessment criteria & methods (prior, during & after training)** | • Practical and written exams<br>• Production of a test specimen |
| **Program content (including modules & sequences)** | The program's structure is divided in four basic vertebras:<br>• Preparation of Aluminum structures<br>• Manufacture of Aluminum Systems<br>• Installation of Aluminum structures<br>• Iron constructions |
| **Training schedule (Length)** | 2 years |
| **Language** | German |
| **Educational resources (including infrastructure, hardware, software, documentation)** | Workplace in companies, workshops in companies, Classroom, Laboratories for reality simulation, fulfilling customers' orders in real time |

*Table 4. Curriculum for state-recognized occupation Construction mechanic*

| Curriculum State-recognized occupation Construction mechanic | |
|---|---|
| **Curriculum 's purpose and scope** | Construction mechanics work in the fields of equipment technology, thin sheet construction, shipbuilding, welding technology and in steel and metal construction |
| **Country in which the Curriculum is applicable** | Germany |
| **Type of Organization using the Curriculum** | Partners in vocational education: Vocational schools, companies practicing apprenticeships |
| **Corresponding EQF level** | EQF 4 |
| **Number of credit points (ECVET)** | Not available |
| **Statutory and regulatory requirements applicable** | • National Vocational training act<br>• Ordinance on Initial Vocational Education and Training in the Occupation of Construction mechanic of 06/28/2018 (Federal Law Gazette, Part I, p 975) Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK) of 25.03.2004 i. d. F. vom 23.02.2018 |
| **Prerequisites** | Nine years of general education |
| **Characteristics of the learners** | Workers in the aluminum and metal construction sector |
| **Conditions for attendance (requirements,** | Final examination administered by the competent body:<br>1. after completion of dual training in a company and at part- |

| | |
|---|---|
| **assiduity, assessment, certification, qualification, payment and financing conditions)** | time vocational school (normal procedure)<br>2. after retraining in a recognized training occupation<br>3. as an external examination for working people without formal vocational qualifications or persons who have been trained at full-time vocational schools or other vocational training institutions |
| **Learning outcomes:**<br>• **Consistent with the Curriculum 's scope**<br>• **Described in terms of competence acquired by learners by completing the curriculum**<br>• **Including level indications for the competences to be achieved**<br>• **Specific, measurable, achievable, relevant and time-bound (S.M.A.R.T.)** | • Plan tasks based on technical documentation<br>• Manufacture parts, assemblies, and metal constructions from sheets, tubes or profiles by means of manual and mechanical production methods<br>• Carry out welding processes, taking work safety and environmental protection into account<br>• Install - uninstall metal constructions and use various jointing techniques<br>• Create auxiliary structures, devices, templates & flat patterns<br>• Select testing devices and methods and apply the company's quality assurance system<br>• Carry out required maintenance work on systems, machines and tools<br>• Coordinate work with upstream & downstream departments<br>• Work on complex projects as part of team<br>• Act autonomously in carrying out activities, taking relevant regulations and safety provisions into account<br>• Use IT systems, including in digitalized processes<br>• Apply regulations relating to data protection & information security |

| | |
|---|---|
| **Training mode and format (e-learning, blended, f-to-f)** | **Training in the "dual system":** Teaching of the knowledge, skills & competences needed for an occupation is based on the typical requirements of work and business processes, preparing trainees for a specific job. **Training is provided in companies and part-timely at vocational schools**: In company, trainees acquire practical skills in a real working environment. One or two days per week, trainees attend part-timely a vocational school, where they gain knowledge related to their training occupation. |
| **Pedagogical methods (including best practices, innovative teaching methods)** | • Demonstration<br>• Teaching-in-4-steps<br>• Work groups<br>• Case studies (plenty of them) |
| **Learning activities are:**<br>• **Suitable to the proposed pedagogical methods Appropriate for ensuring achievement of the learning outcomes**<br>• **S.M.A.R.T.** | • Working in company in real-time-customer's order<br>• Step by step taking responsibility for results |
| **Assessment criteria & methods (prior, during & after training)** | • Practical and written exams<br>• Production of a test specimen |

| | |
|---|---|
| **Program content (including modules & sequences)** | 1. Vocational Training, Employment law, collective bargaining law<br>2. Structure and organization of the concerned company<br>3. Safety and health regulations at work<br>4. Environmental protection<br>5. Operational and technical communication<br>6. Planning and organization of work, assessment of working results<br>7. Discriminate, allocate and use of raw and auxiliary material<br>8. Construction of components and assemblies<br>9. Maintenance of resources<br>10. Control engineering<br>11. Prepare, secure and transport<br>12. Customer orientation<br>13. Handle customers' orders<br>14. Produce and install components and assemblies<br>15. Maintenance, assess, define and repair bugs and incidents<br>16. Check components and installations<br>17. Business processes and quality assurance systems in the field. |
| **Training schedule (Length)** | 3,5 years |
| **Language** | German |
| **Educational resources (including infrastructure, hardware, software, documentation)** | Workplace in companies, workshops in companies, Classroom, Laboratories for reality simulation, fulfilling customers' orders in real time |

*Table 5. Curriculum for Metalworker specialized in structural engineering*

| Curriculum for Metalworker specialized in structural engineering | |
|---|---|
| **Curriculum 's purpose and scope** | Metalworkers specializing in structural engineering find employment opportunities in the construction technology sector, particularly in metal working companies specializing in the manufacture, assembly and repair of steel and light-metal constructions. These include, for example, companies engaged in the manufacture of metal doors, locking and security systems, metal roofing and metal facades |
| **Country in which the Curriculum is applicable** | Germany |
| **Type of Organization using the Curriculum** | Partners in vocational education: Vocational schools, companies practicing apprenticeships |
| **Corresponding EQF level** | EQF 4 |
| **Number of credit points (ECVET)** | Not available |
| **Statutory and regulatory requirements applicable** | • National Vocational training act<br>• Ordinance on Initial Vocational Education and Training in the Occupation of Metalworker – specialized in structural engineering of 07/25/2008 (Federal Law Gazette, Part I, p 1468) Resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany, KMK, of 14.05.2002), (Federal Gazette, No 192a of 15.10.2002) |
| **Prerequisites** | Nine years of general education |
| **Characteristics of the learners** | Workers in the aluminum and metal construction sector |
| **Conditions for attendance (requirements, assiduity, assessment, certification, qualification, payment and financing conditions)** | Final examination administered by the competent body:<br>1. after completion of dual training in a company and part-timely at a vocational school (normal procedure)<br>2. after retraining in a recognized training occupation<br>3. as an external examination for working people without formal vocational qualifications or persons trained full-time at vocational schools or other vocational training institutions |

| | |
|---|---|
| **Learning outcomes:**<br>• **Consistent with the Curriculum 's scope**<br>• **Described in terms of competence acquired by learners by completing the curriculum**<br>• **Including level indications for the competences to be achieved**<br>• **Specific, measurable, achievable, relevant and time-bound (S.M.A.R.T.)** | • Carry out work assignments autonomously & work as part of a team according to relevant regulations & safety provisions, on the basis of technical documentation & work orders<br>• Procure information<br>• Plan coordinate and agree work with line managers, with colleagues and with other work divisions using German and English language technical terminology<br>• Document work and initiate quality assurances measures and measures for health and safety at work and environmental protection<br>• Plan & control work processes, check protocol & evaluate work results<br>• Apply standards and guidelines to ensure product quality and continuous improvement of work processes in the company<br>• Measure and test mechanical and physical values<br>• Make separable and inseparable connections<br>• Manufacture workpieces and components using various manual and machine production processes<br>• Treat and protect surfaces<br>• Secure loads, transport components & sub-assemblies & use lifting gear<br>• Dismantle & assemble components and sub-assemblies; check, monitor & remedy errors & malfunctions; carry out routine repairs to control systems, components & document results<br>• Set up workplaces at building sites<br>• Produce components & construction elements, assemble & dismantle metal and steel constructions<br>• Maintain metal and steel constructions |
| **Training mode and format (e-learning, blended, f-to-f)** | **Training in the "dual system":** Teaching of the knowledge, skills & competences needed for an occupation is based on the typical requirements of work and business processes, preparing trainees for a specific job. **Training is provided in companies and part-timely at vocational schools**: In company, trainees acquire practical skills in a real working environment. One or two days per week, trainees attend part-timely a vocational school, where they gain knowledge related to their training occupation. |

| | |
|---|---|
| **Pedagogical methods (including best practices, innovative teaching methods)**<br>**Learning activities are:**<br>• **Suitable to the proposed pedagogical methods Appropriate for ensuring achievement of the learning outcomes**<br>• **S.M.A.R.T.** | • Demonstration<br>• Teaching-in-4-steps<br>• Work groups<br>• Case studies (plenty of them)<br><br>• Working in company in real-time-customer's order<br>• Step by step taking responsibility for results |
| **Assessment criteria & methods (prior, during & after training)** | • Practical and written exams<br>• Production of a test specimen |
| **Program content (including modules & sequences)** | 1. Vocational Training, Employment law, collective bargaining law<br>2. Structure and organisation of the concerned company<br>3. Safety and health regulations at work<br>4. Environmental protection<br>5. Operational, technical and customer-oriented communication<br>6. Working processes planning & organization, controlling and assessment of working results<br>7. Quality management<br>8. Checking and measuring<br>9. Jointing<br>10. Manual chipping and forming<br>11. Mechanical handling<br>12. Maintenance of resources<br>13. Welding, thermal separating<br>14. Manual and mechanical forming of sheets and profiles<br>15. Electrical engineering<br>16. Handling and protection of surfaces<br>17. Transport of components and assemblies<br>18. Disassembling and mounting of components and devices<br>19. Installing and checking of hydraulic, pneumatic and electrotechnical assemblies<br>20. Installation of workplace on site<br>21. Assembling of metal, steel and aluminium constructions<br>22. Production and fixing of components and assemblies on buildings<br>23. Mounting and disassembling of Metal structures<br>24. Assemble, check and adjust systems<br>25. Maintenance of metal structures |

| | |
|---|---|
| **Training schedule (Length)** | 3,5 years |
| **Language** | German |
| **Educational resources (including infrastructure, hardware, software, documentation)** | Workplace in companies, workshops in companies, Classroom, Laboratories for reality simulation, fulfilling customers' orders in real time |

### 2.2.3 Curriculum developed in previous ERASMUS Project -INNOAPRENET

One relevant Curriculum for the Aluminium and Metal Construction Technician was developed under the ERASMUS Project INNO-APPRE-NET (2014-1-EL01-KA202-001564). This Curriculum aims at EQF Level 4, contrary to the EQF Level 5 that is the task for the METVET Project. Essential elements from this Curriculum were taken into account in order to develop the Curriculum within the METVET Project. A short description of this Curriculum is provided in Table 6 below.

*Table 6. Curriculum for Development of Innovative Apprenticeship Network of Vocational Schools and Very Small Enterprises in the Metal Construction Sector*

| Curriculum Development of Innovative Apprenticeship Network of Vocational Schools and Very Small Enterprises in the Metal Construction Sector | |
|---|---|
| **Curriculum 's purpose and scope** | Serve SME stakeholders, social partners and government institutions representatives, in finding first-hand information on how to introduce and review a curriculum – apprenticeship, appropriate for the labor market and young entrepreneurs, seeking for a positive and financially secure career future. |
| **Country in which the Curriculum is applicable** | Greece/Germany/Italy |
| **Type of Organization using the Curriculum** | Vocational Schools and Very Small Enterprises in the Metal Construction Sector |
| **Corresponding EQF level** | EQF 4 |
| **Number of credit points (ECVET)** | Not available |
| **Statutory and regulatory requirements applicable** | Not available |
| **Prerequisites** | Middle level |
| **Characteristics of the learners** | Workers in the aluminum and metal construction sector |
| **Conditions for attendance (requirements, assiduity, assessment, certification, qualification, payment and financing conditions)** | |

| | |
|---|---|
| **Learning outcomes:**<br>• **Consistent with the Curriculum 's scope**<br>• **Described in terms of competence acquired by learners by completing the curriculum**<br>• **Including level indications for the competences to be achieved**<br>• **Specific, measurable, achievable, relevant & time-bound (S.M.A.R.T.)** | • Improve existing skills and add green ones as well.<br>• Adaptation to future needs |
| **Training mode and format (e-learning, blended, f-to-f)** | Blended (77% theory & 23% practice) |
| **Pedagogical methods (including best practices, innovative teaching methods)** | • Demonstration<br>• Work groups<br>• Plenty of case studies |
| **Learning activities are:**<br>• **Suitable to the proposed pedagogical methods Appropriate for ensuring achievement of the learning outcomes**<br>• **S.M.A.R.T.** | • S.M.A.R.T. |
| **Assessment criteria & methods (prior, during & after training)** | Written exams after graduation |

| | |
|---|---|
| **Program content (including modules & sequences)** | • Align a workpiece, clamp and separate manually or mechanically or form.<br>• Follow the regulations and safety rules when working with electrical installations, equipment and resources.<br>• Check and prepare, assemble and disassemble components, assemblies considering their function according to technical documents.<br>• Produce detachable connections (in particular by screw) or nondetachable connections (in particular by adherence, rivet or welding) in consideration of the assembly directives.<br>• Select machining processes, tools and machines in consideration of the materials.<br>• Prepare sheets of metal, pipes or sections according to drawings and templates and form and separate manually, mechanically or thermally.<br>• Fit components and assemblies considering the dimensional tolerances as well as to align functionally by measuring, gauging and checking visually to ensure the position<br>• Apply control technology and to monitor regulation and control components.<br>• Join and fix metal constructions, components and assemblies according to technical documents, in particular by fusion welding processes, screw, soldering and rivet.<br>• Prepare surfaces for the applying of preservation, corrosion protection agent, coating and insulation means and apply them. |
| **Training schedule (Length)** | 2 Years – 600 Hours |
| **Language** | English |
| **Educational resources (including infrastructure, hardware, software, documentation)** | Small laboratory space where samples of materials and products will be available to explain technical details |

## 2.3 Feedback analyses – skills catalogue update

The results of the researches will be analyzed, evaluated by the WP leader and the expert team of the Project, taking into account Deliverable 2.5.1 - List of Joint Skills for the final skills definition, updating if needed the skills catalogue to be used for the creation of the new curriculum, as much as the Professional Profile (Deliverable 3.4).

## 2.4 Determining curriculum focal points & relative weight of curricular elements

The skills catalogue will be transformed into a set of focal points for the curriculum. This is a crucial step to ensure that the curriculum reflects the educational training needs of Aluminium & Metal Construction technicians educational needs. Once the general focal points are in place, their relative weight in the curriculum will also have to be decided upon. These curricular elements will be modularized to allow maximum flexibility in delivery of the course content.

All involved partners will review the skills catalogue and weigh the importance of each skill to be acquired, according to the following criteria: ESSENTIAL, IMPORTANT, BASIC. According to this weighing, they will then define the focal points of the skills catalogue. They will then order the learning outcomes (Skills) in different categories.

## 2.5 Course module design

With the weighting of the curricular elements in place, the individual units can then be designed. Partners will design the structure of the curriculum, including different teaching units and learning outcomes. For each learning outcome, they will then design content subsets, each with its own set of learning objectives. For each subset, the number of learning hours should be defined, as well as the share of work-based learning.

ECVET points are a numerical representation of the overall weight of learning outcomes in a qualification and of the relative weight of units in relation to the qualification. ECVET points are allocated to:

- qualification, according to the European Union, ECVET points are allocated to a qualification
- learning unit, according to two main criteria:
  - TIME required to acquire the competences included in the Unit.
  - RELEVANCE of the competences included in the Unit.

# JOINT CURRICULUM

## Aluminium & Metal Constructions Technicians

# 3 WP 4 | JOINT CURRICULUM

The central purpose of this Deliverable METVET D4.1 is to provide joint Curriculum for **Aluminium & metal constructions technicians** at EQF Level 5.

## 3.1 Introduction

A transnational partnership of VET-providers and stakeholders is running a European project in the framework of ERASMUS+, called:

"METVET – Creating a joint higher VET course in the Metal Construction Sector"

Partner's from Belgium, Germany, Greece and Italy pursue the goal to upgrade qualifications of metal workers in small and medium sized enterprises (SME) to the capacity to help to achieve the European Climate goals. "Metal Construction Sector" in this context means companies, which manufacture, assembly and repair Aluminium and other metal-constructions. It includes manufacturing and applying doors, windows, locking and security systems, metal roofing and metal facades etc. as part of the construction sector.

Within this Deliverable the curriculum for higher VET-course is hereafter presented, aiming to upgrade skilled experienced workers from European Qualifications framework (EQF) level 4 to EQF level 5. (EQF-levels indicate the degree of autonomy, responsibility, personal and social competence an employee is able to realize by executing his tasks at work). A qualification EQF level 4 implies, that this person is a skilled worker with the capacity to act autonomously in a range of situations and tasks, supervising persons in their work. EQF Level 5 implies deepened knowledge, skills and competences combined with more autonomy and responsibility in one or more fields on his workplace.

