iQMET

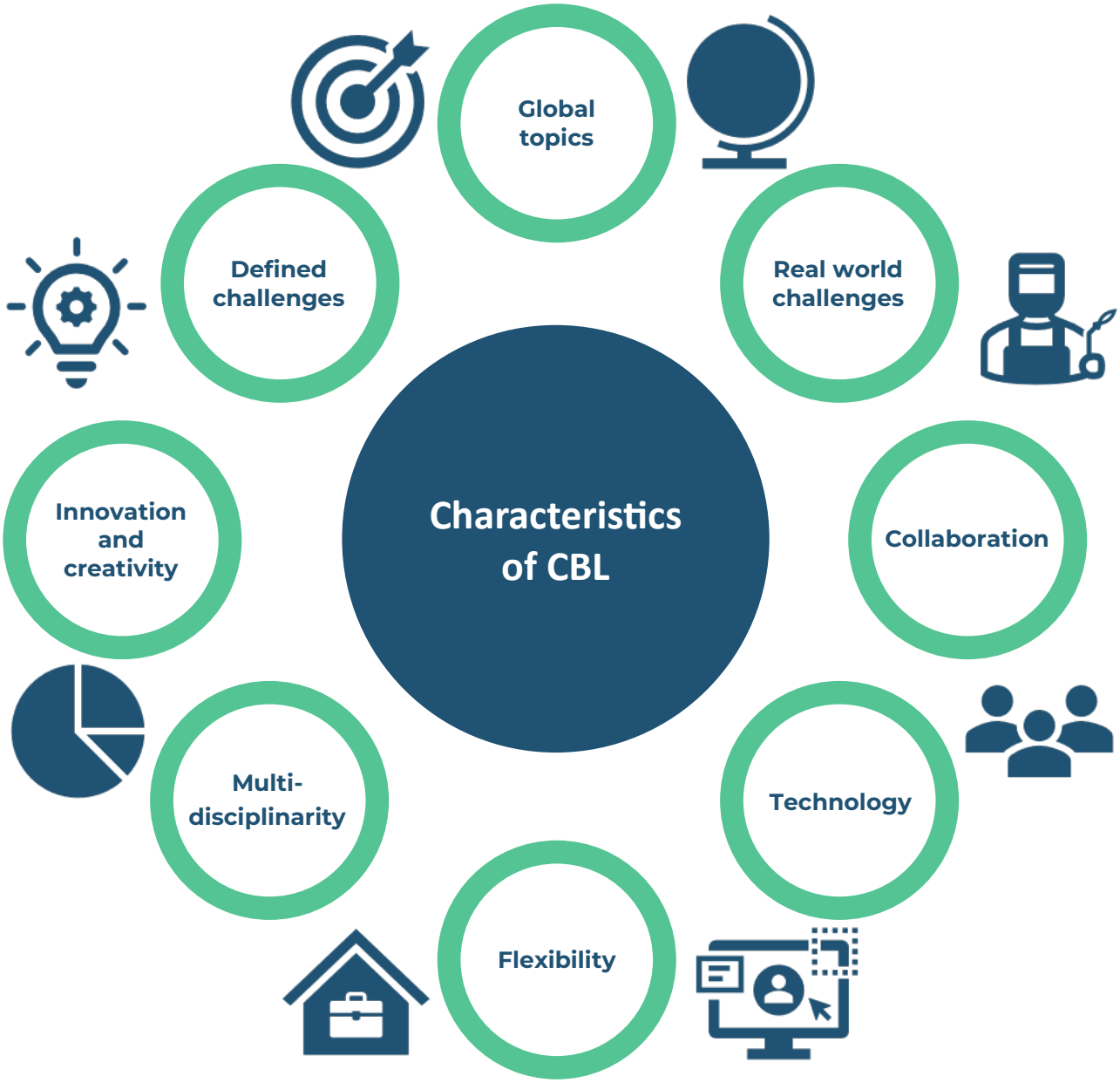
New Innovative Methods for Quality Capacity
Life Cycle Production Process Training of Inspectors

