

EIT STEM Competence Framework

1. Underlying considerations and wider definition

STEM and STEM Skills: A Multidimensional Framework for European Innovation

Science, Technology, Engineering, and Mathematics (STEM) are the disciplines historically prioritised to strengthen scientific capability, technological innovation, and economic competitiveness in knowledge-based economies. The STEM acronym emerged as a policy instrument to focus education, research, and innovation investment on these mutually reinforcing domains because of their central role in advancing discovery, engineering solutions, and digital and industrial transformation.

The EIT STEM Tech Talent Induction and Girls Go STEM define STEM as an integrated, multidimensional framework designed to develop the specific learning outcomes required by a resilient, innovation-driven workforce. This framework moves beyond isolated subject silos by adopting an interdisciplinary approach that mirrors the interconnected nature of modern professional environments. It organises STEM proficiency into three interdependent dimensions, Conceptual Foundations, Procedural Application, and Innovation Mindset, which correspond to the knowledge, skills, and attitudes necessary for the Triple Transition.

The EIT Strategic Focus: From Idea to Market

Central to this definition is the unique focus of the European Institute of Innovation and Technology (EIT) on innovation and entrepreneurship and the transformation of original ideas into market-ready solutions. STEM education within the EIT STEM Tech Talent Induction and Girls Go STEM prioritises the ability to bridge the gap between theoretical knowledge and practical application, to engage with uncertainty, and to manage innovation and intellectual property to accelerate the development of sustainable businesses.

Learner target groups

1. Girls Go STEM

In accordance with the STEM Education Strategic Plan, Girls Go STEM aims to attract female secondary students into STEM study fields and STEM professions and develop their technical and entrepreneurial skills in STEM domains. The initiative focuses on general education as well as initial Vocational Education and Training (iVET) environments.

The target groups are categorised according to the ISCED levels as ISCED level 2 (specifically focusing on the final stage of lower secondary education) and ISCED level 3 (upper secondary education), including iVET. Overall, the initiative targets learners aged fourteen to nineteen.

2. EIT STEM Tech Talent Induction

In accordance with the STEM Education Strategic Plan, the EIT STEM Tech Talent Induction aims to attract individuals to STEM studies and careers by targeting students within secondary and tertiary education. The initiative focuses on technical and Vocational Education and Training (VET) environments, as well as post-secondary and non-university tertiary education.

The target groups are categorised according to the ISCED levels as follows:

- ISCED Level 3 (Upper secondary education): The initiative engages upper secondary learners, with a particular focus on upper secondary VET. This level typically targets learners aged fifteen to nineteen. It encompasses technical school diplomas and apprenticeships which allow for permeability, enabling graduates to transition into university-level education.
- ISCED Level 4 (Post-secondary non-tertiary education): The programme targets learners pursuing specialist certificates (typically ages eighteen and above). This level serves as a critical bridge for those seeking advanced technical qualifications outside of the traditional tertiary system.
- ISCED Level 5 (Short-cycle tertiary education), Level 6 (Bachelor's or equivalent level), and Level 7 (Master's or equivalent level): The initiative engages with tertiary education and Higher VET pathways that bridge the gap between vocational schools and academic universities.
- Adult Education and Lifelong Learning: The initiative provides a continuous skilling offer for European workers, viewing adult education as a "career induction" or "re-induction" into the STEM ecosystem. This is specifically relevant for workers in declining industries who require a transition into technical sectors. Focused modular STEM courses are utilised as a low-risk entry point for adults, including those in remote or rural areas.

2. Integrated STEM Competence Framework

1. Technical Scope and Competence Anchoring

While this framework is inherently interdisciplinary, it remains technically anchored in the core fields identified by the International Standard Classification of Education (ISCED). The primary technical baseline encompasses the following fields:

- Natural sciences, mathematics, and statistics (05)
- Information and Communication Technologies (06)
- Engineering, manufacturing, and construction (07)

In alignment with the STEM Education Strategic Plan, this scope extends to vital related fields where technical induction is increasingly critical, including for example life and health sciences, environmental and earth sciences, or technically oriented architecture.

Beyond disciplinary anchoring, the framework aligns with the Council Recommendation on Key Competences for Lifelong Learning, particularly mathematical competence and competence in science, technology and engineering, as well as digital competence. In this context, STEM competence is understood not only as the acquisition of technical knowledge, but also as the ability to apply scientific and computational thinking, engage in evidence-based reasoning, solve complex problems, use digital technologies critically and responsibly, and understand the societal, ethical, and environmental implications of technological innovation.