## 3.2 General specifications of vocational training program

| Aim of Vocational Training Program: |
| --- |
| The aim of the training program is to upgrade the knowledge, skills and competencies of the aluminium and metal workers from EQF level 4 to 5.<br><br>In particular, knowledge will be upgraded to horizontals, green and vertical skills and given the impetus to change culture and assimilate a new way of organizing, working and implementing new practices and tools, which are essential for both environmental protection and adaptation of Enterprises in the new conditions of international competition. |
| **Objectives of the program:** |
| **Objective 1**<br><br>The creation of an appropriately trained - specialized human resource in the aluminium & metal construction sector, which will be the driving force of business development in the coming years in a highly competitive business environment that is transformed rapidly.<br><br>**Objective 2**<br><br>The program aims to provide all trainees with the appropriate knowledges, skills and competences, directly linked with the needs of the market, while at the same time reinforcing their mobility in the EU labor market.<br><br>**Objective 3**<br><br>The acquisition of the necessary technical knowledge, skills and competences for the construction, installation and maintenance of technically sound and environmentally friendly, green aluminium and metal constructions.<br><br>**Objective 4**<br><br>Employee familiarization with new developments and changes in the aluminium and metal constructions sector such as energy saving concepts, product safety-CE marking etc, towards meeting the EU goals for climate changes and energy savings. |

| Program ENTRANCE Requirements (at least EQF 4) |
| --- |
| The student shall have acquired EQF 4 level on a sector related to building constructions. |
| **Trainer Profiles / Criteria** |
| • Certified Educational Proficiency Generally (depending on country requirements)<br>• Minimum 5 years of professional experience in the specialty or related fields<br>• Minimum 100 hours teaching experience in specialty or related specialties |
| **Training Materials and Minimum Equipment Requirements** |
| • Computer & Video Projector<br>• Board and markers<br>• Flip chart<br>• Filling materials, aluminum profiles, metal profiles, panels, glazing<br>• Consumables: welding electrodes, corner's glues, silicone cleaners, sealants etc.<br>• Hardware Accessories: hinges, rollers, brushes, gasket, mechanisms, handles etc.<br>• Profile Sections: Small sections of different systems and typologies.<br>• Machines: Crimping machines, saw, welding machines, milling machine, compressor.<br>• Prototypes- Mockups: opening sliding & casements systems, curtain walling etc.<br>• Other Tools: Assembly bench, Screwdrivers, Drills etc. |
| **Educational environment - Arrangement of the theoretical technical training program** |
| The desks shall have a Π shape in order to facilitate participation and learning through case studies. It should be possible for both instructors and trainees to move around the space during demonstration of skills and group work.<br>There will be space with samples of materials, parts / profiles and sections to explain technical details. |

### 3.3 Program Structure in Learning Modules (LM)

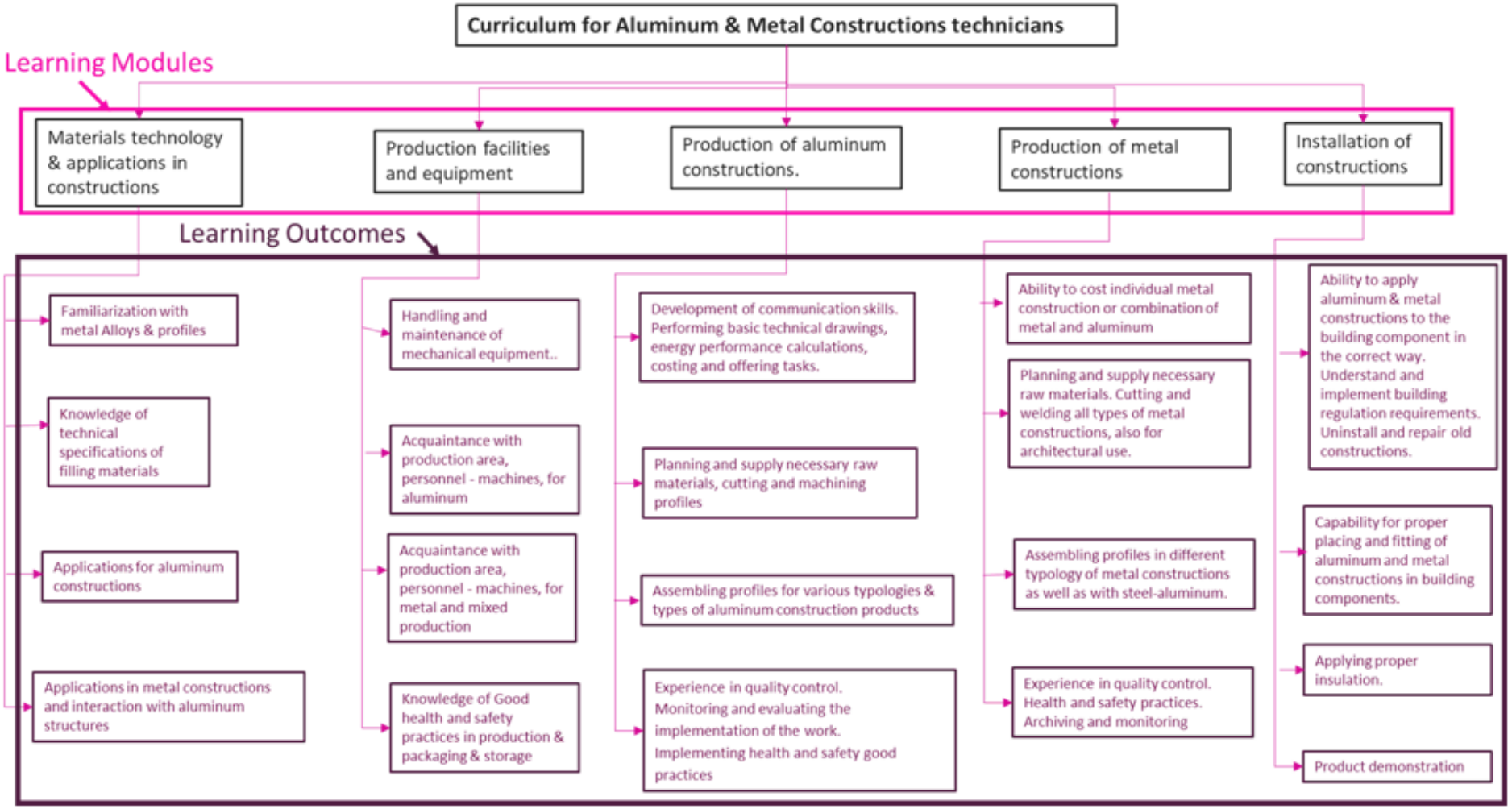
| Learning Modules (LM) | |
|---|---|
| Program Title: «Curriculum for Aluminum & Metal Constructions technicians» | LM 1 Materials technology & applications in constructions |
| | LM 2 Production facilities and equipment |
| | LM 3 Production of aluminum constructions |
| | LM 4 Production of metal constructions |
| | LM 5 Installation of constructions |

| Duration in Hours per Learning Module | | | |
|---|---|---|---|
| Learning Module | Theory | Practice | Total Hours Training |
| LM 1 Materials technology & applications in constructions | 40 | | 40 |
| LM 2 Production facilities and equipment | 37 | 100 | 137 |
| LM 3 Production of aluminum constructions | 75 | 380 | 455 |
| LM 4 Production of metal constructions | 29 | 240 | 269 |
| LM 5 Installation of constructions | 22 | 92 | 114 |
| TOTALS | 203 | 812 | 1015 |

| Overview of Knowledges, Skills and Competencies expected to be acquired after completion of the program | | | |
|---|---|---|---|
| **Learning Module** | **Knowledges** | **Skills** | **Competencies** |
| **Materials technology & applications in constructions** | Knowledge of Alloys & profiles, mechanical & technical properties, applications in constructions. | • Select appropriate materials<br>• Apply proper alloy and profile for construction requirements.<br>• Select the best combination of materials & construction type according to building specifications and energy saving and efficiency | Selecting and applying the right materials, profiles, accessories per typologies per case per client/project. |
| **Production facilities and equipment** | Knowledge of new equipment technologies and modern production lines | Use all types of equipment and manage personnel based on EU health and safety legislation | Organizing, controlling and directing personnel and equipment with minimal dead time |
| **Production of aluminum constructions** | Knowledge of materials, communication, production for architectural management and recycling | • Apply production process - cutting, machining, assembling, controlling & packing<br>• Renovate/upgrade old constructions<br>• Manage recyclable materials<br>• Communicate autonomously with interested parties | • Adapt the administrative and production process to the available resources<br>• Identify customer needs and flexibility in solving problems arising from customers, employees, products and production processes |

| | | | |
|---|---|---|---|
| **Production of metal constructions** | • Knowledge of materials, communication, production management and recycling.<br>• Product production knowledge for architectural use or mixed with aluminum and recycling | • Apply the production process - cutting, machining, assembling, controlling & packing. Proper techniques for constructions intended for architectural use.<br>• Renovation/upgrade old constructions.<br>• Manage the recyclable materials correctly<br>• Communicate autonomously with all interested parties | • Adapt the administrative and production process to the available resources.<br>• Ability to choose the right combination of materials, metal, aluminum for joint or separate use depending on the construction type |
| Installation of constructions | • Knowledge of leveling, fastening, insulating and demonstration of products.<br>• Knowledge of good uninstallation and maintenance practices | • Apply techniques and materials for adequate waterproofing and insulation, compatible to the adjacent structural element, in order to minimize thermal loses/bridges.<br>• Communicate autonomously with all interested parties | Select and apply methods for installation pertinent to each building element, geographical area, type of residence etc. |

## Schematic presentation of Learning Outcomes (LO)

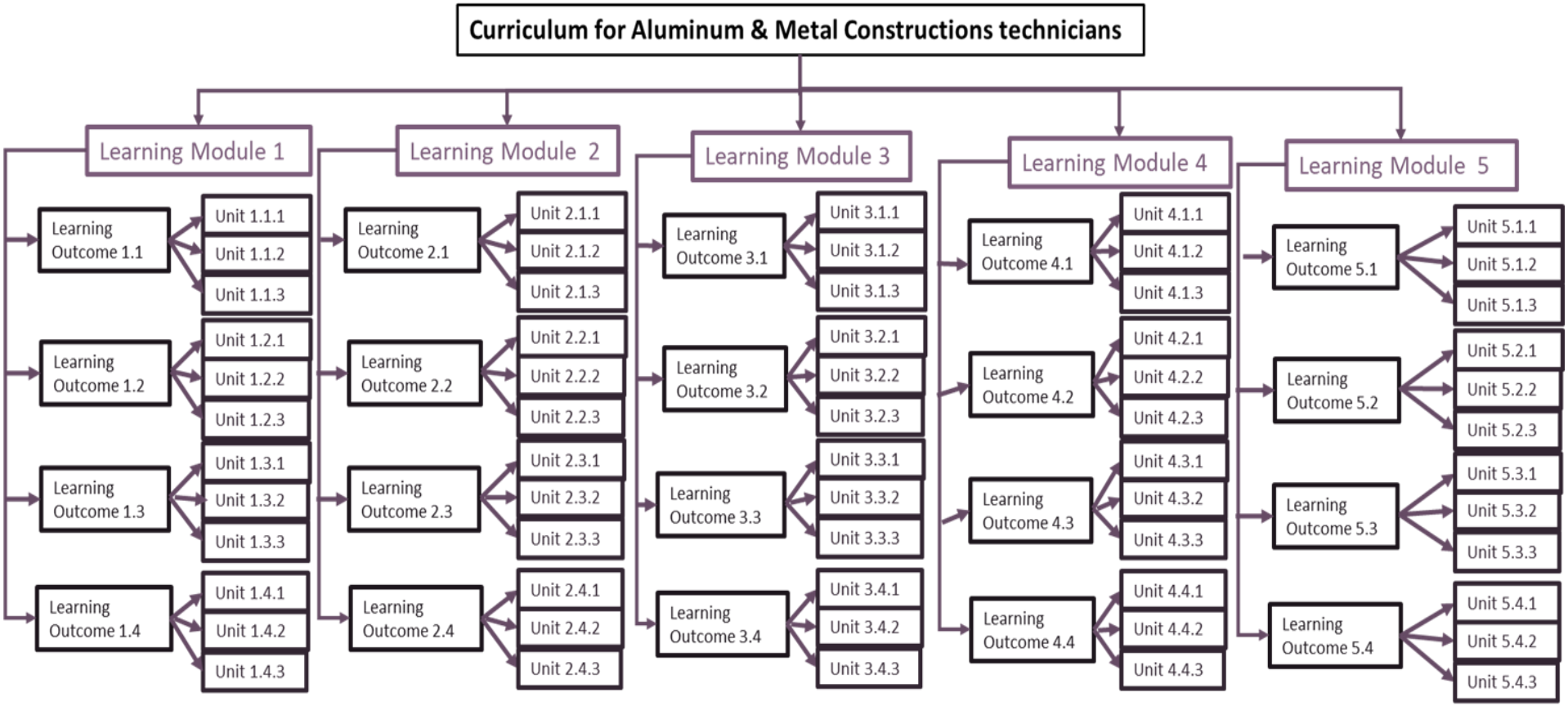


1. **LM 1 Materials technology & applications in constructions**
   - **1.1. LO 1.1 Familiarization with metal Alloys & profiles**
   - **1.2. LO 1.2 Knowledge of technical specifications of filling materials**
   - **1.3. LO 1.3 Applications for aluminum constructions**
   - **1.4. LO 1.4 Applications in metal constructions and interaction with aluminum structures**
2. **LM2 Production facilities and equipment**
   - **2.1. LO 2.1 Handling and maintenance of mechanical equipment.**
   - **2.2. LO 2.2 Acquaintance with production area, personnel - machines, for aluminum**
   - **2.3. LO 2.3 Acquaintance with production area, personnel - machines, for metal and mixed production**
   - **2.4. LO 2.4 Knowledge of Good health and safety practices in production & packaging & storage**
3. **LM3 Production of aluminum constructions**
   - **3.1. LO 3.1 Development of communication skills. Performing basic technical drawings, energy performance calculations, costing and offering tasks**
   - **3.2. LO 3.2 Planning and supply necessary raw materials, cutting and machining profiles**
   - **3.3. LO 3.3 Assembling profiles for various typologies & types of aluminum construction products**
   - **3.4. LO 3.4 Experience in quality control. Monitoring and evaluating the implementation of the work. Implementing health and safety good practices**
4. **LM4 Production of metal constructions**
   - **4.1. LO 4.1 Ability to cost individual metal construction or combination of metal and aluminum**
   - **4.2. LO 4.2 Planning and supply necessary raw materials. Cutting and welding all types of metal constructions, also for architectural use**
   - **4.3. LO 4.3 Assembling profiles in different typology of metal constructions as well as with steel-aluminum**
   - **4.4. LO 4.4 Experience in quality control. Health and safety practices. Archiving and monitoring**
5. **LM5 Installation of constructions**
   - **5.1. LO 5.1 Apply building components properly. Understand and implement building regulation requirements. Uninstall and repair old constructions**
   - **5.2. LO 5.2 Capability for proper placing and fitting of aluminum and metal constructions in building components**
   - **5.3. LO 5.3 Applying proper insulation**
   - **5.4. LO 5.4 Product demonstration**

| Learning Outcomes (LO) per Learning Module (LM) | | | | |
|---|---|---|---|---|
| **Learning Modules** | **LO 1** | **LO 2** | **LO 3** | **LO 4** |
| **Materials technology & applications in constructions** | LO 1.1 Familiarization with metal Alloys & profiles | LO 1.2 Knowledge of technical specifications of filling materials | LO 1.3 Applications for aluminum constructions | LO 1.4 Applications in metal constructions and interaction with aluminum structures |
| **Production facilities and equipment** | LO 2.1 Handling and maintenance of mechanical equipment. | LO 2.2 Acquaintance with production area, personnel - machines, for aluminum | LO 2.3 Acquaintance with production area, personnel - machines, for metal and mixed production | LO 2.4 Knowledge of Good health and safety practices in production & packaging & storage |
| **Production of aluminum constructions** | LO 3.1 Development of communication skills. Performing basic technical drawings, energy performance calculations, costing and offering tasks. | LO 3.2 Planning and supply necessary raw materials, cutting and machining profiles | LO 3.3 Assembling profiles for various typologies & types of aluminum construction products | LO 3.4 Experience in quality control. Monitoring and evaluating the implementation of the work. Implementing health and safety good practices |

| | | | | | |
|---|---|---|---|---|---|
| | **Production of metal constructions** | LO 4.1 Ability to cost individual metal construction or combination of metal and aluminum | LO 4.2 Planning and supply necessary raw materials. Cutting and welding all types of metal constructions, also for architectural use | LO 4.3 Assembling profiles in different typology of metal constructions as well as with steel-aluminum | LO 4.4 Experience in quality control. Health and safety practices. Archiving and monitoring |
| | **Installation of constructions** | LO 5.1 Apply building components properly. Understand and implement building regulation requirements. Uninstall and repair old constructions | LO 5.2 Capability for proper placing and fitting of aluminum and metal constructions in building components | LO 5.3 Applying proper insulation | LO 5.4 Product demonstratio |