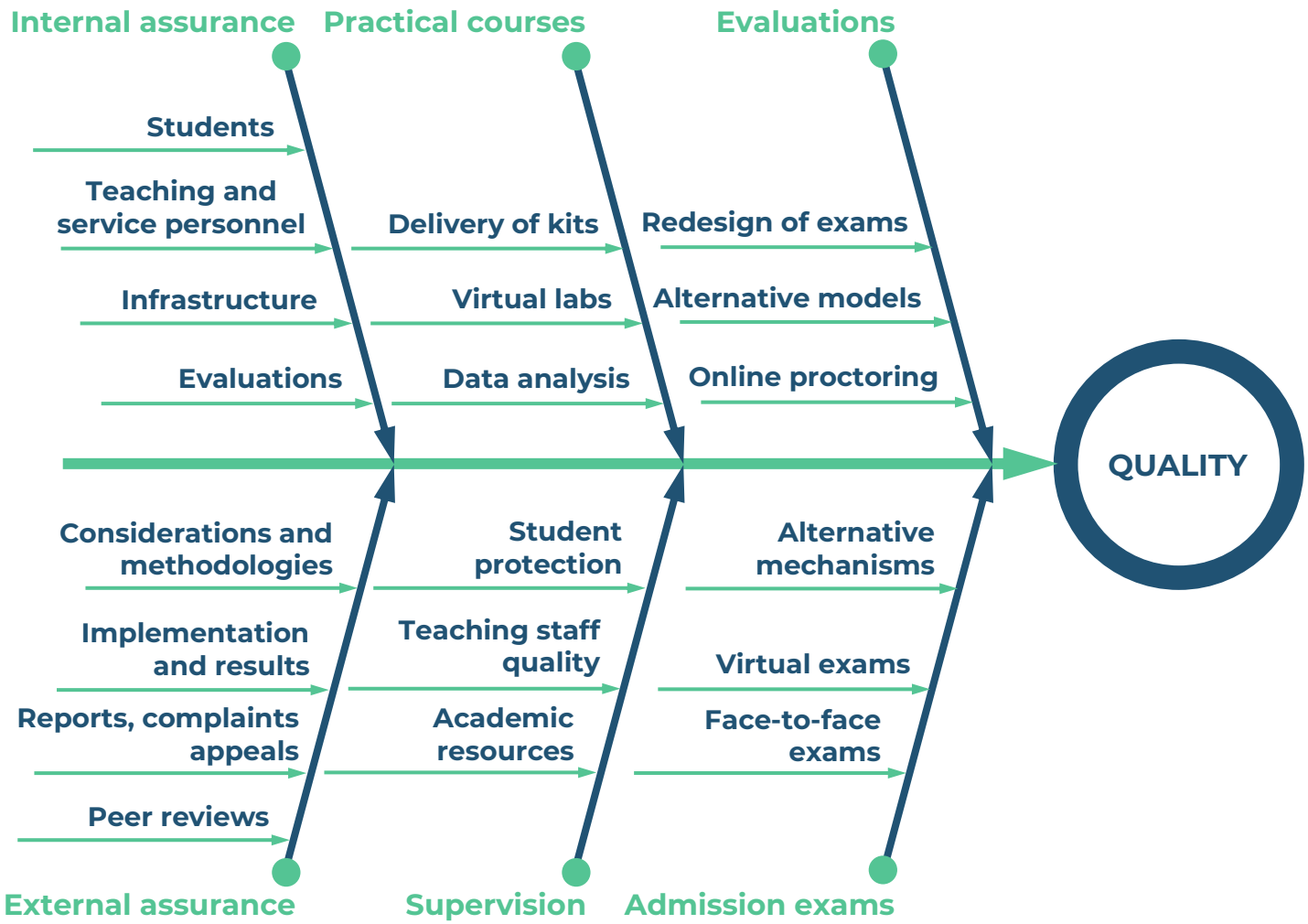
D2.4 Pedagogical guideline

The IQMET Pedagogical Guideline

equips educators and learners to **adapt to evolving teaching paradigms**. Designed for teachers, students, and institutions, these principles emphasize **innovative approaches** like **Challenge-Based Learning** (CBL) to address **real-world challenges, foster creativity, and enhance motivation**.