## Schematic depiction of the curriculum structure – Units



| Analysis - Description of Learning Outcomes (LO) by LM 1 | | | | |
|---|---|---|---|---|
| | **Learning Outcomes** | **Theory** | **Practice** | **Total Hours Training** |
| LM 1 Materials technology & applications in constructions | **LO 1.1 Familiarization with metal Alloys & profiles** | **10** | | **10** |
| | **LO 1.2 Knowledge of technical specifications of filling materials** | **10** | | **10** |
| | **LO 1.3 Applications for aluminum constructions** | **10** | | **10** |
| | **LO 1.4 Applications in metal constructions and interaction with aluminum structures** | **10** | | **10** |
| | **Total Learning Module Hours** | **40** | | **40** |

| Analysis - Description of Learning Outcomes (LO) by LM 2 | | | | |
|---|---|---|---|---|
| | **Learning Outcomes** | **Theory** | **Practice** | **Total Hours Training** |
| **LM 2 Production facilities and equipment** | **LO 2.1 Handling and maintenance of mechanical equipment.** | **11** | **30** | **41** |
| | **LO 2.2 Acquaintance with production area, personnel - machines, for aluminum** | **15** | **35** | **50** |
| | **LO 2.3 Acquaintance with production area, personnel - machines, for metal and mixed production** | **7** | **25** | **32** |
| | **LO 2.4 Knowledge of Good health and safety practices in production & packaging & storage** | **4** | **10** | **14** |
| | **Total Learning Module Hours** | **37** | **100** | **137** |

| Analysis - Description of Learning Outcomes (LO) by LM 3 | | | | |
|---|---|---|---|---|
| | **Learning Outcomes** | **Theory** | **Practice** | **Total Hours Training** |
| **LM 3 Production of aluminum constructions** | **LO 3.1 Development of communication skills. Performing basic technical drawings, energy performance calculations, costing and offering tasks.** | **14** | **40** | **53** |
| | **LO 3.2 Planning and supply necessary raw materials, cutting and machining profiles.** | **28** | **160** | **188** |
| | **LO 3.3 Assembling profiles for various typologies & types of aluminum construction products.** | **28** | **160** | **188** |
| | **LO 3.4 Experience in quality control. Monitoring and evaluating the implementation of the work. Implementing health and safety good practices** | **5** | **20** | **25** |
| | **Total Learning Module Hours** | **75** | **380** | **455** |

| Analysis - Description of Learning Outcomes (LO) by LM 4 | | | | |
|---|---|---|---|---|
| | **Learning Outcomes** | **Theory** | **Practice** | **Total Hours Training** |
| **LM 4 Production of metal constructions** | **LO 4.1 Ability to cost individual metal construction or combination of metal and aluminum** | **7** | **33** | **40** |
| | **LO 4.2 Planning and supply necessary raw materials. Cutting and welding all types of metal constructions, also for architectural use.** | **10** | **100** | **110** |
| | **LO 4.3 Assembling profiles in different typology of metal constructions as well as with steel-aluminum.** | **10** | **100** | **110** |
| | **LO 4.4 Experience in quality control. Health and safety practices. Archiving and monitoring** | **2** | **7** | **9** |
| | **Total Learning Module Hours** | **29** | **240** | **269** |

| Analysis - Description of Learning Outcomes (LO) by LM 5 | | | | |
|---|---|---|---|---|
| | **Learning Outcomes** | **Theory** | **Practice** | **Total Hours Training** |
| **LM 5 Installation of constructions** | **LO 5.1 Ability to apply aluminum & metal constructions to the building component in the correct way. Understand and implement building regulation requirements. Uninstall and repair old constructions.** | **5** | **18** | **23** |
| | **LO 5.2 Capability for proper placing and fitting of aluminum and metal constructions in building components.** | **7** | **35** | **42** |
| | **LO 5.3 Applying proper insulation.** | **8** | **35** | **43** |
| | **LO 5.4 Product demonstration.** | **2** | **4** | **6** |
| | **Total Learning Module Hours** | **22** | **92** | **114** |
| **Total hours of the program** | | **203** | **812** | **1015** |

| Analysis - Description of units from LM 1 Materials technology & applications in constructions | | |
|---|---|---|
| **Learning Module** | **Learning Outcomes** | **Learning Units** |
| LM 1 Materials technology & applications in constructions | LO 1.1 Familiarization with metal Alloys & profiles | Aluminum alloys. Alloys for extrusion, architectural profiles, casting, hardware. |
| | | Metal alloys, Steel, Stainless steel. Profile / bending shapes. |
| | | Technical features / sheet bending / closed profiles - welding techniques. |
| | LO 1.2 Knowledge of technical specifications of filling materials | Technical characteristics & dimensioning of glazing for fenestrations. |
| | | Technical characteristics & dimensioning coverings. |
| | | Technical characteristics / dimensioning synthetic panels coverings. |
| | LO 1.3 Applications for aluminum constructions | Fenestration, shutters, roller shutters typologies and their features. |
| | | Curtain walling systems and their features. |
| | | Outdoors systems, fences, pergolas, railing etc. |
| | LO 1.4 Applications in metal constructions and interaction with aluminum structures | Metal construction products typologies with various alloys. |
| | | Special constructions, i.e. fire-resistant, anti-burglar, bullet proof etc. |
| | | Scope of metal-to-aluminum co-operation in metal pre-frame and other mixed- curtain walling, atrium-metal applications. |

| Determination of Knowledges, Skills and Competencies of LM 1 Materials technology & applications in constructions | | | | |
|---|---|---|---|---|
| | Learning Outcome | Learning Units | | |
| | | Knowledges | Skills | Competencies |
| LM 1 Materials technology & applications in constructions | LO 1.1 Familiarization with metal Alloys & profiles | • Knowledge of aluminum alloys<br>• Alloys for extrusion, profiles, casting, accessories | • Choose the appropriate alloys and equipment for processing according to technical specifications<br>• Select the appropriate materials<br>• Knowledge of mechanical-qualitative materials behavior<br>• Continuous improvement mindset.<br>• Apply good practices for raw materials | Understanding the consequences of wrong choice |
| | | • Knowledge of metal alloys, steels -Stainless steel<br>• Profile & bending shapes | • Sheet metal forming cutting and elaboration process for all categories of metal shapes<br>• Understand basic circular economy aspects | Choose the ideal alloy in special climatic conditions & aesthetics |
| | | Knowledge of technical features / configuration / closed profiles - welding options | • Implement the appropriate profile for elaboration based on technical needs<br>• Knowledge of mechanical-qualitative materials behavior<br>• Apply different soldering techniques | Exploiting the ideal cross section in relation to the use of construction |

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| | LO 1.2 Knowledge of technical specifications of filling materials | Knowledge of technical characteristics & dimensioning of glazing for fenestrations | • Implement the appropriate glazing in quality and thickness in relation to the dimensional requirements<br>• Choose the right materials combinations (profiles, glass, etc.)<br>• Understand basic circular economy aspects | Ability to apply alternative quality & technical features for best results |
| | | Knowledge of technical characteristics & dimensioning of covering | • Optimize different application techniques for each covering<br>• Select the best combination of materials, taking into consideration energy saving and efficiency | Understanding the consequences of an incorrect application - location, use of materials or technical positioning |
| | | Knowledge of technical characteristics – dimensioning of synthetic panels coverings | • Synthetic panel applications in all kinds of aluminum or steel construction<br>• Recycle | Utilization and combination of covering in masonry, frames or fences and generally in composite structures |
| | LO 1.3 Applications for aluminum constructions | Knowledge of the typologies, casement, sliding etc. of fenestrations and their features | • Apply typology to customer needs and available space<br>• Select the best combination of materials and typology type according to building specifications and energy saving and efficiency | Apply an alternative category of frame for best results |
| | | Knowledge of curtain walling systems and their features | • Selection and implementation of the appropriate system<br>• Understand basic circular economy aspects | Customize by selecting and executing on-the-spot alternatives to troubleshooting |
| | | Knowledge of outdoors systems, fences, pergolas, railing etc. | Implementation of the ideal system for collaboration with neighboring structures and landscape architecture | Making the most of system combinations to technical specifications and adapting to the desired results |

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| | LO 1.4 Applications in metal constructions and interaction with aluminum structures | Knowledge of the typologies of metal fenestration with different alloys | Selection and manufacture of typology according to the client's needs with the ideal metal alloy | Exploiting an alternative alloy - typology class for the ideal construction |
| | | Knowledge of the possibilities of fire-resistant constructions | • Selection and construction of typology in relation to place and fire safety requirements<br>• Apply good practices for raw materials and final products storage | Ability to use mixed typology to solve technical & esthetical problems |
| | | Field of application of metal-to-aluminum co-operation in metal pre-frame and other mixed- curtain walling, atrium-metal applications | Ideal metal profile cross sections for static reinforcement & support of aluminum cross sections | Utilizing the strength of the metal alloys to support the aluminum frames in the installation and the static strengthening of the large openings |

| Analysis - Description of units from LM2 Production facilities and equipment | | |
|---|---|---|
| **Learning Module** | **Learning Outcomes** | **Learning Units** |
| LM2 Production facilities and equipment | LO 2.1 Handling and maintenance of mechanical equipment. | Handling equipment for cutting, machining, assembling etc. |
| | | Tools and consumables |
| | | Basic maintenance principles. |
| | LO 2.2 Acquaintance with production area, personnel - machines, for aluminum | Optimum layout of machinery in the production site. |
| | | Organize human resources based on production requirements. |
| | | Principles for cost estimation- Data collection, timesheets etc. |
| | LO 2.3 Acquaintance with production area, personnel - machines, for metal and mixed production | Optimum layout of machinery in the production site. |
| | | Organize human resources based on production requirements. |
| | | Principles for cost estimation- Data collection, timesheets etc. |
| | LO 2.4 Knowledge of Good health and safety practices in production & packaging & storage | Good health and safety practices in the production area |
| | | Good health and safety practices in equipment handling |
| | | Good health and safety practices after product manufacturing |

| Determination of Knowledges, Skills and Competencies of LM2 Production facilities and equipment | | | | |
|---|---|---|---|---|
| | Learning Outcomes | Units | | |
| | | Knowledges | Skills | Competencies |
| LM2 Production facilities and equipment | LO 2.1 Handling and maintenance of mechanical equipment. | Knowledge of handling equipment for cutting, machining, assembling etc | • Ensuring operational readiness of machines and plants<br>• Handle equipment properly (machine tools, presses, pantographs, hand tools) with health & safety<br>• Read, understand and apply CAD-produced and presented descriptions and work orders<br>• Apply regulations relating to data protection and information security<br>• Plan and control work processes, check, protocol and evaluate work results<br>• Understand and use 3D-Equipment for production of tools, parts etc<br>• Use IT systems, including in digitized processes<br>• Implement good working practices (working field, equipment, etc.)<br>• Handle the measuring equipment correctly | • Choosing the most suitable machine with the ideal way to load processing data and use it to get the expected results<br>• Knowledge of selecting the appropriate mechanical equipment in relation to the size and type of production |
| | | Tools and consumables, when, how and where they are used in relation to the needs of equipment | Use and application of tools and consumables, ideal for the equipment with health & safety | Selection of the most suitable tool and consumables for optimal and faster processing |
| | | Knowledge of basic cleanliness and maintenance periods of mechanical equipment | • Implementation of the maintenance instructions of the manufacturer of mechanical equipment<br>• Carry out required maintenance work on systems, machines and tools | Maintenance of mechanical equipment for optimum operating condition and maintain a timely log of damage |

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| | LO 2.2 Acquaintance with production area, personnel - machines, for aluminum | Knowledge of the layout of machinery in the production site to minimize dead time | • Arrangement of mechanical equipment for saving time.<br>• Create auxiliary structures, devices, templates and flat patterns<br>• Practical and productive knowledge<br>• Knowledge of production methods | Exploiting the ideal layout of machinery, tools and consumables in relation to production requirements |
| | | Organize human resources based on production skills and needs | • Utilizing the skills of employees in the appropriate production location<br>• Plan coordinate and agree work with line managers, with colleagues and with other work divisions using technical terminology | Selection of alternatives, for own employee, for optimum results |
| | | Data collection knowledge on production costing | • Data collection, timesheets etc<br>• Updating timetables for cost accounting | Ability to create additional schedules or modify existing ones if needed |
| | LO 2.3 Acquaintance with production area, personnel - machines, for metal and mixed production | Knowledge of the layout of machinery in the production site to minimize dead time | • Arrangement of mechanical equipment for saving time and protect aluminum from metal constructions<br>• Isolate the treatment of metals from aluminum<br>• Create auxiliary structures, devices, templates and flat patterns<br>• Practical and productive knowledge<br>• Knowledge of production methods | Exploiting the ideal layout of machinery, tools and consumables in relation to production requirements |
| | | Organize human resources based on production skills and needs | • Utilizing the skills of employees in the appropriate production location<br>• Plan coordinate and agree work with line managers, with colleagues and with other work divisions using technical terminology | • Select personnel with common knowledge<br>• Selection of alternatives, for own employee, for optimum results |
| | | Data collection knowledge on production costing | • Data collection, timesheets etc.<br>• Updating timetables for cost accounting | Ability to create additional schedules or modify existing ones if needed |

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| | LO 2.4 Knowledge of Good health and safety practices in production & packaging & storage | Good health and safety practices in the production area | • Document work and initiate quality assurances measures and measures for health and safety at work and environmental protection<br>• Implement health and safety rules at work<br>• Carry out work assignments autonomously and work as part of a team according due consideration to the relevant regulations and safety provisions and on the basis of technical documentation and work orders | Ability to adapt production steps to occupational health and safety rules |
| | | Good health and safety practices in equipment handling | Document work and initiate quality assurances measures and measures for health and safety at work and environmental protection | Ability to adapt equipment handling to occupational health and safety rules |
| | | Good health and safety practices after product manufacturing. | • Implement logistics and warehouse good practices<br>• Secure loads, transport components and sub-assemblies and use lifting gear<br>• Implement good working practices (suitable vehicle, appropriate means of support)<br>• To load on a truck and transport the construction in safety | Ability to adapt health and safety rules in the field of corridors, storage, loading, transport & unloading |

| Analysis - Description of units from LM3 Production of aluminum constructions | | |
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| **Learning Module** | **Learning Outcomes** | **Units** |
| LM3 Production of aluminum constructions | LO 3.1 Development of communication skills. Performing basic technical drawings, energy performance calculations, costing and offering tasks | Understanding customer/project needs. Relevant European and national legislation |
| | | Accounting and cost estimation software |
| | | Negotiations and final agreement |
| | LO 3.2 Planning and supply necessary raw materials, cutting and machining profiles | Use of technical – production manuals, catalogues |
| | | Procurement of raw materials. Production planning |
| | | Cutting, machining, Recycling |
| | LO 3.3 Assembling profiles for various typologies & types of aluminum construction products | Use of technical – production manuals, catalogues |
| | | Production planning |
| | | Assembling, fenestration & outdoors systems |
| | LO 3.4 Experience in quality control. Monitoring and evaluating the implementation of the work. Implementing health and safety good practices | Quality control |
| | | Health and safety good practices |
| | | Project documentation and monitoring |

| Determination of Knowledges, Skills and Competencies of LM3 Production of aluminum constructions | | | | |
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| | Learning Outcomes | Learning Units | | |
| | | Knowledges | Skills | Competencies |
| LM3 Production of aluminum constructions | LO 3.1 Development of communication skills. Performing basic technical drawings, energy performance calculations, costing and offering tasks | • Knowledge of basic communication principles for understanding customer needs and sales<br>• Procurement of raw materials | • Communicate & inform engineers and clients on the various construction types & the selected ones.<br>• Communicate and share information with the building engineer, e.g. the architecture engineer.<br>• Organize collaboration with external partners (specifications, times, costs, etc)<br>• Implement good working practices (customer loyalty etc.)<br>• Apply the relevant European and national legislation.<br>• Plan and organize autonomously the works that need to be done within the timetable and the cost constraints<br>• Reading of technical drawing<br>• Procure information<br>• Extract the dimensions of the construction<br>• Extract the dimensions from blueprints, drawings, sketches etc<br>• Measure correctly and extract dimensions<br>• Understand the peculiarities of each project<br>• Take project measurements (products' dimensions) on site | • Understanding of the customer's needs in relation to the applicable legislation in order to give the ideal technical - financial offer<br>• Win-Win |

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| | | • Measure the dimensions of the openings of the project<br>• Draw and provide sketches, and blueprints based on the building's blueprint<br>• Understand project demands and recommend the best technical solution<br>• Understand the requirements for energy saving in buildings through aluminum constructions<br>• Recommend the optimal solution in terms of materials and their materials combinations, based on the project specifications and design<br>• Plan, coordinate and agree work with line managers, with colleagues and with other work divisions using technical terminology<br>• Basic Knowledge of Statics and Load stress, Dynamic load, Wind load.<br>• Organize and select the appropriate legal and regulatory requirements for each construction<br>• Implement holistic view on processes.<br>• Make quality control of the raw materials, hardware and supplementary materials, considering the technical datasheets, and the quality system |

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| | Knowledge of accounting and costing software and relevant European legislation on the performance of construction. | • Have alternative suggestions using software and present it to the client in the form of a written offer.<br>• Calculate the cost and the time schedule needed to complete the project.<br>• Understand the legal and regulatory requirements for aluminum constructions (CE marking, Regulations for Energy Saving in Buildings etc.).<br>• Handle software for calculating thermal properties.<br>• Calculate thermal properties (e.g. U-value) for various construction products by using appropriate software tools.<br>• Understand & calculate the energy performance of products (energy labeling).<br>• Understand the environmental performance of products (environmental product declaration).<br>• Understand the demands and the specifications for Near to Zero Energy Buildings (nZEB).<br>• Organize the file of each completed project. | Alternative proposals for quality upgrading of buildings with better thermal performance |
| | Negotiation knowledge of the final agreement, ways of archiving and monitoring works | • Negotiate the final price, payment terms<br>• Keep a record of offers and track of the sales outcome<br>• Understand basic corporate finances.<br>• Planning of time | Understanding customer-supplier intentions for better sales-purchase agreement and follow-up capability |

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| | **LO 3.2 Planning and supply necessary raw materials, cutting and machining profiles** | **Knowledge of use of technical manuals, catalogue of technical – production manuals, catalogues** | • **Utilize production manuals, directories, profiles for cutting dimensions and the list of accessories**<br>• **Handle technical manuals for the manufacture of aluminum systems**<br>• **Estimation of production time**<br>• **Recognize and apply the requirements of the system designer's technical manuals when cutting and machining profiles, in order to achieve maximum energy outcomes when assembly**<br>• **Apply standards and guidelines to ensure product quality and continuous improvement of work processes in the company** | **Understand the value of using production manuals and cutting software to optimize and production plan to minimize scrap/waste** |
| | | • **Procurement of raw materials**<br>• **Production planning** | • **Raw material management**<br>• **Supplies of materials according to the technical requirements of manufacture**<br>• **Make quality control of raw materials, hardware and supplementary materials, considering the technical datasheets, and the quality system**<br>• **Apply good practices for raw materials and final products storage**<br>• **Make logistics on incoming materials, e.g. fill in the appropriate forms, safely store them etc**<br>• **Group the cutting by type production to avoid errors**<br>• **Measure and test mechanical and physical values.**<br>• **Dismantle & assemble components & sub-assemblies**<br>• **Check, monitor & remedy errors and malfunctions**<br>• **Carry out routine repairs to control systems and components and document results**<br>• **Planning of time** | **Perception of organization groups of similar cutting systems, for raw materials and production time savings** |

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| | | • Knowledge of cutting, machining<br>• Recycling | • Apply all stages of production, cutting, processing, assembly of all types of frames<br>• Practical and productive knowledge<br>• Processing procedure appropriate to the material used<br>• Organize and apply the appropriate measurement and construction techniques<br>• Cut the profiles<br>• Tune the cutting parameters<br>• Select the suitable positioning of the profiles on the saw<br>• Cut with precision and with safety<br>• Perform and document quality controls<br>• Categorize the cut profiles and label them appropriately<br>• Practical knowledge of construction methods.<br>• Treat and protect surfaces<br>• Machine or drill the appropriate holes for water drainage, ventilation etc<br>• Imprint the profiles correctly. To machine and trim the profiles correctly<br>• Handle recyclable materials<br>• Identify critical checkpoints, pertinent to construction quality which can affect thermal energy losses | Utilizing the best and fastest appropriate process of production stages |

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| | **LO 3.3 Assembling profiles for various typologies & types of aluminum construction products** | • Knowledge of technical – production manuals, catalogues.<br>• Select the ideal cross sections | • Recognize and apply the requirements of the system designer's technical manuals when assembling frames, in order to achieve maximum energy outcomes<br>• Dimensional the basic profiles from the technical chart for different loads and selects the appropriate mounting accessories<br>• Basic knowledge of Statics and Load stress, Dynamic load, Wind load | • Understand the value of using production manual & software in order to check the maximum permitted dimensions of the construction and the right components<br>• Alternative proposals of different aesthetics |
| | | Production planning knowledge | • Processing procedure appropriate to the material used<br>• Assembling and dismantling working components<br>• Grouping assembly per type production, sliding, casement etc., to avoid errors<br>• Write, implement and check work orders<br>• Measure and test mechanical and physical values<br>• Check monitor and remedy errors and malfunctions<br>• Carry out routine repairs to control systems and components and document results<br>• Planning of time | Utilizing the best and fastest appropriate process of production stages |
| | | Knowledge of assembling, fenestration & outdoors systems | • Comply with National and European Legislation, e.g. Construction Products Regulation 305/2011/EU, CE-marking, Buildings Energy Performance Regulations<br>• Apply all stages of production<br>• assembling of all types of fenestrations and outdoor, fencing, railing systems etc<br>• Processing procedure appropriate to the material used<br>• Install the locks, the handles etc | Utilizing the best and fastest appropriate process of production stages |

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| | | | • Position the materials, e.g. the profiles, correctly on the joining machines<br>• Recognize and apply the requirements of the system designer's technical manuals when assembling frames, in order to achieve maximum energy outcomes<br>• Assembly products in energy-efficient ways according to the assembly designer's requirements | |
| | LO 3.4 Experience in quality control. Monitoring and evaluating the implementation of the work. Implementing health and safety good practices | Knowledge of quality control | • To check the functionalities of the construction in the 10 critical point as the mechanism, gaskets etc<br>• Implement the appropriate measurement techniques for quality control | Implement the appropriate measurement techniques for quality control |
| | | Health and safety practices | • Implement health and safety rules at work<br>• Carry out work assignments autonomously and work as part of a team according due consideration to the relevant regulations and safety provisions and on the basis of technical documentation and work orders<br>• Document work and initiate quality assurances measures and measures for health and safety at work and environmental protection<br>• Safely package the products for transport | Implementation of all protective measures at work |
| | | Ways of archiving and monitoring the implementation of the work | Organize the file of each completed project | Apply file creation to track and record each task |

| Analysis - Description of units from LM4 Production of metal constructions | | |
|---|---|---|
| **Learning Module** | **Learning Outcomes** | **Units** |
| LM4 Production of metal constructions | LO 4.1 Ability to cost individual metal construction or combination of metal and aluminum | Costing techniques and relevant European and National legislation |
| | | Use of loads charts/tables, technical-economic characteristics of the metal profiles |
| | | Combining metal profiles with aluminum systems |
| | LO 4.2 Planning and supply necessary raw materials. Cutting and welding all types of metal constructions, also for architectural use | Using the appropriate of equipment for machining & welding |
| | | Use of suitable consumables - electrodes, gas, etc |
| | | Metal joining techniques, with bolts or welding |
| | LO 4.3 Assembling profiles in different typology of metal constructions as well as with steel-aluminum | Use of technical – production manuals, catalogues |
| | | Mixed constructions assembling |
| | | Artistic aspects, finishing of joints & special structures |
| | LO 4.4 Experience in quality control. Health and safety practices. Archiving and monitoring | Quality control |
| | | Health and safety good practices |
| | | Project documentation and monitoring |

| Determination of Knowledges, Skills and Competencies of LM4 Production of metal constructions | | | | |
|---|---|---|---|---|
| | Learning Outcomes | Units | | |
| | | Knowledges | Skills | Competencies |
| LM4 Production of metal constructions | LO 4.1 Ability to cost individual metal construction or combination of metal and aluminum | Knowledge of cost software and relevant European legislation on the static loads and the performance of construction | • Offer for individual metal construction or metal-aluminum combination<br>• Handle software for calculating the weight of the profiles<br>• Handle software to calculate constructions cost<br>• Make quality control of raw materials, hardware and supplementary materials, considering the technical datasheets and the quality system<br>• Make logistics on the incoming materials, e.g. to fill in the appropriate forms/documents, to safely store them etc | • Correct choice of metal profiles and consumables to protect aluminum from oxidation<br>• Ability to selecting the appropriate cross sections according to the offer requested |
| | | Knowledge of the use of loads chairs/tables, features and weights of the metal profiles for proper offering | • Choose the ideal profile for metal construction based on required loads<br>• Reading of technical drawing | Understand alternative choice of metal profiles for the best financial offer |
| | | Knowledge of Combining metal profiles with aluminum systems for composite offering | • Make the ideal profile choice for individual metal construction or metal-aluminum combining<br>• Corrosion problems<br>• Make separable and inseparable connections | Understanding the right choice of metal profiles by combining the required durability and the desired aesthetics |

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| | **LO 4.2 Planning and supply necessary raw materials. Cutting and welding all types of metal constructions, also for architectural use** | **Knowledge of supply necessary raw materials. Using the appropriate of equipment for cutting & machining** | • **Supply necessary raw materials**<br>• **Practical and productive knowledge**<br>• **Select & operate machinery according to manufacturer's specifications**<br>• **Apply all production stages, cutting, processing & assembly, of frame types**<br>• **Cut profiles**<br>• **To tune the cutting parameters**<br>• **Select the suitable profiles positioning on saw different technical solutions**<br>• **Process material appropriate procedure**<br>• **Organize and apply appropriate measurement & construction techniques**<br>• **Treat and protect surfaces**<br>• **Manufacture parts, assemblies, and metal constructions from sheets, tubes or profiles by means of manual and mechanical production methods**<br>• **Identification cut and steel shaping for reinforcement points**<br>• **Positioning and assembling of steelwork for reinforcement points**<br>• **Organize steel workings for reinforcement points**<br>• **Implement work health & safety rules**<br>• **Apply standards and guidelines to ensure product quality and continuous improvement of work processes** | **Use of mechanical equipment in relation to the subsequent mounting process** |

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| | | Knowledge of use of suitable consumables - electrodes, gas, etc. for welding | • Select the appropriate consumables for welding / cutting in each case<br>• Carry out welding processes practicing<br>• Cutting and welding of steel constructions for reinforcement points<br>• Carrying out manual metal arc (MMA) welding with coated electrode<br>• Carrying out metal arc welding in Metal Inert Gas (MIG) or Metal Active Gas (MAG)<br>• Carrying out manual metal arc (MMA) welding with Tungsten Inert Gas procedure (TIG)<br>• Welding of metal materials with flame processes (i.e. oxy-acetylene welding, brazing) | Understanding the correct selection and use of consumables to avoid accidents |
| | | Knowledge of metal joining techniques, with bolts or welding | • Apply appropriate technique to the joints of steel structures based on the drawings of the construction<br>• Knowledge of using technical tables for selecting bolts for connections | Understanding the strength of the union and the consequences of failure |

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| | **LO 4.3 Assembling profiles in different typology of metal constructions as well as with steel-aluminum** | **Knowledge of use of technical – production manuals, catalogues** | • **Recognize and apply the requirements of the system designer's technical manuals when assembling frames**<br>• **Dimension basic profiles from the technical chart of different loads and select the appropriate mounting mode**<br>• **Basic knowledge of Statics and Load stress, Dynamic load, Wind load**<br>• **Knowledge of using technical tables for selecting the ideal profile**<br>• **To communicate and share information with the building engineer, e.g. architecture engineer** | **Able to select the appropriate table for construction requirements** |
| | | **Knowledge of assembling, fenestration, outdoors, etc. Mixed constructions** | • **Comply with National and European Legislation, e.g. Construction Products Regulation 305/2011/EU, CE-marking, Buildings Energy Performance Regulations**<br>• **Apply all production stages for**<br>• **assembling all types of fenestrations & outdoor, fencing, railing systems etc.**<br>• **Processing procedure appropriate to the material used**<br>• **Realization of workmanships on metal sheets**<br>• **Process material appropriate procedure**<br>• **Communicate and share information with the building engineer, e.g. the architecture engineer for the big constructions** | **Understanding the details of construction and perception of the consequence of the wrong choice in the static, aesthetic & corrosion in structure of construction** |

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| | | Knowledge of the artistic processing and finishing of joints - welding of special structures | • Applies tools and consumables for perfect aesthetic restoration of glued joints<br>• Welding finishing techniques | Understanding the need for good aesthetic results in steel structures for architectural use |
| | LO 4.4 Experience in quality control. Health and safety practices. Archiving and monitoring | Knowledge of quality control | • Check the functionalities of the construction, and the proper treatment of the joints<br>• Oxidation test | Implement the appropriate measurement techniques for quality control |
| | | Health and safety practices | • Safely package the products for transport<br>• Load on a truck and transport the construction in safety<br>• Load and fasten the packages on the appropriate truck | Implementation of all protective measures at work |
| | | Ways of archiving and monitoring the implementation of the work | Organize the file of each completed project | Apply file creation to track and record each task |

| Analysis - Description of units from LM5 Installation of constructions | | |
|---|---|---|
| **Learning Module** | **Learning Outcomes** | **Learning Units** |
| **LM5 Installation of constructions** | **LO 5.1 Apply building components properly. Understand and implement building regulation requirements. Uninstall and repair old constructions** | **Familiarization with the architectural drawings and building regulation requirements. Installing and uninstalling constructions** |
| | | **Proper leveling** |
| | | **Proper shimming** |
| | **LO 5.2 Capability for proper placing and fitting of aluminum and metal constructions in building components** | **Interpretation of the forces applied in the construction and analysis of the typology of the anchor position** |
| | | **Selection of the appropriate anchor number and diameter, length** |
| | | **Connection and fastening of mixed aluminum-steel constructions** |
| | **LO 5.3 Applying proper insulation** | **Assessment of the external and internal construction conditions for the selection and application of waterproofing materials** |
| | | **Evaluation of the level of construction of the base for the correct selection and application of insulation materials** |
| | | **Waterproofing and insulation of mixed metal aluminum construction** |
| | **LO 5.4 Product demonstratio** | **Illustration of the product technical features/performance** |
| | | **User manual explanation** |
| | | **Maintenance and cleaning products instructions** |

| Determination of Knowledges, Skills and Competencies of LM5 Installation of constructions | | | | |
|---|---|---|---|---|
| | Learning Outcomes | Learning Units | | |
| | | Knowledges | Skills | Competencies |
| LM5 Installation of constructions | LO 5.1 Apply building components properly. Understand and implement building regulation requirements. Uninstall and repair old constructions | • Knowledge of interpretation of architectural designs and the building regulations for the placement of the construction and knowledge of the different location options of the structures in the building block<br>• Knowledge of uninstallation of old construction & repair it | • Install the construction to the appropriate points, interpreting the designs correctly<br>• Field preparation for installation<br>• Set up workplaces at building sites<br>• Carry out work assignments autonomously and work as part of a team according due consideration to the relevant regulations and safety provisions and on the basis of technical documentation and work orders<br>• Recognize and apply the requirements of technical guidelines during product installation, in order to achieve maximum energy outcomes<br>• Install and affix the construction on the right place, correctly taking into account the peculiarities of the building thermal insulation<br>• Uninstalls the construction to the appropriate way without damaging the construction and the component. Damage walls repair | Exploitation - evaluation of alternative installation location, if there is an obstacle to the proposed |

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| | | Knowledge of proper leveling | • Apply leveling inside, outside, diagonally, up & down<br>• Communicate and collaborate with other workers group on the field | Ability to adapt to any structural failure |
| | | Knowledge of the proper shimming | Apply the shimming, according to the typology of the construction to the building block | Variable load estimation and utilization of complex, large structures, for proper fit |
| | LO 5.2 Capability for proper placing and fitting of aluminum and metal constructions in building components | Knowledge of interpretation of the forces applied in the construction and analysis of the typology of the anchor position | • Apply the anchors to the correct construction position.<br>• Select the appropriate materials and materials combinations based on the technical specifications and guidelines | Utilizing the shimming table by construction typology |
| | | Selection knowledge from the tables of the appropriate anchor number and diameter, length | • Apply the instructions in the anchor dimension table.<br>• To install and finishes the construction | Assessment of load tables for fitting the ideal quantity and place of anchors |
| | | Connection and installation. knowledge of mixed aluminum-steel construction | Apply intermediate protective materials when joining / fastening mixed construction | Exploiting the ideal antioxidant products between metal and aluminum |

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| | **LO 5.3 Applying proper insulation** | **Assessment knowledge of the external and internal construction conditions for the selection and application of waterproofing materials** | • **Apply waterproofing products**<br>• **Seal the construction and to achieve maximum energy efficiency** | **Exploiting the climatic parameters and features of the construction for the ideal choice of waterproofing products** |
| | | **Evaluation knowledge of the level of construction of the base for the correct selection and application of insulation materials** | • **Apply insulation products**<br>• **Install all necessary supporting elements taking into account minimization of thermal losses and voidance of thermal bridges** | **Exploiting the way of mounting and features of the construction for the ideal choice of insulation products.** |
| | | **Knowledge of waterproofing and insulation for mixed metal aluminum construction** | **Application of insulation and waterproofing products in metal / aluminum construction** | **Ability to apply same products to neighboring locations** |
| | **LO 5.4 Product demonstration** | **Communication with the customer about the quality of the constructions delivered** | • **Inform customers about constructions technical characteristics and CE performance**<br>• **Explain information of the Declaration of Performance and CE Marking**<br>• **Communicate and inform clients and the engineer on good operation practices** | **Ability to be informed about the certified deliverable** |
| | | **Communicate with the customer on how to use and handle construction** | • **Informs about the use and handling of the mechanisms**<br>• **To demonstrate the functions of the construction (product)**<br>• **Explain the operating and maintenance instructions for the products, the rules of the warranty and its obligations as a manufacturer** | **Assess customer perception on technical issues for relevant explanations** |

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| | | **Customer communication knowledge on how to maintain and clean structures** | • **Informs about maintenance and cleaning**<br>• **Hand the pertaining documents and provide information on maintenance and cleaning, safety in use instructions, end use instructions, product warranty and product's performance (CE-marking, DOP)**<br>• **Clean the field and leave the place uncluttered, and to clear up and tidy up his/her tools**<br>• **Check the functionalities and regulates the mechanisms**<br>• **Keep files with the project details, the technical details of the projects and any particularities** | **Exploitation of certifications as a provision for the client** |

### 3.4 Methodology for Evaluating Learning Outcomes

The achievement of the objectives of the training program should be properly monitored and documented. For this reason, different evaluation methods and tools should be used both during and at the end of the training program. The exact selection of the method for assessment has been discussed among the consortium as well as over the in-depth interviews, the discussion on which is presented in METVET WP3 Report.

Four general methods were selected for the assessment of each knowledge, skill and competence. These are:

- Written exams
- Interview
- Case Study

The choice between the above-mentioned methods followed the European Guidelines for Validating non-formal and informal learning (CEDEFOP, 2009). The following criteria were considered in this selection:

- Breadth of knowledge, skills and competences to be assessed
- Depth of learning required
- How current of recent are the knowledge, skills and competence
- Sufficiency of information for an assessor to make a judgment
- Authenticity of the evidence being the candidate's own learning outcomes

With these criteria covered it is possible to examine the better off assessment tool. The following criteria need then to be met:

- Validity: the tool must measure what it is intended to measure
- Reliability: the extent to which identical results would be achieved every time a candidate is assessed under the same conditions

- Fairness: the extent to which an assessment decision is free from bias (context dependency, culture and assessor bias)
- Cognitive range: does the tool enable assessors to judge the breadth and depth of the candidate's learning
- Fitness for purpose of the assessment: ensuring the purpose of the assessment tool matches the use for which it is intended.

In all cases of knowledge, the assessment method is the written exams, based on multiple choices, for a poll of questions that will be developed. This process will be further analyzed in the corresponding METVET WP4 Deliverable, that is included in an upcoming METVET WP4 Report Volume.

For the skills and competences either interview or case study has been selected, based on the particularities of each case and the time and tooling constraints of the laboratory on which the assessment takes place.