It can be used as a **reference guide** when **planning, designing, implementing** and **evaluating** any teaching **module**. It helps to align teaching with the 6 main and 2 specific **Educational Principles** for **welding and welding inspector training**.





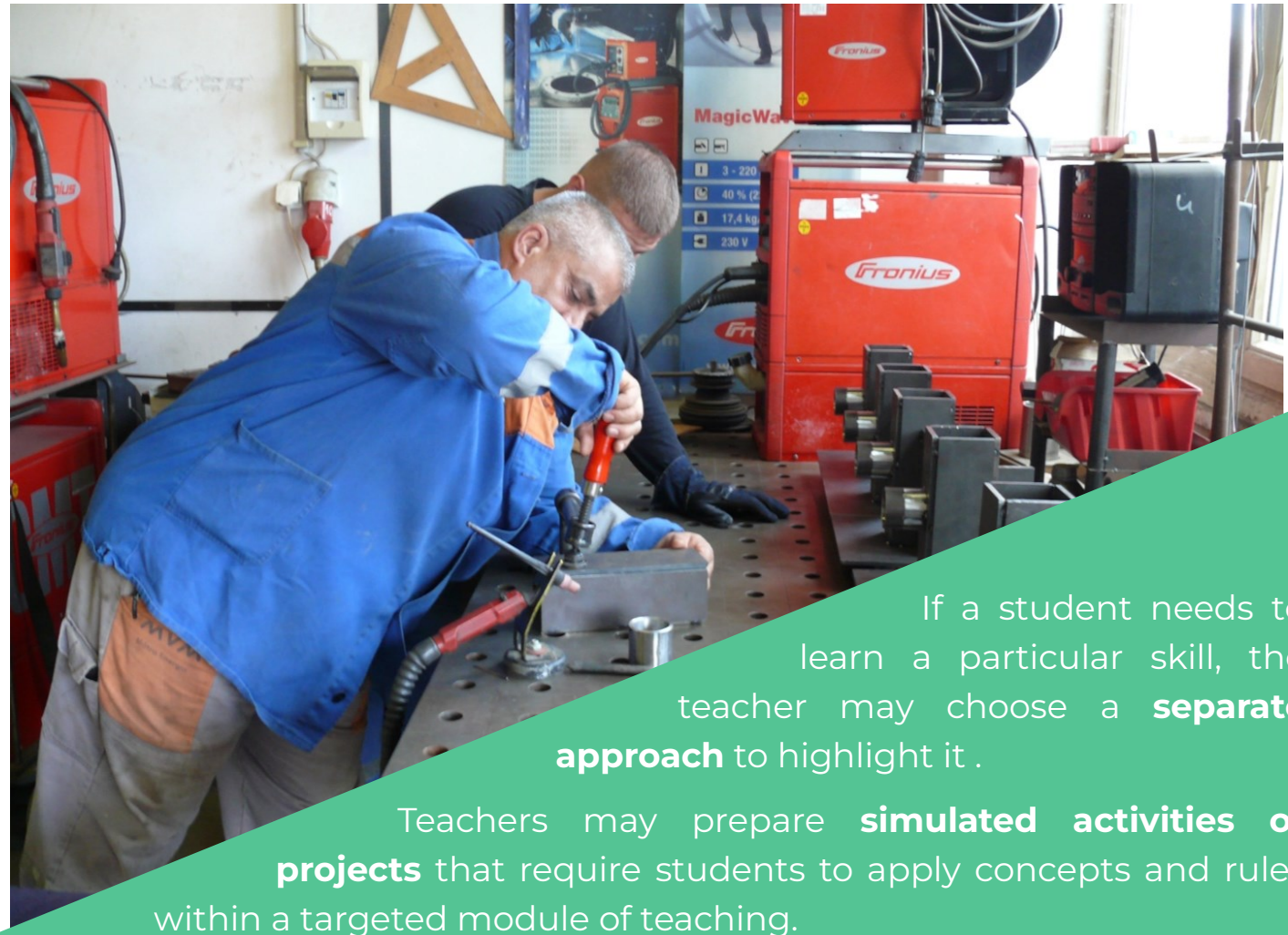
We must capitalize on the progress made in **technological innovation** and include a greater number of **virtual or blended courses** in the frame of a new curriculum, for which an **internal quality assurance strategy** is necessary.