**Analysis of the evaluation process (methods and tools) Knowledge - Skills - Competencies by Units**
**LM 1** Materials technology & applications in constructions

| Learning Outcome | Units | | | | | |
|---|---|---|---|---|---|---|
| | Knowledges | Evaluation methods | Skills | Evaluation methods | Competencies | Evaluation methods |
| LO 1.1 Familiarization with metal Alloys & profiles | Knowledge of aluminum alloys. Alloys for extrusion, profiles, casting, accessories | Written exams | • Choose the appropriate alloys and equipment for processing according to technical specifications.<br>• Select the appropriate materials<br>• Knowledge of mechanical-qualitative materials behavior.<br>• Continuous improvement mindset<br>• Apply good practices for raw materials | Interview | Understanding the consequences of wrong choice | Interview |
| | Knowledge of metal alloys, steels | Written exams | • Sheet metal forming cutting and elaboration process for | Interview | Choose the ideal alloy in special | Interview |

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| | | -Stainless steel Profile & bending shapes | | all categories of metal shapes<br>• Understand basic circular economy aspects | | climatic conditions & aesthetics | |
| | LO 1.2 Knowledge of technical specifications of filling materials | Knowledge of technical features / configuration / closed profiles - welding options | Written exams | • Implement the appropriate profile for elaboration based on technical needs<br>• Knowledge of mechanical-qualitative materials behavior<br>• Application of different soldering techniques | Interview | Exploiting the ideal cross section in relation to the use of construction | Interview |
| | | Knowledge of technical characteristics & dimensioning of glazing for fenestrations | Written exams | • Appropriate glazing implementation in quality & thickness in relation to the dimensional requirements<br>• Choose right combinations of materials (profiles, glass, etc.)<br>• Understand basic circular economy aspects | Case study | Ability to apply alternative quality & technical features for best results | Interview |

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| | Knowledge of technical characteristics & dimensioning of covering | Written exams | • Optimization of different application techniques for each covering<br>• Select the best combination of materials, taking into consideration energy saving and efficiency | Case study | Understanding the consequences of an incorrect application - location, use of materials or technical positioning | Interview |
| | Knowledge of technical characteristics – dimensioning of synthetic panels coverings | Written exams | • Synthetic panel applications in all kinds of aluminum or steel construction.<br>• Recycle | Interview | Utilization and combination of covering in masonry, frames or fences and generally in composite structures | Interview |

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| LO 1.3 Applications for aluminum constructions | Knowledge of the typologies, casement, sliding etc. of fenestrations and their features | Written exams | • Apply typology to customer needs and available space<br>• Select the best combination of materials and typology type according to building specifications and energy saving and efficiency | Interview | Applying an alternative category of frame for best results | Interview |
| | Knowledge of curtain walling systems and their features | Written exams | • Selection and implementation of the appropriate system.<br>• Understand basic circular economy aspects | Interview | Customize by selecting and execute on-the-spot alternatives to troubleshooting | Interview |
| | Knowledge of outdoors systems, fences, pergolas, railing etc | Written exams | Implementation of the ideal system for collaboration with neighboring structures and landscape architecture | | Make the most of system combinations to technical specifications and adaption to desired results | Interview |

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| LO 1.4 Applications in metal constructions and interaction with aluminum structures | Knowledge of the typologies of metal fenestration with different alloys | Written exams | Selection and manufacture of typology according to the client's needs with the ideal metal alloy | Case study | Exploiting an alternative alloy - typology class for the ideal construction | Interview |
| | Knowledge of the possibilities of fire-resistant constructions | Written exams | • Selection and construction of typology in relation to place and fire safety requirements<br>• Apply good practices for raw materials and final products storage | Interview | Ability to use mixed typology to solve technical & esthetical problems | Interview |
| | Application of metal-to-aluminum co-operation in metal pre-frame and other mixed-curtain walling, atrium-metal applications | Written exams | Ideal metal profile cross sections for static reinforcement & support of aluminum cross sections | Interview | Utilizing the strength of metal alloys to support aluminum frames in the installation and the static strengthening of large openings | Interview |

| Determination of Knowledge - Skills - Competencies by Units<br>**LM2** Production facilities and equipment | | | | | | |
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| **Learning Outcome** | **Units** | | | | | |
| | **Knowledges** | **Evaluation methods** | **Skills** | **Evaluation methods** | **Competencies** | **Evaluation methods** |
| **LO 2.1 Handling and maintenance of mechanical equipment.** | **Knowledge of handling equipment for cutting, machining, assembling etc** | **Written exams** | • **Ensuring operational readiness of machines and plants**<br>• **Safely handle equipment properly (presses, pantographs, hand tools)**<br>• **Read, understand and apply CAD-produced descriptions and work orders**<br>• **Apply regulations relating to data protection and information security**<br>• **Plan and control work processes, check, protocol & evaluate work results**<br>• **Understand and use 3D-Equipment for production of tools, parts etc**<br>• **Use IT systems & digitized processes**<br>• **Implement good working practices (working field, equipment, etc.)**<br>• **Handle measuring equipment correctly** | **Case study** | • **Choosing the most suitable machine with the ideal way to load processing data and use it to get the expected results**<br>• **Knowledge of selecting the appropriate mechanical equipment in relation to the size and type of production** | **Interview** |

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| | Tools and consumables, when, how and where they are used in relation to the needs of equipment | Written exams | Use and application of tools and consumables, ideal for the equipment with health & safety | Case study | Selection of the most suitable tool and consumables for optimal and faster processing | Interview |
| | Knowledge of basic cleanliness and maintenance periods of mechanical equipment | Written exams | • Implementation of the maintenance instructions of the manufacturer of mechanical equipment<br>• Carry out required maintenance work on systems, machines and tools | Interview | Maintenance of mechanical equipment for optimum operating condition and maintain a timely log of damage | Interview |

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| **LO 2.2 Acquaintance with production area, personnel - machines, for aluminum** | Knowledge of the layout of machinery in the production site to minimize dead time | Written exams s | • Arrangement of mechanical equipment for saving time<br>• Create auxiliary structures, devices, templates and flat patterns<br>• Practical and productive knowledge<br>• Knowledge of production methods | Interview | Exploiting the ideal layout of machinery, tools and consumables in relation to production requirements | Interview |
| | Organize human resources based on production skills and needs | Written exams | • Utilizing the skills of employees in the appropriate production location.<br>• Plan coordinate and agree work with line managers, with colleagues and with other work divisions using technical terminology | Case study | Selection of alternatives, for own employee, for optimum results | Interview |
| | Data collection knowledge on production costing | Written exams | • Data collection, timesheets etc<br>• Updating timetables for cost accounting | Interview | Ability to create additional schedules or modify existing ones if needed | Interview |

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| LO 2.3 Acquaintance with production area, personnel - machines, for metal and mixed production | Knowledge of the layout of machinery in the production site to minimize dead time | Written exams s | • Arrangement of mechanical equipment for saving time and protect aluminum from metal constructions<br>• Isolate the treatment of metals from aluminum<br>• Create auxiliary structures, devices, templates and flat patterns<br>• Practical and productive knowledge.<br>• Knowledge of production methods | Case study | Exploiting the ideal layout of machinery, tools and consumables in relation to production requirements | Interview |
| | Organize human resources based on production skills and needs | Written exams | • Utilizing the skills of employees in the appropriate production location.<br>• Plan coordinate and agree work with line managers, with colleagues and with other work divisions using technical terminology | | Select personnel with common knowledge in aluminum & metal. Selection of alternatives, for own employee, for optimum results | Interview |
| | Data collection knowledge on production costing | Written exams | • Data collection, timesheets etc.<br>• Updating timetables for cost accounting | Interview | Ability to create additional schedules or modify existing ones if needed | Interview |

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| **LO 2.4 Knowledge of Good health and safety practices in production & packaging & storage** | **Good health and safety practices in the production area** | **Written exams** | • **Document work and initiate quality assurances measures and measures for health and safety at work and environmental protection**<br>• **Implement health and safety rules at work**<br>• **Carry out work assignments autonomously and work as part of a team according due consideration to the relevant regulations and safety provisions and on the basis of technical documentation and work orders** | **Interview** | **Ability to adapt production steps to occupational health and safety rules** | **Interview** |

| Determination of Knowledge - Skills - Competencies by Units<br>**LM3** Production of aluminum constructions | | | | | | |
|---|---|---|---|---|---|---|
| Learning Outcome | Units<br>Knowledges | Evaluation methods | Skills | Evaluation methods | Competencies | Evaluation methods |
| **LO 3.1 Development of communication skills. Performing basic technical drawings, energy performance calculations, costing and offering tasks** | • Knowledge of basic communication principles for understanding customer needs and sales<br>• Procurement of raw materials | Written exams s | • Communicate and inform the engineers and/or the clients on the various construction types and the selected one.<br>• Communicate and share information with the building engineer, e.g. the architecture engineer<br>• Organize collaboration with external partners (specifications, times, costs, etc.)<br>• Implement good working practices (customer loyalty etc.)<br>• Apply relevant European and national legislation<br>• Plan and organize autonomously the works that need to be done within the timetable and the cost constraints<br>• Reading of technical drawing<br>• Procure information<br>• Extract the dimensions of the construction | Case study | • Understanding of the customer's needs in relation to the applicable legislation in order to give the ideal technical - financial offer<br>• Win-Win | Interview |

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| | | | | • Extract the dimensions from blueprints, drawings, sketches etc<br>• Measure correctly and extract dimensions<br>• Understand peculiarities of each project<br>• Take project measurements (products' dimensions) on site<br>• Measure dimensions of project openings<br>• Draw and provide sketches, and blueprints based on building's blueprint<br>• Understand the project demands and recommend the best technical solution<br>• Autonomously assess the project on-site<br>• Understand energy saving requirements in buildings through aluminum constructions<br>• Recommend the optimal materials solution and combinations, based on the project specifications and design<br>• Plan, coordinate and agree work with line managers, with colleagues and with other work divisions using technical terminology<br>• Basic Knowledge of Statics and Load stress, Dynamic load, Wind load<br>• Organize & select appropriate legal and | | | |

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| | | | regulatory requirements for construction<br>• Implement holistic view on processes.<br>• Make quality control of raw materials, hardware and supplementary materials, considering technical datasheets and quality systems | | | |
| | Knowledge of accounting and costing software and relevant EU legislation on the performance of construction | Written exams | • Have alternative suggestions using software and present it to the client in a written offer<br>• Calculate the cost and the time schedule needed to complete the project<br>• Understand the legal and regulatory requirements for aluminum constructions (CE marking, Regulations for Energy Saving in Buildings etc.)<br>• Handle software for calculating thermal properties<br>• Calculate thermal properties (e.g. U-value) for various construction products by using appropriate software tools<br>• Understand & calculate the energy performance of products (energy labeling)<br>• Understand the environmental | Case study | Alternative proposals for quality upgrading of buildings with better thermal performance | Interview |

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| | | | performance of products (environmental product declaration)<br>• Understand the demands and the specifications for Near to Zero Energy Buildings (nZEB)<br>• Organize each completed project file | | | |
| | Negotiation knowledge of the final agreement, ways of archiving and monitoring works | Written exams | • Negotiate the final price, payment terms<br>• Keep a record of offers and track of the sales outcome<br>• Understand basic corporate finances<br>• Planning of time | | Understanding customer-supplier intentions for better sales-purchase agreement and follow-up capability | Interview |
| LO 3.2 Planning and supply necessary raw materials, cutting and machining profiles | Knowledge of use of technical manuals, catalogue of technical – production manuals, catalogues | Written exams | • Utilize production manuals, directories, profiles for cutting dimensions and the list of accessories<br>• Handle technical manuals for the manufacture of aluminum systems<br>• Estimation of production time<br>• Recognize and apply the requirements of the system designer's technical manuals when cutting and machining profiles, in order to achieve maximum energy outcomes when assembly<br>• Apply standards and guidelines to ensure product quality and continuous improvement of work processes | Case study | Understand the value of using production manuals and cutting software to optimize and production plan to minimize scrap/waste | Interview |

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| | • Procurement of raw materials<br>• Production planning | Written exams | • Raw material management<br>• Supplies of materials according to the technical requirements of manufacture<br>• Make quality control of the raw materials, hardware and supplementary materials, considering the technical datasheets, and the quality system<br>• Apply good practices for raw materials and final products storage<br>• Make logistics on the incoming materials, e.g. to fill in the appropriate forms/documents, to safely store them etc<br>• Group the cutting by type production to avoid errors<br>• Measure and test mechanical and physical values<br>• Dismantle and assemble components and sub-assemblies<br>• Check, monitor and remedy errors and malfunctions<br>• Carry out routine repairs to control systems and components and document results<br>• Planning of time | Interview | Perception of organization groups of similar cutting systems, for raw materials and production time savings | Interview |

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| | | • Knowledge of cutting, machining<br>• Recycling | Written exams | • Apply all types of frames stages of production, cutting, processing, assembly<br>• Practical and productive knowledge<br>• Processing procedure appropriate to the material used<br>• Organize and apply the appropriate measurement & construction techniques<br>• Cut profiles<br>• Tune the cutting parameters<br>• Select the suitable positioning of the profiles on the saw<br>• Cut with precision and with safety<br>• Perform and document quality controls<br>• Categorize cut profiles and label them appropriately<br>• Practical knowledge of construction methods<br>• Treat and protect surfaces<br>• Machine or drill the appropriate holes for water drainage, ventilation etc<br>• Imprint the profiles correctly. Machine and trim the profiles correctly<br>• Handle recyclable materials<br>• Identify critical checkpoints, pertinent to construction quality, affecting thermal energy losses | Case study | Utilizing the best and fastest appropriate process of production stages | Interview |

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| LO 3.3 Assembling profiles for various typologies & types of aluminum construction products | Knowledge of technical – production manuals, catalogues. Select the ideal cross sections | Written exams | • Recognize and apply the requirements of the system designer's technical manuals when assembling frames, in order to achieve maximum energy outcomes<br>• Dimensional the basic profiles from the technical chart for different loads and selects the appropriate mounting accessories.<br>• Basic knowledge of Statics and Load stress, Dynamic load, Wind load | Case study | • Understand the value of using production manual & software in order to check the construction's maximum permitted dimensions and the right components<br>• Alternative proposals of different aesthetics | Interview |
| | Production planning knowledge | Written exams | • Processing procedure appropriate material used to the<br>• Assembling and dismantling working components<br>• Grouping assembly per type production, sliding, casement etc., to avoid errors<br>• Write, implement and check work orders<br>• Measure & test mechanical & physical values<br>• Check monitor and remedy errors and malfunctions<br>• Carry out routine repairs to control systems, components & document results<br>• Planning of time | Interview | Utilizing the best and fastest appropriate process of production stages | Interview |

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| | Knowledge of assembling, fenestration & outdoors systems | Written exams | • Comply with National and European Legislation, e.g. Construction Products Regulation 305/2011/EU, CE-marking, Buildings Energy Performance Regulations<br>• Apply all stages of production<br>• assembling of all types of fenestrations and outdoor, fencing, railing systems etc<br>• Processing procedure appropriate to the material used<br>• Install the locks, the handles etc<br>• Position the materials, e.g. the profiles, correctly on the joining machines<br>• Recognize and apply the requirements of the system designer's technical manuals when assembling frames, in order to achieve maximum energy outcomes<br>• Assembly products in energy-efficient ways according to the assembly designer's requirements | Case study | Utilizing the best and fastest appropriate process of production stages | Interview |

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| LO 3.4 Experience in quality control. Monitoring and evaluating the implementation of the work. Implementing health and safety good practices | Knowledge of quality control | Written exams | • Check the functionalities of the construction in the 10 critical point as the mechanism, gaskets etc<br>• Implement the appropriate measurement techniques for quality control | Case study | Implement the appropriate measurement techniques for quality control | Interview |
| | Health and safety practices | Written exams | • Implement health and safety rules at work<br>• Carry out work assignments autonomously and work as part of a team according due consideration to the relevant regulations and safety provisions and on the basis of technical documentation and work orders<br>• Document work and initiate quality assurances measures and measures for health and safety at work and environmental protection<br>• Safely package the products for transport | Interview | Implementation of all protective measures at work | Interview |
| | Ways of archiving and monitoring the implementation of the work | Written exams | Organize the file of each completed project | Interview | Apply file creation to track and record each task | Interview |

| Determination of Knowledge - Skills - Competencies by Unit<br>**LM4** Production of metal constructions | | | | | | |
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| **Learning Outcome** | **Units** | | | | | |
| | **Knowledges** | **Evaluation methods** | **Skills** | **Evaluation methods** | **Competencies** | **Evaluation methods** |
| **LO 4.1 Ability to cost individual metal construction or combination of metal and aluminum** | **Knowledge of cost software and relevant European legislation on the static loads and the performance of construction** | **Written exams** | • **Offer for individual metal construction or metal-aluminum combination**<br>• **Handle software for calculating profiles weight**<br>• **Handle software to calculate constructions cost**<br>• **Make quality control of the raw materials, hardware and supplementary materials, considering the technical datasheets, and the quality system**<br>• **Make logistics on the incoming materials, e.g. fill in appropriate forms/documents, to safely store them etc** | **Case study** | • **Correct choice of metal profiles and consumables to protect aluminum from oxidation**<br>• **Ability to selecting the appropriate cross sections according to the offer requested** | **Interview** |
| | **Knowledge of loads use chairs/tables, features and metal profiles weights for proper offering** | **Written exams** | • **Choose the ideal profile for the metal construction based on the required loads**<br>• **Reading of technical drawing** | **Case study** | **Understand alternative choice of metal profiles for the best financial offer** | **Interview** |

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| LO 4.2 Planning and supply necessary raw materials. Cutting and welding all types of metal constructions, also for architectural use | Knowledge of Combining metal profiles with aluminum systems for composite offering | Written exams | • Make the ideal profile choice for individual metal construction or metal-aluminum combining<br>• Corrosion problems<br>• Make separable and inseparable connections | Interview | Understanding the right choice of metal profiles by combining the required durability and the desired aesthetics | Interview |
| | Knowledge of supply necessary raw materials. Using the appropriate of equipment for cutting & machining | Written exams | • Supply necessary raw materials<br>• Practical and productive knowledge<br>• Select and operate machinery according to manufacturer's specifications<br>• Apply all stages of production, cutting, processing, assembly of all types of frames<br>• Cut the profiles<br>• Tune the cutting parameters<br>• Select the suitable positioning of the profiles on the saw<br>• different technical solutions<br>• Processing procedure appropriate to the material used<br>• Organize and apply the appropriate measurement and construction techniques | Case study | Use of mechanical equipment in relation to the subsequent mounting process | Interview |

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| | | | | • Treat and protect surfaces<br>• Manufacture parts, assemblies, and metal constructions from sheets, tubes or profiles by means of manual and mechanical production methods<br>• Identification cut and steel shaping for reinforcement points<br>• Positioning and assembling of steelwork for reinforcement points<br>• Being able to organize the steel workings for reinforcement points<br>• Implement health and safety rules at work<br>• Apply standards and guidelines to ensure product quality and continuous improvement of work processes in the company | | | |

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| | | Knowledge of use of suitable consumables - electrodes, gas, etc. for welding | Written exams | • Select the appropriate consumables for welding / cutting in each case<br>• Carry out welding processes practicing<br>• Cutting and welding of steel constructions for reinforcement points<br>• Carrying out manual metal arc (MMA) welding with coated electrode<br>• Carrying out metal arc welding in Metal Inert Gas (MIG) or Metal Active Gas (MAG)<br>• Carrying out manual metal arc (MMA) welding with Tungsten Inert Gas procedure (TIG)<br>• Welding of metal materials with flame processes (i.e. oxy-acetylene welding, brazing) | Case study | Understanding the correct selection and use of consumables to avoid accidents | Interview |

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| **LO 4.3 Assembling profiles in different typology of metal constructions as well as with steel-aluminum** | **Knowledge of metal joining techniques, with bolts or welding** | **Written exams** | • **Apply appropriate technique to the joints of steel structures based on the drawings of the construction**<br>• **Knowledge of using technical tables for selecting bolts for connections** | **Case study** | **Understanding the strength of the union and the consequences of failure** | **Interview** |
| | **Knowledge of use of technical – production manuals, catalogues** | **Written exams** | • **Recognize and apply the requirements of the system designer's technical manuals when assembling frames**<br>• **Dimensional the basic profiles from the technical chart for different loads and selects the appropriate mounting mode**<br>• **Basic knowledge of Statics and Load stress, Dynamic load, Wind load**<br>• **Knowledge of using technical tables for selecting the ideal profile**<br>• **Communicate and share information with the building engineer, e.g. the architecture engineer** | **Case study** | **Able to select the appropriate table for construction requirements** | **Interview** |

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| | Knowledge of assembling, fenestration, outdoors, etc. Mixed constructions | Written exams | • Comply with National and European Legislation, e.g. Construction Products Regulation 305/2011/EU, CE-marking, Buildings Energy Performance Regulations.<br>• Apply all stages of production<br>• assembling of all types of fenestrations and outdoor, fencing, railing systems etc.<br>• Processing procedure appropriate to the material used<br>• Realization of workmanships on metal sheets<br>• Processing procedure appropriate to the material used<br>• Communicate and share information with the building engineer, e.g. the architecture engineer for the big constructions | Case study | Understanding the details of construction and perception of the consequence of the wrong choice in the static, aesthetic & corrosion in structure of construction | Interview |
| | Knowledge of the artistic processing and finishing of joints - welding of special structures | Written exams | • Apply tools and consumables for perfect aesthetic restoration of glued joints<br>• Welding finishing techniques | Case study | Understanding the need for good aesthetic results in steel structures for architectural use | Interview |

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| | LO 4.4 Experience in quality control. Health and safety practices. Archiving and monitoring | Knowledge of quality control | Written exams | • Check the functionalities of the construction, and the proper treatment of the joints<br>• Oxidation test | Interview | Implement the appropriate measurement techniques for quality control | Interview |
| | | Health and safety practices | Written exams | • Safely package the products for transport<br>• Load on a truck and transport the construction in safety<br>• Load and fasten the packages on the appropriate truck | Interview | Implementation of all protective measures at work | Interview |
| | | Ways of archiving and monitoring the implementation of the work | Written exams | Organize the file of each completed project | Interview | Apply file creation to track and record each task | Interview |

| Determination of Knowledge - Skills - Competencies by Unit<br>**LM5** Installation of constructions | | | | | | |
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| **Learning Outcome** | **Units** | | | | | |
| | **Knowledges** | **Evaluation methods** | **Skills** | **Evaluation methods** | **Competencies** | **Evaluation methods** |
| **LO 5.1 Apply building components properly. Understand and implement building regulation requirements. Uninstall and repair old constructions** | **Knowledge of interpretation of architectural designs and the building regulations for the placement of the construction and knowledge of the different location options of the structures in the building block. Knowledge of uninstallation of old construction & repair it** | **Written exams** | • **Install the construction to the appropriate points, interpreting the designs correctly**<br>• **Field preparation for installation.**<br>• **Set up workplaces at building sites**<br>• **Carry out work assignments autonomously and work as part of a team according to relevant regulations and safety provisions on the basis of technical documentation and work orders**<br>• **Recognize and apply the requirements of technical guidelines during product installation, in order to achieve maximum energy outcomes**<br>• **Install and affix the construction on the right place, taking into account the building's thermal insulation peculiarities**<br>• **Uninstall the construction without damaging the construction and the component. Damage walls repair** | **Case study** | **Exploitation - evaluation of alternative installation location, if there is an obstacle to the proposed** | **Interview** |

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| LO 5.2 Capability for proper placing and fitting of aluminum and metal constructions in building components | Knowledge of proper leveling | Written exams | • Apply leveling inside, outside, diagonally, up & down<br>• Communicate and collaborate with other workers group on the field | Case study | Ability to adapt to any structural failure | Interview |
| | Knowledge of the proper shimming | Written exams | Apply the shimming, according to the typology of the construction to the building block | Case study | Variable load estimation and utilization of complex, large structures, for proper fit | Interview |
| | Knowledge of interpretation of the forces applied in the construction and analysis of the typology of the anchor position | Written exams | • Apply the anchors to the correct construction position<br>• Select the appropriate materials and materials combinations based on the technical specifications and guidelines | Interview | Utilizing the shimming table by construction typology | Interview |
| | Selection knowledge from the tables of appropriate anchor number and diameter, length | Written exams | • Apply the instructions in the anchor dimension table<br>• Install and finishes the construction | Interview | Assessment of load tables for fitting the ideal quantity and place of anchors | Interview |

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| LO 5.3 Applying proper insulation | • Connection and installation<br>• knowledge of mixed aluminum-steel construction | Written exams | Apply intermediate protective materials when joining / fastening mixed construction | Interview | Exploit the ideal antioxidant products between metal and aluminum | Interview |
| | Assessment knowledge of the external and internal construction conditions for the selection and application of waterproofing materials | Written exams | • Apply waterproofing products.<br>• Seal the construction and to achieve maximum energy efficiency | Case study | Exploit the climatic parameters and features of the construction for the ideal choice of waterproofing products | Interview |
| | Evaluation knowledge of the level of construction of the base for the correct selection and application of insulation materials. | Written exams | • Apply insulation products<br>• Install all necessary supporting elements taking into account minimization of thermal losses and voidance of thermal bridges | Interview | Exploit the way of mounting and features of the construction for the ideal choice of insulation products | Interview |

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| LO 5.4 Product demonstration | Knowledge of waterproofing and insulation for mixed metal aluminum construction | Written exams | Application of insulation and waterproofing products in metal / aluminum construction | Interview | Ability to apply same products to neighboring locations | Interview |
| | Communication with the customer about the quality of the constructions delivered | Written exams | • Inform the customer about the technical characteristics of the constructions and the CE performance<br>• Explain the information contained in the Declaration of Performance and CE products Marking<br>• Communicate and inform the clients and/or the engineer on the good operation practices | Interview | Ability to be informed about the certified deliverable | Interview |
| | Communicate with the customer on how to use and handle construction | Written exams | • Inform about the use and handling of the mechanisms<br>• Demonstrate the functions of the construction (product)<br>• Explain the operating and maintenance instructions for the products, the rules of the warranty and its obligations as a manufacturer | Interview | Assess customer perception on technical issues for relevant explanations | Interview |

| | | | | | | | |
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| | | Customer communication knowledge on how to maintain and clean structures | Written exams | • Inform about maintenance and cleaning<br>• Hand the pertaining documents and provide information on maintenance and cleaning, safety in use instructions, end use instructions, product warranty and product's performance (CE-marking, DOP)<br>• Clean the field and leave the place uncluttered, and to clear up and tidy up his/her tools<br>• Check the functionalities and regulates the mechanisms<br>• Keep files with the project details, the technical details of the projects and any particularities | Interview | Exploitation of certifications as a provision for the client | Interview |

# Joint CURRICULUM

## Innovative Teaching Methodology

# 4 WP4 | SYSTEMIC DEFINITION OF THE INNOVATIVE TEACHING METHODOLOGY

## 4.1 Introduction

Systemic, refers to characterizing an entire system or network of interconnected and interdependent systems. Innovation is the process of translating an idea into a value-creating service from which learners will gain pioneering knowledge. The term "method" refers to planned and screened research. The methodology is based on each discipline, where scientific research is based on systematic effort and follows a specific course.

The concept of innovation encompasses "the production, development and implementation of new ideas and behaviors, or refers to the selection and initial use by an organization or subunit of a practice that has not been used before".

There are two types of innovations:

1. **autonomous innovations,**
2. **systemic innovations**.

Autonomous innovations are innovations, which do not require any modification on the part of any other components residing in the overall system, whereas systemic innovations do require significant change to other components of the system.

Any systemic innovation for it to become successful will require simultaneous and complementary innovations. Systemic innovation requires significant adjustments of other parts of the system. This implies that benefits of systemic innovation can be realized only in conjunction with related complementary innovations. Innovation is increasingly seen as a critical factor in maintaining competitiveness in a globalized economy.

Successful economies and societies rely on a good foundation of education and skills. In order to fulfill this role, education systems need innovation themselves. Although

public services, including education, do not tend to operate in competitive markets, there are significant arguments in favor of innovation in education to maximize the value of public investment.

Demographic pressures, growing demand for government services, higher public expectations and tighter budgetary constraints mean that the public sector needs innovative solutions to increase productivity, reduce costs and increase public satisfaction. Simultaneously, the course delivery system is changing from a traditional face to face education system with ample contact hours, into one with a far larger share of autonomous learning and group work, enforcing a reduction of the traditional hours of face to face.

Delivery models of knowledges seem to move away from teacher and classroom-based models of knowledge transfer, towards more inclusive and asynchronous models with an increasing emphasis on learner centricity. Discoveries in scientific disciplines and related course domains always trigger a discussion on the reinterpretation of existing knowledge offered in curricula.

**Reorganization of content, courses and curricula may result.**

In addition to discipline-specific innovations generating new knowledge, also pedagogical innovations are able to provoke systemic change.

## 4.2 Teaching methods and materials in Greece, Germany and Italy

### 4.2.1 Teaching methods and materials in Greece

Until school year 2017/18, school advisors had the responsibility for the scientific and pedagogical support and guidance of secondary education teachers. Law 4547/2018 replaced them with the institution of coordinators of educational work and established new structures for the support of educational work:

- Regional Centers for Educational Planning (PEKES)

- Educational and Counseling Support Centers (KESY)
- School Networks of Educational Support (SDEY)
- Committees of Interdisciplinary Educational Evaluation and Support (EDEAY)
- Environmental Education Centers (KPE).

School textbooks and curricula are developed under the supervision of the Institute of Educational Policy (IEP) and are approved by the Ministry of Education.

The publication and distribution of the textbooks is conducted by the Computer Technology Institute & Press "Diophantus" (ITYE), a research and technology organization focusing on the research and the effective use of Information and Communication Technologies in the education sector (law 3966/2011).

Textbooks are distributed free of charge in public schools. They are common for all students of the same grade

Within the framework of vocational education, the textbooks of the Eugenides foundation are used, according to law 4186/2013.

At the beginning of the school year, teachers of all specializations are given teaching guidelines covering general and specific objectives of the cognitive subjects they are about to teach. They are also given additional general and specific methodological instructions on the teaching methods of these cognitive subjects.

However, teachers enjoy a relative autonomy as they are free to modify their teaching methods in ways that suit the nature of the subject they teach and students' abilities and interests.

In vocational secondary education, the application of modern teaching methods is sought after, depending on the desired learning outcomes, the modern professional and scientific trends in every sector of vocational education and within the framework of health and safety at the workplace.

Curricula are revised and updated, as foreseen in the relevant legislation. Methods such as experimenting, simulation, case studies, demonstration, role playing may be

used parallel to group teaching and exercises for skills development. Pupil encouragement to be autonomous, take initiative and engage in active participation is crucial in the context of practice in work areas, and practice in school laboratories or special laboratory centers (EK)

### 4.2.2 Teaching methods and materials in Germany

The Berufsschule bases its teaching on action-oriented didactic methods that are reflected in the curricula by the concept of learning areas. The use of new information and communication technologies opens up a further scope of conveying up-to-date vocational knowledge. The basic didactic methods to be used in on-the-job training are outlined in the Ausbildungsordnungen (training regulations).

### 4.2.3 Teaching methods and materials in Italy

**Regional vocational education and training (IFP)**

The main teaching aspect of IFP courses, especially on courses organized by upper secondary vocational institutes, is the use of guidance-centered teaching methods. This teaching approach makes it possible to: a) link training to the future profession more clearly and emphatically; b) rethink students' choices, if they do not correspond to their training needs and their initial training path.

In addition to this aspect, the Regions also provide training agencies with methodological guidance on approaches and techniques based on active teaching, particularly through projects, simulated business experiences and other simulation techniques (e.g. role play and case studies). They also strongly recommend the use of problem-solving methods.

In addition to traditional active teaching methods, training institutions are often open to local opportunities and participate in extracurricular initiatives such as study visits, competitions and twinning experiences.

These methods aim to facilitate the learning process and meet the needs of learners to acquire cultural and technical/professional competences through practice. In this regard, work placements are a much-appreciated learning experience for learners.

The Regions establish the length of work placements, taking into account individual qualifications. However, in the first year, placements are guidance-oriented and take place through visits to local enterprises. In subsequent years, placements have a practical and training focus. Learners work within the company and their training is organized and coordinated by the placement tutor in the training institution and the tutor at the host company.

The publishers of textbooks for vocational training are the same as those of school textbooks. Teachers are free to use textbooks and other teaching materials.

**Legislative references**

Law 28 March 2003, no. 53 (reform of the education system, traineeships)

Law 30 October 2008, no. 169 (Citizenship and Constitution)

C.M. no. 86 of 27 October 2010 (Citizenship and Constitution)

DPR 15 March 2010, no. 87 (organization of vocational institutes)

DPR 15 March 2010, no. 88 (organization of technical institutes)

DM 22 August 2007, 139 (competences compulsory education)

Directive 15 July 2010, no. 57 (Guidelines first two years of technical institutes)

Directive 16 January 2012, no. 4 (Guidelines last three years of technical institutes)

Law 6 August 2008, no. 133 (textbooks)

Law Decree 18 October 2012, no.179 (textbooks)

Ministerial Decree 27 September 2013, no. 781 (textbooks)

Law 13 July 2015, no. 107 (reform of the education system, traineeships)

Dlgs. 13 April 2017, no. 61 (reorganization of vocational institutes)

DM 24 May 2018, no. 92 (study plans and timetables)

### 4.3 Systemic Innovation

The complexity of systemic innovation of education, that is, the interdependence of all degrees of education, all stakeholders, differentiated cognitive levels, etc., can be described with the following example citing industrial innovation

- Systemic innovation, observing in the industry sector, requires multiple concurrent innovations in other independent companies and that it would require coordination with producers of complementary products.
- To ensure the sustainability of system innovations, system innovation also involves coordinating (complementary) innovations with direct competitors.
- Therefore, systematic innovation requires co-ordination activities, which include not only intense interaction with suppliers, customers, partners, developers but also with competitors, in order to provide rich information on the development of different (complementary) elements of system innovation.
- Systemic innovation usually involves coordinating different parts of a value network. It is precisely in education that every change, in educational methodology, in learning units, etc. affects the learning outcomes.

### 4.4 Educational Innovations

The term "educational innovations" is used to describe " and systematic actions, activities and / or integrated programs that integrate, exploit and promote improvements, changes and new educational perceptions of specific aspects of school reality" into four, essentially levels:

- Implementation of new training methods and strategies,
- The use of new educational facilities,
- Developing non-subject-specific learning skills (e.g. problem-solving or collaborative problem-solving skills),

- Changing pedagogical principles and beliefs about goals, priorities and educational practices.

### 4.5 Systemic Change

Though the societal needs have significantly changed over the last decades, many education systems have remained unchanged in using teaching techniques of the old industrial époque.

The fact that the fabric of many societies has changed though, has increased the urgency to review the way we organize our educational systems, and has heightened the notion to research appropriate methods for innovation.

**In systemic change, raising student achievement is regarded a central goal.**

Change must bring significant improvements to the educational experience of students, families, employees, communities and society.

Systemic transformation must meet the essential needs of an innovation- based society.

Learners need to be empowered to innovate through high quality education, but also through those forms of education which can naturally complement formal education.

A piecemeal change can never be enough to improve the overall system.

### 4.6 Educational Techniques

Depending on the content, educational techniques could be classified as follows:

- Research techniques: Discovery of knowledge by students themselves, eg. working groups, discussion.
- Application techniques: Allow students to use the knowledge they have acquired, e.g. exercises.

- Presentation Techniques: Presenting topics to students, e.g. discussion and demonstration.
- Guidance Techniques: Focus on co-editing lesson content by teachers and students, e.g. role playing, brainstorming, snowstorm, talk.
- Discovery Techniques: Students pursue intellectual exploration mainly through various forms of simulation.

Depending on the participation of the trainees or not, they are divided into:

- Active - participatory teaching techniques: They develop teacher - learner interaction as well as between the learners themselves and give them the opportunity to develop critical ability, process solutions and learn by doing.
- Non-active techniques: Techniques such as discussion, suggestion, and question and answer

### 4.7 Criteria for selecting an educational technique

According to Reppa & Ioannou (2008), no technique guarantees by definition the success and effectiveness of the educational process. The effectiveness of each varies from case to case.

For this reason, the teacher needs to be able to select the appropriate technique at a time and be able to combine it with others in order to achieve the highest possible student participation.

These choices must take into account various criteria such as their interconnection with pedagogical goals and educational goals.

In addition, the context of the learning object often necessitates the use of a teaching technique, as well as the learners' learning modes and characteristics, that is, the experiences, the degree of familiarity, the attitudes and preferences of the learners with regard to the different teaching techniques.

The skills of the trainer are also a criterion for choosing an educational technique. That is, it may be capable of an educational technique. But this should not discourage the teacher to try other teaching methods. Also, the learning climate that is formed in a group more or less indicates the educational technique to be used.

Finally, the time available and the resources available are a deterrent to the application of some techniques and suggest the use of others.

## 4.8 The design of learning programs

The design of learning programs should be such that separate components make a logical and reinforcing system.

Components, which do not support each other, or which have contradictory indications, must be eliminated.