The four dimensions for **self-assessment** of the quality of a **distance education program** are related to:

Students	**Evaluation**
Academic and support staff	**Infrastructure**

Related to the above matters, **eight topics** were identified as making a difference in student performance.

Diverse learning approaches



If a student needs to learn a particular skill, the teacher may choose a **separate approach** to highlight it .

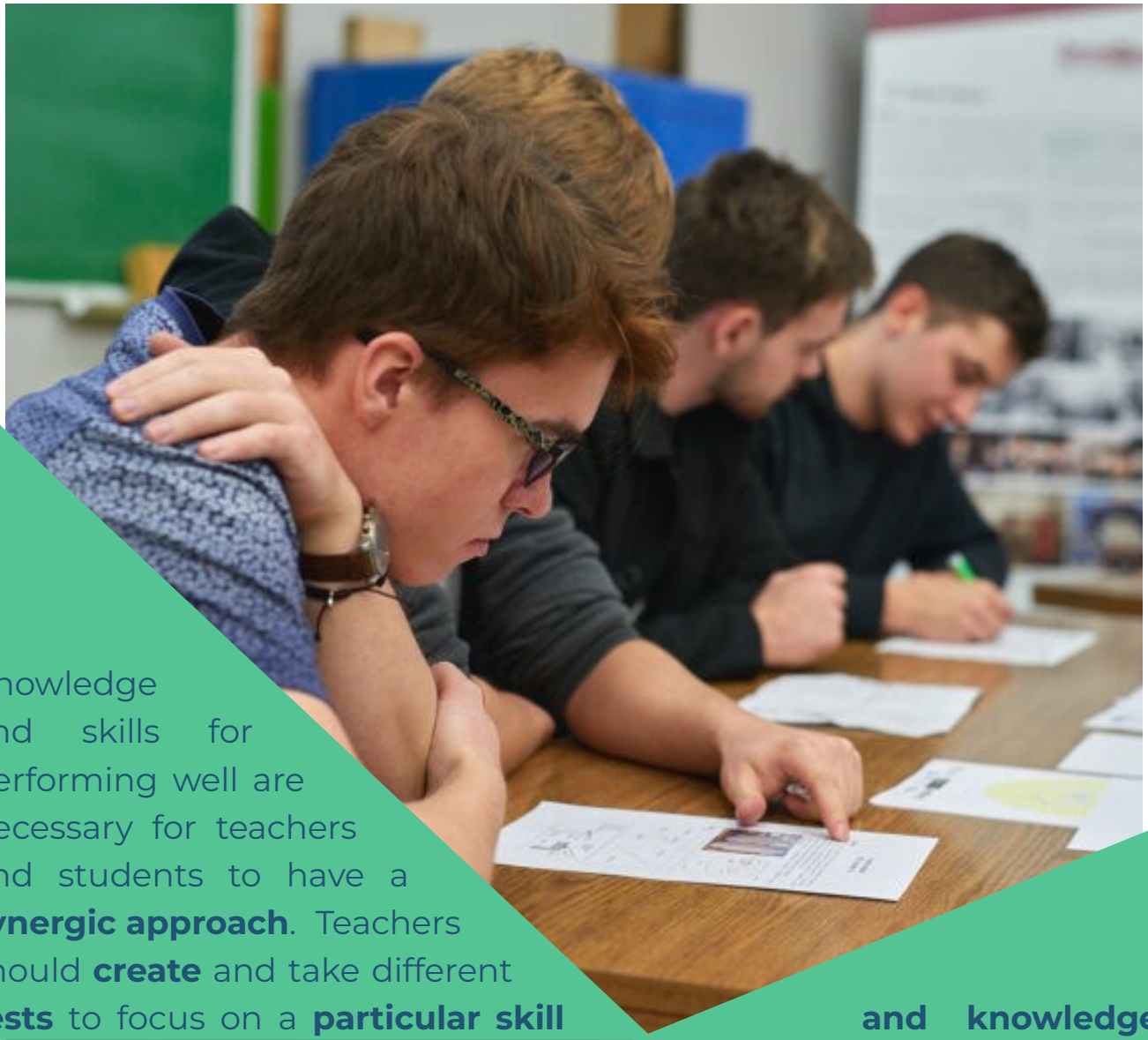
Teachers may prepare **simulated activities or projects** that require students to apply concepts and rules within a targeted module of teaching.