According to Parker (1995), systemic change entails development of programs, performance standards, student assessments, and monitoring systems. Conley (1993) sets forth a framework of twelve dimensions of educational restructuring that are grouped into three subsets:

1. **central variables**
2. **enabling variables**
3. **supporting variables**

Learner outcomes, curriculum, instruction and assessment make up the central variables, as they have a powerful direct effect on student learning.

Enabling variables, also closely related to instruction, consist of learning environment, technology, school- community relations, and time.

Supporting variables, those further removed from the classroom; consist of governance, teacher leadership, personnel structures, and working relationship.

In another work is indicated that if only one element in a system is changed, no matter where in that system the element resides, it is still piecemeal change, should

be accompanied by significant changes in practically all other parts of the system, due to interrelationships.

Systemic change recognizes the interrelationships and interdependencies between the educational system and its community, including parents, employers, social service agencies, religious organizations and much more, with the consequence that all those stakeholders are given active ownership over the change effort.

## 4.9 Dimensions for the education system

For systemic innovation of education, the most important dimensions are:

1. **Ruling system and paradigmatic views (A paradigm may be thought of as a mental representation of how an entity is structured, the parts and their interrelationships and how it functions)**
2. **Ratio, integration and variability of complementary innovations**
3. **Multi-sector observatory: tracking and recording of compartmentalized innovations**
4. **Interfacing & complementary systemic alignment: chaining performance**
5. **Systemic innovation of non-formal and informal learning processes**
6. **Legacy, transition and market restructuring**

## 4.10 Five systems in education

We may understand the relationship and interdependence between different systems in education.

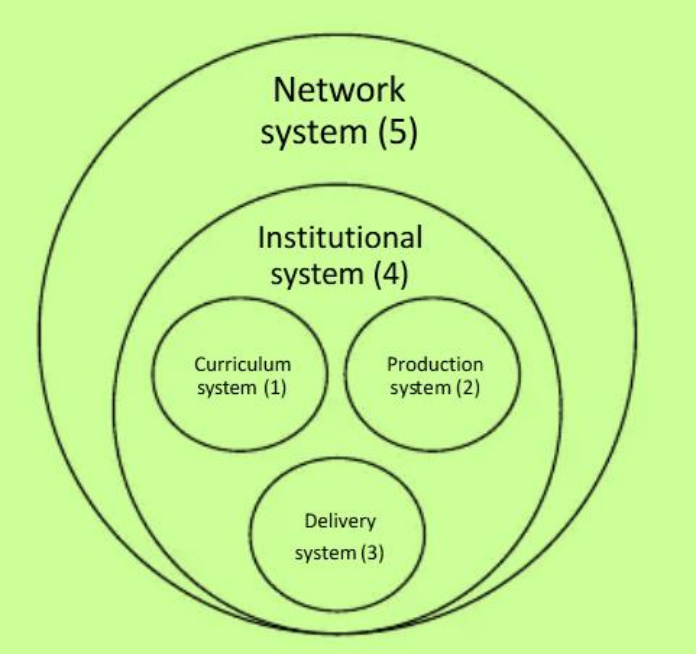


Figure 1. Five systems with paradigmatic views. (Adrianus, 2011)

1. **Curriculum:** Breakthrough discoveries in scientific disciplines and related course domains always trigger a discussion on the reinterpretation of existing knowledge offered in curricula. Reorganization of content, courses and curricula may result. In addition to discipline-specific innovations generating new knowledge, also pedagogical innovations are able to provoke systemic change.

2. **Course production:** production is turning from traditional textbook-based systems to those which increasingly rely on ICT, electronic learning objects, and the exchange of learning objects with other complementary production systems. Moreover, parties which have traditionally been involved in the course production and publication seem to be changing from those that represent the traditional publishing industry, towards an increasing larger share of parties able to deliver digital learning resources.

3. **Delivery knowledge:** Simultaneously, the course delivery system is changing from a traditional face to face education system with ample contact hours, into one with a far larger share of autonomous learning and group work. These developments are typically supported by the technological possibilities of blended

learning and distance learning. In cooperation with complementary innovators, delivery models seem to move away from teacher and classroom-based models of knowledge transfer, towards more inclusive and asynchronous models with an increasing emphasis on (more) learner centricity.

4. **The ruling institutional paradigm** is very important in terms of realizing change in the before mentioned three systems. Legacy institutions, for example, representing traditional hierarchical, social and cultural systems, risk smothering the flame of change as innovations need to pass multiple echelons and decision structures. At the very least, such structures slow down change considerably.

5. **Networking** is a contributing factor to paradigmatic change. Proximity in networks allows the flame of change to be passed over to different institutions in the network, shifting the balance within the network as a whole.

Much of educational change is seemingly rooted in technological change. Technological innovation of education is not systemic change, but rather autonomous innovation.

Systemic change of education implies a relationship with complementary innovations such as those that can be realized by simultaneously innovating educational work practice to discoveries in the learning and neurosciences, generating new knowledge on the relation between such variables as technology, cognitive processing and learning.

### 4.11 Innovations from ICT

Systemic innovation depends on knowledge and innovations generated in adjacent and complementary domains.

In education, dominate innovations from ICT (Information and Communication Technologies) the learning and neurosciences.

With education being subdivided into target groups, systemic solutions must carefully denote the properties of the target group and configure the innovation system accordingly.

The integration and the ratio of complementary innovations in systemic solutions may vary.

Learner and learning properties direct at best how solutions should take shape.

The interplay of knowledge from ICT innovations on the one hand and neurosciences and learning sciences on the other hand, make way for grounded learning solutions.

The ratio and integration of learning innovations in systemic solutions, is one of great considerations

### 4.12 Learning approaches

In sequential education systems from primary to tertiary, the level is different and pupil development is high, and therefore the learning solutions will be different in these target groups. It is not an easy task because of the many learning approaches available today, such as:

- cohort teaching (CT)
- socio-collaborative learning (SCL)
- cooperative learning (CL)
- independent learning (IL)
- personalized learning (PL)
- pre-teaching (PT)
- remedial teaching (RT)

### 4.13 The complex interrelationship of all of the factors

For success on implementation of systemic innovations, teachers must innovate as well, whereas not sticking to tradition but actually applying the new pedagogical principles when using innovations in the classroom.

Systemic innovation is not autonomous innovation: complementary change of teaching and working practices, is essential, and training needs to follow up on that. In the next figure shows the complex interrelationship of all of the factors.

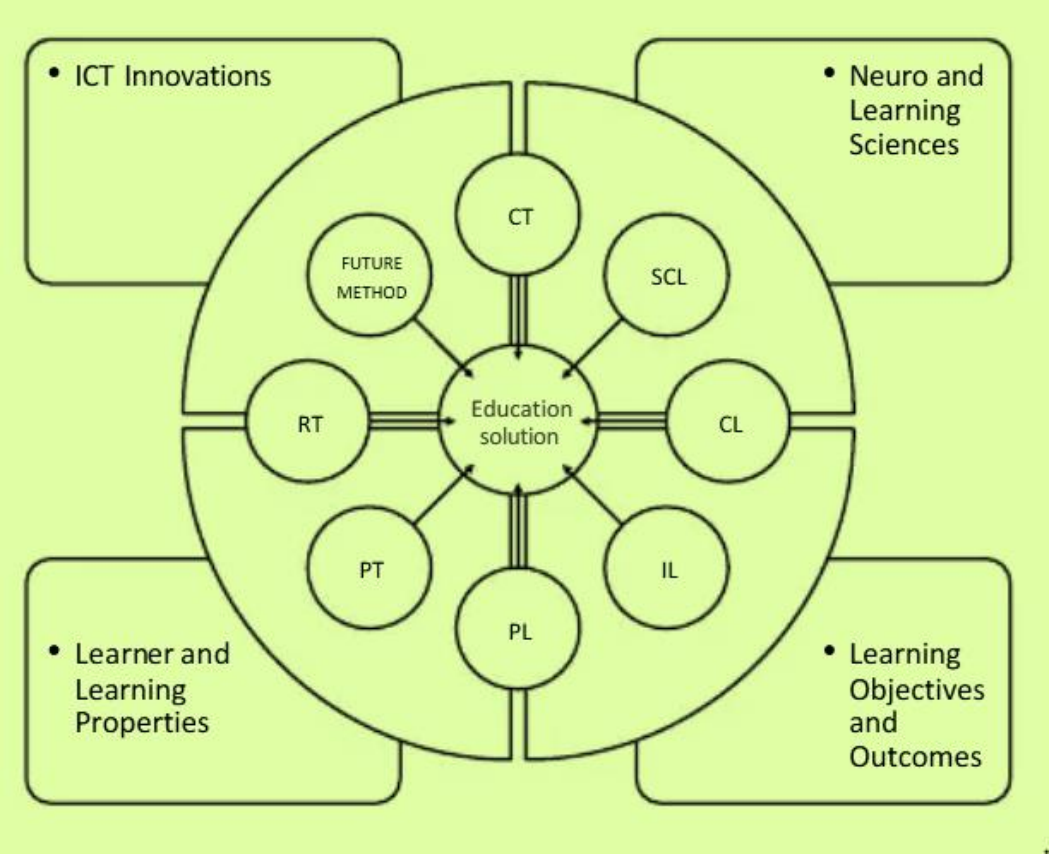


Figure 2. Complex model of factors. (Adrianus, 2011)

### 4.14 The structure of education sector

The education sector is not homogenous, but a rather heterogeneous whole, which comprises of many educational subsystems: pre-primary education, primary education, secondary education, vocational education, professional higher and academic higher education, post program education, continuing and distance education.

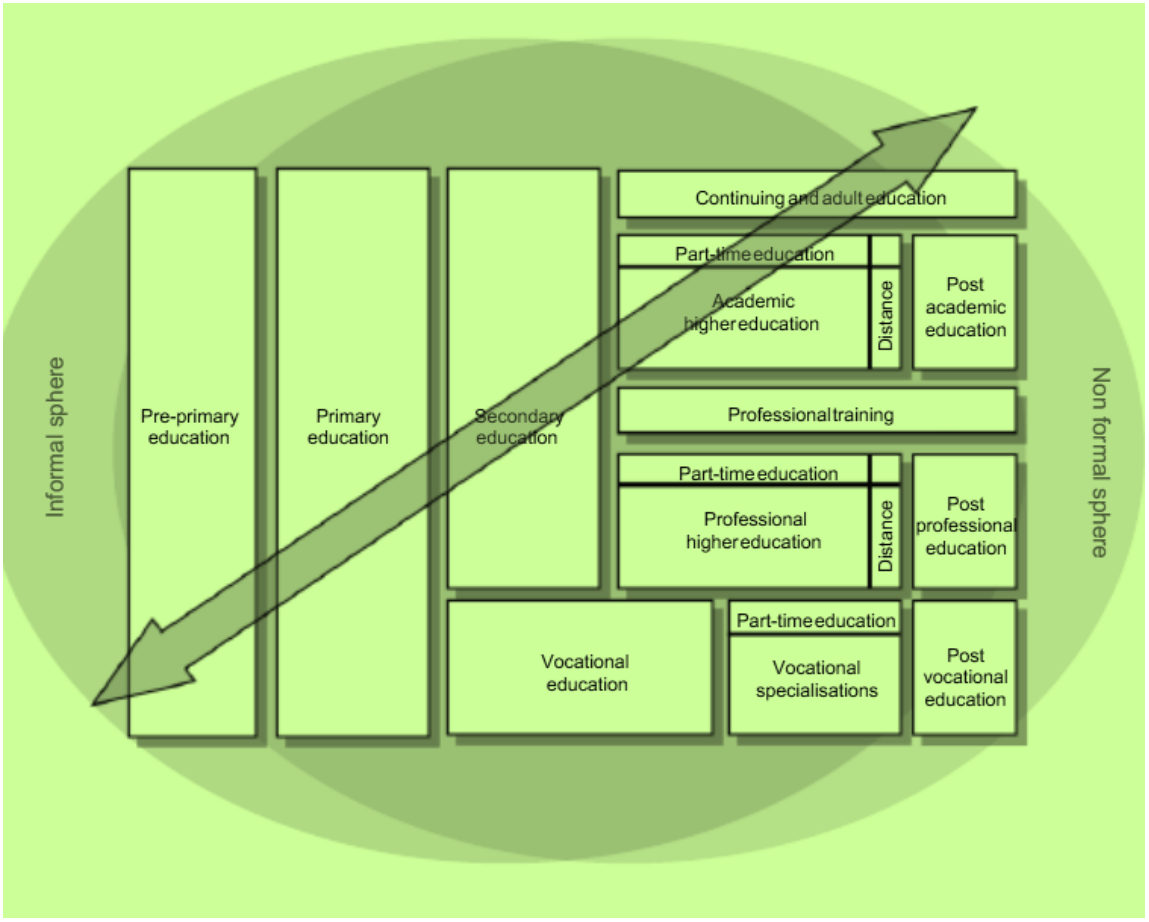


Figure 3. General model of education. (Adrianus, 2011)

Increasing the general level of education implies including all sectors in the discussion.

To benefit fully, new innovative concepts must be monitored and evaluated, and assessed on their potential for application in other sectors as well.

One may refer to the introduction of modern learning arrangements with more learning flexibility to benefit learners not just in e.g., distance education, but also in traditional higher education, polytechnics and vocational education, allowing learners in multiple systems to raise proficiency levels.

So, for innovation to become increasingly systemic, this dimension, heterogeneous, is important.

### 4.15 Social technologies

In the analysis of systemic innovation for education, we also have to take on a positive attitude towards learning occurring in non-formal and informal processes.

Whereas formal education once possessed a monopoly over knowledge, informal and non-formal sources have become increasingly important knowledge providers.

By example, we refer to the deployment of open educational resources, which may include all forms of learning: formal, informal and non-formal.

Social technologies (of using human, intellectual and digital resources in order to influence social processes) represent another example.

Social technologies have enabled knowledge transfer and learning for all of social class and those that are not attracted to formal education.

Whereas social technologies have also given rise to new pedagogies in classrooms and living rooms.

Evidently, the recognition of systemic innovation in non-formal and informal learning processes must be taken up in the discussion

### 4.16 The emergence of a whole new system

When we talk about systemic innovation, we are not referring to fragmented improvement or gradual change. We are talking about the appearance of a completely new system, which either comes up (for a while) or replaces any given system in operation. We may understand what the birth of a new system means, through the following example.

In the field of telecommunications, we have seen the upgrading of services, and of (new) mobile and information technology services. It is not too long before fixed communication was used, not mobile devices.

Systemic innovation is responsible for the emergence of a new system of interconnected players, on a whole new and different level. The same goes for education.

New teaching practices will be at the forefront of systemic change, leading to the restructuring of the educational market.

### 4.17 Measure of learning yields

In order to measure, to the extent that the impact of innovation can be measured, systems must be decomposed into components.

For formal systems, this implies the growth of such subsystems as higher education, vocational and primary education, secondary education, etc.

For informal systems, this implies enlargement to such subsystems as: family, community, clubs, media, etc.

For non-formal systems, this implies enlargement to such subsystems as: vocational training, work-related seminars, workshops, courses of interest, etc.

In these constituent systems, its (imported) impact on innovation can be measured by its ability to improve human performance, namely: key knowledge, skills and competences.

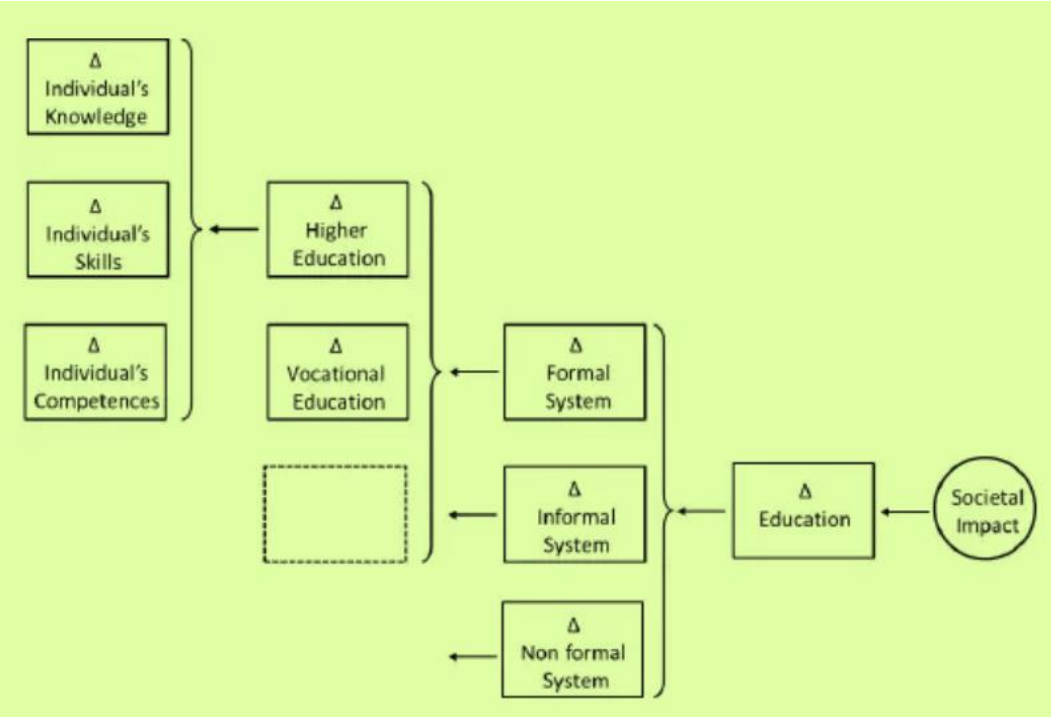


Figure 4. Researching educational change. (Adrianus, 2011)

Education systems can measure their own performance by how well their students achieve, on passing through subsequent (other) education systems. Such achievements function as an indicator of the quality of the system from which students originated

### 4.18 The geographical outreach of the innovations

Systemic innovations can be geographically divided into four categories.

1. **Local level.**
2. **National level**
3. **Continental plane**
4. **World level**

In each category, the concept of ecosystem, is important for the long-term sustainability of innovation and plays a key role.