Digital educational tools inject an element of interactivity and engagement into the learning process, captivating students' attention and fostering a **deeper understanding of complex concepts**.

Examples for diverse learning approaches:

- Applying various lesson types **tailored** to students' needs,
- Incorporating **simulations** and **gamified learning** to boost engagement and performance,
- Providing asynchronous learning materials for **self-paced learning**,
- Providing **targeted** review and **feedback**,
- Using each approach to **scaffold ways to think** and discuss (e.g. summarizing, justifying answers, making connections).

Integrating tests into instruction



Knowledge and skills for performing well are necessary for teachers and students to have a **synergic approach**. Teachers should **create** and take different **tests** to focus on a **particular skill and knowledge** requirement. Teachers should also discuss how these demands relate to **national and international regulations** and expectations and the **ways to integrate** these skills and knowledge **into the curriculum**.
Immediate feedback that is **specific, constructive, and timely** is more likely to positively **impact student learning.**

Providing effective feedback

- by developing reflective, **skill-oriented assessments**,
- by using **feedback loops** through quizzes, assignments, and iterative evaluations to **enhance learning outcomes**.
- by developing and implementing **model lessons** that **integrate test preparation** into the curriculum.

Connecting Curriculum with Real Life

Teachers must consciously develop and weave a web of **connections within** lessons, **across lessons**, and to **students' professional lives based upon** their relationship with the whole program and their connections to **student needs** and the **curricular goals.**

Case studies are active learning strategies that have been found to **encourage student reflection** and **critical thinking**. Case studies provide students with opportunities to apply what they have learned in the classroom to **real-world problems**. When working on case studies, **students** often **need to work together** to research the problem, develop solutions, and present their findings.

Teachers should define the **learning outcomes** before each lesson and connect them with the previous materials, showing students the complexity of their studies. These learning outcomes **help with the structuring** of a large learning material **into competence units.**

- Aligning lessons with **practical applications** and **career goals**.
- Encouraging collaborative curriculum design and **cross-lesson integration**.
- Selection of professional development **topics** that are **related to** national/international **regulations** and the curriculum framework.

Strategic Work Methodologies

It is important for **students** to **learn** not only the content of the subject matter but also **how to think** about the possible **connections** and do documented **work** for each subject taught.

The **teachers must divide** new or **difficult tasks** into segments and **provide** their students **guidelines** on how to accomplish them. They must guide students through the entire process and **teach** them **the necessary steps** to accomplish the needed task. The teachers must provide **strategies** to **maximize the outcome**. These strategies must be discussed, drafted, and modeled, and the teachers also have to develop reminder sheets for the student. In this way, **students learn during the process** and **successfully complete their assignments.**

- Teaching **procedural** and **metacognitive strategies** to complete tasks effectively.
- Use of rubrics and guides to **promote critical thinking** and **organized responses**.
- Designing of models and **guides** that lead the student to understand **how to approach each assigned task**.

Development of Generative Thinking

Teachers should go beyond the students' knowledge acquisition and engage the students in a creative process to make **critical use of their knowledge.** The teachers need to provide a **variety of activities** to for acquiring a deeper understanding.

For example, students may be asked to **research for a specific time period** or **topics that are considered not fully understood**. Teachers have to be attuned to the questions raised by the student and **use** the **student questions as opportunities** to elaborate further and generate meaning in the teaching. Once the student arrives at a **desired level of expertise**, the teacher should continue to provide an array of activities that challenge them for **newer and more complex tasks** so as to help them to learn to **think more deeply** for each topic.