Type 1 systemic innovation refers to the maintenance of educational innovations through ecosystems locally.

These educational innovations are usually closely linked to local financial interests.

Systemic innovation of type 2 refers to the state of innovation implemented by ecosystems that support new educational processes at national level.

Systemic innovations that have reached the global regional level are usually supported by ecosystems across the national territory.

These innovations are referred to as Type 3 Systemic Innovations and affect an entire part of the world: Europe, Asia, Africa, North America, South America or Australia.

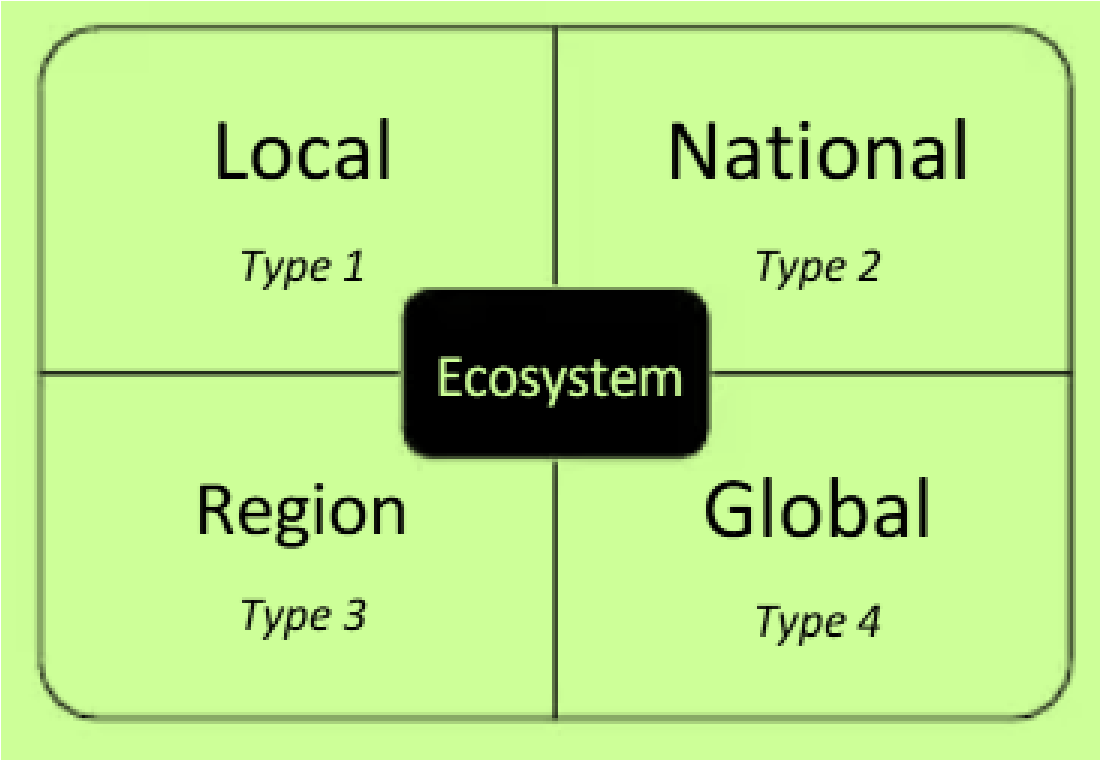


Figure 5. Geographically division of systemic innovations. (Adrianus, 2011)

Systemic innovation 4 implies the implementation of an ecosystem to maintain consistent educational processes worldwide. We can refer to such a system as integrating world value by creating educational processes.

Europe has internal experience mainly in linking national education systems, making transparent, comparable and compatible systems of credit, diplomas, qualifications, quality and funding more transparent.

As for developments in Europe, the region is slowly evolving into Type 3 systemic innovation, while expanding globally such systems as Erasmus and Bologna could still mean systemic Type 4 innovation.

### 4.19 The measurement of innovation

Measuring innovation and its effectiveness in education are still in its infancy. Recent work in the framework of the OECD's Center for Educational Research and Innovation (CERI) Strategic Innovation project, referred to in "Measuring Innovation in Education" (OECD, 2014), provides new measures to measure education in innovation.

There are two approaches to measuring the duration of innovation:

- Assess the perceptions of recent higher education graduates, including those working in education, about innovation in their workplace.
- Analysis of organizational change through student-teacher surveys

## 4.20 'General didactic' and 'Vocational didactic'

The distinction between so-called 'didactic' or 'general didactic' and 'vocational didactic' or 'specific didactic' lies in three main points:

1. **Specific teaching examines,** on a case-by-case basis, specialized methods to adapt general principles to specific practical-theoretical objects
2. **Specific teaching emphasizes applied theory** - the laboratory applied part where information and skills coexist harmoniously to achieve readily measurable results
3. **Special didactics derives its subject matter** - it is directly related to professional reality and modern market practices

The interaction between teacher and trainee, which is an established principle of traditional education in special teaching, is a fundamental condition.

In special teaching the course is practical-theoretical and should be presented in small flexible sections with explanatory titles and subtitles, documented, with informative instructions for its successful interconnection with professional practice.

Implementation and workshops are the main area of action and education must be experiential.

The link between theory and practice must be combined with professional practice at national and global level

## 4.21 The two educational models

The two educational models applied across the globe are face-to-face learning, and the hybrid learning and usually involves working in a classroom where the teacher and students interact across time and space, with personal and distance learning techniques to disseminate information to members of a learning community.

This type of learning combines technology-based teaching and traditional teaching.

Asynchronous or hybrid teaching has the following advantages:

- It encourages the learning process.
- It offers time flexibility for part-time work or other contract holders.
- It reduces overcrowded classrooms.
- The Department can add more extra hours and maximize student learning.
- Improving student skills, critical thinking and problem solving.

The hybrid model of student model teaching is that they can interact better with the school and the classmates remain committed.

### 4.22 Traditional teaching method

When teaching a teacher, it is possible to use one or a combination of several techniques to make the piece of material taught and understandable by students.

The term used to denote the above is a "teaching technique" and is synonymous with the terms "teaching technique" or "educational technique" and refers to a pedagogical "tool" that is used in the teaching and learning activities of a teaching activity strategy and characterizes the didactic form of teaching.

It is clear that depending on the syllabus, the technique that is considered to bring about the best learning outcomes and motivate the students' interest is selected.

Following is a series of teaching techniques that can be utilized in the context of teaching.

1. **Suggestion or lecture or monologue presentation**

   Students are not involved in the learning process, they do not cultivate their critical and creative abilities, and they cannot discuss, choose and reflect

2. **Discussion or dialogue**

"Discussion" or "dialogue" allows the exchange of views within a group of students about a topic for the purpose of producing conclusions or decisions.

3. **Questions and Answers**

Questions and answers are an essential element of a dialogue and their quality determines the success of the discussion.

The first to theoretically support the use of question and answer was Socrates ('obstetrician method').

## 4.23 Innovative teaching strategies

Hybrid teaching includes e - learning in addition to the face to face teaching.

Use of smart gadgets for different tasks like teaching, designing question papers, assessment of student, feedback and research methodology is discussed.

The role of education is to ensure that teachers, what is taught should also be intelligible to students emanating from culturally and linguistically diverse backgrounds.

It is more often than not the case that students underachieve because of the fact that they have not grasped an awareness of the level of assessment or what it is that the lecturer expects from them.

The use of technology in the classroom helps to engage the students with different kinds of stimuli and creates an environment of activity-based learning. It makes the content of the classroom more interesting and makes learning fun

Innovative teaching strategies:

1. **Cross over Teaching**

   This form of teaching does not include technology. Here, the learning happens in an informal setting such as after-school learning clubs, or trips to museums and exhibition. The teacher can link the educational content with the experiences that the students are having. This teaching is further enhanced and deepened by adding questions related to the subject.

2. **Teaching through Smart Boards**

   Smart boards are an effective way to bring the classroom to life while helping students experience a deeper level of engagement and understanding. This is done by making the course content interactive and visual. The smart boards transform the teaching experience into an interactive and collaborative experience as the teachers use dynamic multimedia content, to help convey the topic more effectively to the students and making it a visual, engaging experience.

3. **Teaching through Flipping Classrooms**

   Flipping the classroom is becoming an increasingly popular effective teaching method. In this technique, the students are made active participants of the learning process by passing the onus of learning on them, it requires the teachers to relegate to the role of resource providers and the students take the responsibility of gathering concepts information. This method of teaching is one of the best ways to lay the foundation in independent learning.

4. **Teaching through collaboration**

   Another innovative method of teaching involves encouraging student collaboration for various projects. Today, we live in a globalized world and collaboration is an essential life skill that is important for all careers and enterprises. Teachers can help foster this skill in the classroom by allowing students to learn study and work in groups. It also teaches students empathy, negotiation skills, teamwork, and problem-solving.

5. **Teaching through Virtual Reality**

Virtual Reality technology involves helping students learn through interactions with a 3D world. For instance, instead of taking the students through a boring history class, the teachers can use 3D technology to explore ancient civilizations, travel to distant countries for a class in geography or even take a trip to outer space during a class on science.

6. **Teaching through 3D printing technology**

Teachers looking for innovative methods of teaching can also look at 3D printing as a means of teaching. This method is fast gaining global acceptance, especially in higher educational institutes where 3D printers are used to create prototypes and make complex concepts easy to understand.

7. **Teaching through Cloud Computing**

Bring technology into the classroom allows educators to experiment with innovative teaching methods. The use of cloud computing is such a method where teachers may save vital resources, such as lesson plans, notes, audio lessons, videos, and assignments details on the classroom cloud. This can then be accessed by the students from the comfort of their homes, whenever needed bringing the classroom back to the students with the click on a mouse.

## 4.24 Innovative teaching methods

The Innovative teaching Methods are:

1. **Avalanche**

The avalanche technique aims to exchange views with the aim of promoting and exploring reflection on a topic.

2. **Brainstorm**

The brainstorming technique deals with examining a topic or concept by encouraging / motivating students to make free, spontaneous expression of ideas. The goal is to involve students in exploring the subject with any spontaneous idea or suggestion they have.

### 3. Demonstration

The 'demonstration' technique is usually used to demonstrate a practical skill as it introduces its skill, purpose and importance. Students are then trained in the skill and personally supported in its implementation.

### 4. Work groups

The "work group" technique is applied whenever the teacher asks students to break into groups and do any kind of work or generally manage any issue. It is applied in combination with other techniques.

### 5. Case study

Through the 'case study', students are presented with a real or hypothetical example of the subject area of the classroom that aims to analyze in depth and explore either the solutions to the problems that emerge or the factors that shaped the particular case.

### 6. Role playing

Students “play roles” associated with a particular situation that is examined within a teaching module aimed at through experiential situations that result in a deeper understanding of both the situation itself and its reactions and attitudes. Usually, this technique is applied in the context of conflict situations analysis of abilities, attitudes, communication and behavior. The most common example of this technique is "interview simulation

### 7. Simulation

'Simulation' refers to an activity in which students are meaningfully involved in representing a reality-relevant situation. They are invited to understand what some people would think and react to in certain circumstances.

### 8. Mind mapping

Mind map can be used by teachers to explain concepts in an innovative way. They are much quicker to make and much easier to remember and review because of their visual quality. Mind Maps are also very quick to review, as it is easy to refresh information in your mind just by glancing once. Mind Maps can also be effective mnemonics and remembering their shape and structure can provide the cues

necessary to remember the information within it. Pictures, music, color, even touch and smell play a part in our learning armory will help to recollect information for long time.

### 9. Project method

The project method is an educational business in which students solve a practical problem over several days or weeks. It may include the construction of a frame, the design of a metal table, etc. The designs may be suggested by the teacher, but they are designed and executed as much as possible by the students themselves, individually or in groups.

### 10. Role play games

Role-playing games are cooperative, improvisational, structured, and free form "interactive stories" that take place in the participants' imagination, usually seated around a table and using paper and pencil to keep track of events and persona of note. Typically, one of the participants is chosen to act as the narrator, or referee, of this non-competitive recreational experience, known variously as the Game Master (GM) or Dungeon Master (DM). The GM creates or modifies the settings in which the other participants, the Player Characters (PCs), will interact with each other and various Non-Player Characters (NPCs) under the control of the GM. Then the group of participants dynamically unfolds a series of social interactions and events for an improvisational-theater-like experience.

### 11. Field study

Field study is a general method for collecting data about users, user needs, and product requirements that involves observation and interviewing. Data are collected about task flows, inefficiencies, and the organizational and physical environments of users. It is very important as it helps to gather required information so as the problems under investigation is studied in depth as per the predefined objectives. Enable the investigator to comprehend the situation and processes in totality and at the place of their occurrence.

### 12. Portfolio development

A student portfolio is a compilation of academic work and other forms of educational evidence assembled for the purpose of

- evaluating coursework quality, learning progress, and academic achievement
- determining whether students have met learning standards or other academic requirements for courses, grade-level promotion, and graduation
- helping students reflect on their academic goals and progress as learners and
- creating a lasting archive of academic work products, accomplishments, and other documentation. Advocates of student portfolios argue that compiling, reviewing, and evaluating student work over time can provide a richer, deeper, and more accurate picture of what students have learned and are able to do than more traditional measures—such as standardized tests, quizzes, or final exams—that only measure what students know at a specific point in time.

### 13. Problem-based learning.

Psychological research and theory suggest that by having students learn through the experience of solving problems, they can learn both content and thinking strategies. Problem-based learning (PBL) is an instructional method in which students learn through facilitated problem solving. In PBL, student learning centers on a complex problem that does not have a single correct answer. Students work in collaborative groups to identify what they need to learn in order to solve a problem. The teacher acts to facilitate the learning process rather than to provide knowledge.

## 4.25 Differences between old and modern teaching approaches

In the table below we can see the main differences between the different teaching modes in the first column is the traditional one and in the second the innovation one.

Table 7. Main differences between the different teaching modes

| Learning that focuses on the student | Instructor-led learning |
|---|---|
| **Interdisciplinary educational material** | Training material is divided into sections |
| **The instructor leads the learning experience** | The trainer transfers knowledge |
| **The student is active** | The student has a passive role |
| **Students are involved in educational planning** | Students have no knowledge of educational planning |
| **Learning is dominated by discovery techniques** | Memory and practice are practiced |
| **Internal motivation is cultivated** | External rewards are used |
| **It does not correlate with academic standards** | Associated with academic specifications |
| **Very few tests** | Large number of tests |
| **Collaborative practices are encouraged** | There is competition |
| **Teaching is done in groups** | Teaching is done with the whole class |
| **Emphasis on creative expression** | Emphasis is placed on storage |
| **Equal emphasis is placed on emotional and cognitive development** | Emphasis is placed on cognitive development |
| **The process is evaluated** | The result is evaluated |

### 4.26 Conclusions

Education is a light that shows the mankind the right direction.

The purpose of education is not just making a student literate but adds rationale thinking, knowledgeably and self-sufficiency.

When there is a willingness to change, there is hope for progress in any field.

Any teaching method without destroying the objective could be considered as innovative methods of teaching.

There searchers believe that the core objective of teaching is passing on the information or knowledge to the minds of the students.

There are a number of ways that teachers can bypass the system and offer students the tools and experiences that spur an innovative mindset.

For this reason, we have to form innovation and inspire creativity in the classroom, adapting to new strategies, techniques, ideas, mindsets, technologies, that is, a new way of life in education.

We have to adopt the «Thinking» i.e change the way of teaching I.e. the teacher speaks, and his students listen. To change this kind of tradition and make the classroom more innovative, they need to think of their students as leaders - acting as guides rather than teaching content.

Self-reflection in the classroom is a way for teachers to look back on their teaching strategies to discover how and why they teach in a certain way and how their students responded.

When teachers ask open-ended questions, there may be various answers and opinions. Student responses can lead to strong collaboration, exciting conversations, new ideas, and encouraging leadership skills.

With a variety of teaching methods, it is important for teachers to consider how to use their classroom space. For example, when teachers can easily move furniture around the classroom, they may find it to be an important variable to improve student learning.

Create a place for all students. When a class focuses exclusively on teamwork - which emphasizes whole-group discussions, extroversion in the classroom can be developed and gained.

Instead to solving the problem, teachers can help students in order to solving problem together.

Students need to see that adults try many things in their lives and constantly fail but keep trying. Students need to experience failure to learn.

When teachers use a reversed classroom model, the traditional classroom instruction and events are reversed. Students can see the teaching materials, read the text, or do research as their work before reaching the classroom. Class time is devoted to activities that can include learning, as well as discussions or collaborative work.

Using technology as a place of communication and approach, teachers can reach different leaders through social networking sites such as LinkedIn or Twitter or Skype at the touch of a button.

The design thinking process is a set of structured strategies

There are five phases to the process: discovery, interpretation, ideation, experimentation, and evolution.

For each phase, students and teachers can follow the following pattern:

- I have a challenge. How do I approach it?
- I learned something. Now, how do I interpret it?
- I see an opportunity. What can I create?
- I have an idea. How can I build it?
- I tried something new. How do I make it evolve?

It is important to systemic apply all the innovative methods of teaching that is, to take into account all educational levels, different characters of trainees, different cultures.

Considering the following and for the Curriculum prepared within METVET we propose the following scheme with teaching methodologies.

**LM 1 Materials technology & applications in constructions.**

Demonstration/ Work groups/ Case study/ Mind mapping/ Portfolio development

**LM 2 Production facilities and equipment.**

Demonstration/ Work groups/Case study/Mind mapping/ Project method/ Problem-based learning.

### LM 3 Production of aluminum constructions.

Avalanche/ Brainstorm/ Demonstration/ Work groups/ Case study/ Role play games /Simulation/Mind mapping/ Project method/ Problem-based learning/ Portfolio development/ Field study.

### LM 4 Production of metal constructions

Avalanche/ Brainstorm/ Demonstration/ Work groups/ Case study/ Role play games /Simulation/Mind mapping/ Project method/ Problem-based learning.

### LM 5 Installation of constructions.

Demonstration/ Work groups/ Case study/ Simulation/ Mind mapping/Project method/ Field study/Problem-based learning.

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