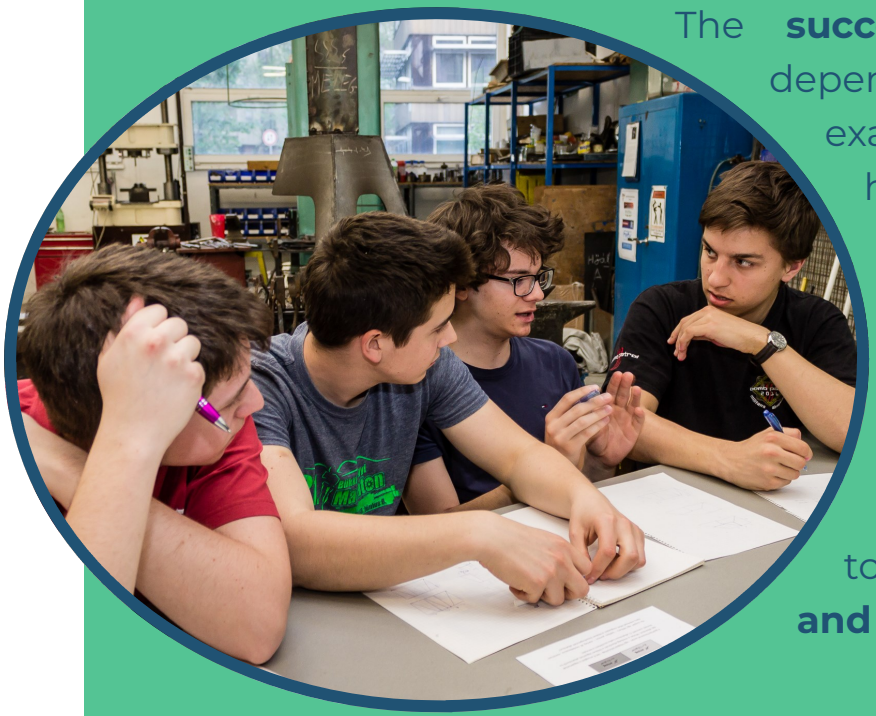
- Moving beyond rote learning to **foster creative problem-solving** and **deep exploration** of topics.
- Encouraging **research, multi-perspective analysis**, and advanced documentation skills.
- Exploration the learning material from **many points of view.**
- Designing **follow-up lessons** that lead the student to move beyond the initial thinking approach.

Cognitive Collaboration in Classrooms

- Promoting **teamwork** through **group discussions** and **collaborative problem-solving**.
- Using **small and diverse groups** to **share, challenge, and refine ideas.**
- Encouragement of various **questions and challenges** that lead students to **think more deeply**.

The students should work in **communicative groups**, and the teachers should help the students **participate in meaningful dialogues**. The students should **engage**, as much as possible, **in teamwork**. They should bring their **personal, cultural, and academic knowledge** to these interactions, in which they should play the **multiple roles** of learner and/or teacher and will have the opportunity to consider the same issue from **multiple perspectives**. The **students should interact** as both **problem-generators** and **problem-solvers**. Teachers should expect the students not merely to work together but also to **sharpen their understanding** with, against, and from each other.

Students shall **learn to work together, listen, and interact** with one another regarding the ideas at hand. Teachers should understand the importance of addressing the students as members of dynamic communities that **rely on social and cognitive interactions** to **support their learning process**.



The **success of group projects** is depending on various factors. For example, the students should have a **clear understanding** of the project **goals and objectives**. The groups should be **small enough** to allow for **meaningful involvement** from all members but large **enough** to provide **diverse perspectives and skills**.

Use of Welding Simulators

Today's society is perfectly engaged in the use of **information and communication technology** (ICT) tools. People use them for practically all their daily activities. Thus, it is natural to make **use** of **these tools in the learning process,** not only as a way to **motivate learners** (both young and adult) but also to **promote a flexible learning environment** (e.g. e-learning) and the acquisition and exchange of information between learners and teachers.

The use of **simulators** provides **practical** and **immediate learning** of a given subject, as well as **immediate feedback** and **correction** about the learners' performance, giving them autonomy to **access the results** obtained and giving teachers the possibility to use these results to **adjust** their **teaching methods** to the needs demonstrated by the learners. The use of simulators also allows them to **perform exercises at their own pace**, which promotes the **enhancement of self-esteem** in learners, including those not used to formal learning.

Types of welding simulators

Simulators that **combine theoretical and practical training.**

Simulators for **evaluating the influencing factors** on the welding process.

Target groups:

- who shall be **trained or re-trained as welders.**
- who need to **get basic knowledge** about **welding technology** and the **influencing parameters** for the welding processes.

Theoretical and practical training

Welding simulators (WS) can **support** both **theoretical, practical and online or offline assessment** of the student. These simulators can also be used for developing and refining **motoric movement skills.** Additionally, they can be used to **reduce the costs of training** and cost of materials, gases and so forth and **simultaneously increase** the **"arc-time"** for training.

These simulators are ideal for **self-paced training.**

Evaluation of the influencing factors

These simulators use data from **material certificates** as well as **design drawings** and **WPS data** in order to visualize its technical **influences on the joint** itself and calculate the **total costs** for a given weld length. Such simulators could be used when the key question is: "**what are the consequences of my data selection**" for the total welding costs in a structure or the impact it has on the technical data like **hardness, tensile strength** and so forth. As well as the consequences of **CO_2 gases**, **weld repair**, pollution, and so forth.

Target group and assessment

A candidate completing the training is expected to acquire **basic competence** in the field of **welding technology/inspection** and be competent in using WS tools in a flexible learning environment.

- being able to **develop solutions** to **basic** and **specific problems,**
- being able to **analyze** and/or **supervise basic welding applications,**
- **taking responsibility** for inspection/decision making in basic work,
- taking actions to **avoid defects and occurrences** during their own welding work,
- being able to **select** the most "green" and **economical welding process**.

Requirements

Welder level course

- **Sufficient prior knowledge**
- **Health, physical and mental capability**

Inspector basic level course

- International Welding Practitioner **(IWP) diploma or evidence for IWI -B level access**
- **2 years experience in basic level welding and inspection**

Inspector standard level course

- International Welding Specialist **(IWS) diploma or evidence for IWS level access**
- **3 years experience in standard level welding and inspection**
- **Experience and education to become IWI-S**

Quality assessment

Application assessment	The **Training Body** will review applications to determine their **suitability** for the desired qualification level.
Certification Exemption	Individuals with **ISO 9712 certifications** may be **exempt from** certain **NDT modules** but must still take the final exam.
Teacher Qualifications	The course must have enough **qualified teachers with the necessary knowledge** and **experience** to cover the syllabus.
Exam Eligibility	Only those who **attend** at least **90% of the course** are eligible for the final exam.
Audit Team Composition	The audit team will consist of **one Lead Assessor** assigned by a **consortium member** to **evaluate another member country**.
Conflict of Interest	**Lead Assessors** must **disclose** any potential **conflicts of interest** that may affect their impartiality.
Audit Purpose	The purpose of the audits is to **assess the implementation of the project's guidelines** and rules.
Findings and Recommendations	Any findings or recommendations will be documented in a **non-conformity/ observation report** and followed up with the Training Body.

Summary

This **Pedagogical guideline**, developed in the frame of the IQMet Project, explains the **pedagogical alignment** between the topics of the **European Welder Guideline** and the **European Inspector Guideline,** will be ensured by the IQMET partners involved in the development of the **learning contents** and how the **technical revision** was conducted towards the final version of the above-mentioned **pedagogical approach**, considering their **compliance with the new teaching methods**. Their applicability and **relevance to trainees' education** and **practical training,** as well as the **theoretical knowledge** to be achieved, complies with the **European Guidelines** and the most updated state of the art.

Strengths of the IQMET pedagogical guideline

- **Flexibility:** Adaptable to diverse teaching and institutional needs.
- **Technology Integration:** Enhanced learning with simulators and digital tools.
- **Future-Ready:** Preparing students for real-world challenges with innovative approaches.

References

The below references were used to develop this deliverable material in the frame of the IQMET Project.

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