2. Competence Architecture

This framework intends to ensure STEM proficiency through three interdependent dimensions of competence by aligning the above-listed ISCED technical fields with the Council Recommendation on Key Competences for Lifelong Learning and the EQF components Knowledge, Skills, and Responsibility and Autonomy.

The three dimensions are intended to be developed through active, experiential, and interdisciplinary learning approaches, including project-based, challenge-based, collaborative, and real-world problem-solving methodologies adapted to different learner contexts.

Dimension 1: Conceptual foundations (knowledge & theoretical baselines)

This dimension represents the “Knowledge” component of the Council Recommendation on Key Competences for Lifelong Learning and aligns with the EQF “Knowledge” pillar. It

- is grounded in the above-listed ISCED fields 05-07 while also extending to relevant domains where STEM and digital competences are increasingly important.
- encompasses the understanding of established theories, principles, and concepts relevant to scientific, technological, engineering, mathematical, and digital literacy.
- provides the conceptual foundations required for evidence-based inquiry, analytical and computational reasoning, interpretation of data and logical reasoning in technological and societal contexts.
- supports understanding of the role, opportunities, limitations, and societal implications of science, engineering, mathematics, and digital technologies, including ethical, environmental, and sustainability-related considerations.

This dimension defines the core theoretical content that learners must master in relation to the relevant ISCED fields, for example:

- Scientific principles, such as fundamental laws and theories in natural sciences, mathematics, and statistics. (ISCED 05)
- Technological and computational logic, including the architecture, functioning and responsible use of information and communication technologies. (ISCED 06)
- Engineering and design principles including system thinking, manufacturing processes, and construction logic and problem analysis. (ISCED 07)
- Thematic foundations in relevant interdisciplinary domains, such as e.g. life and health sciences, environmental and earth sciences, and technically oriented architecture.

Table 1: Dimension 1 – Conceptual Foundations (Knowledge), Focus: Mastering the theoretical and factual baseline of STEM disciplines.

ISCED Level	Educational Context	Examples of Conceptual Knowledge
ISCED 2-3	Lower Secondary, Upper Secondary / VET	Foundational principles of the natural world, introductory logic, and basic concepts of digital systems. Statistics and data interpretation, flowcharts and problem decomposition, cybersafe practices, ecosystem analysis, design processes, production methods, and properties of materials.
ISCED 4 - 5	Post-Secondary Non-Tertiary, Short- Cycle Tertiary / Higher VET	Specialised technical theory for specific occupations, such as renewable energy system logic or advanced telecommunications protocols. Reading technical blueprints, circuits, or formulas.
ISCED 6 - 7	Bachelor or Equivalent, Master or Equivalent	Advanced mechanics or engineering, core principles of biotechnology and life sciences. High-level materials science, theoretical and philosophical frameworks for artificial intelligence, and complex system dynamics.

Dimension 2: Application (procedural and practical application of STEM skills)

This dimension represents the “Skills” component of the Council Recommendation on Key Competences for Lifelong Learning and aligns with the EQF “Skills” pillar.

- It encompasses both cognitive and practical skills.
- It focuses on the application of methods, techniques and processes within e.g. engineering, manufacturing, or digital environments. This includes the ability to use specific tools, perform procedures, develop software, and execute designs.
- It enables the learner to use knowledge to solve concrete problems and complete complex tasks.

This dimension defines the practical abilities and capacity to carry out processes and use the existing knowledge to achieve results:

- The use of specific tools, software, and equipment (technical fluency).
- The capacity to conduct experiments, collect and analyse data, and perform modelling and forecasting actions (empirical methodology)

Table 2: Dimension 2 – Procedural and Practical Application (Skills), Focus: Developing cognitive and practical abilities to solve real-world challenges.

ISCED Level	Educational Context	Examples of Application Skills
ISCED 2 - 3	Lower Secondary, Upper Secondary / VET	Safe operation of introductory laboratory equipment and basic block-based or textual programming for simple tasks. Execution of standard workshop methodologies. Collecting and analysing data, Interpreting graphs and models, creating digital products (apps, games...), building digital prototypes, Testing and evaluating solutions
ISCED 4 - 5	Post-Secondary Non-Tertiary, Short-Cycle Tertiary / Higher VET	Troubleshooting and maintenance of specialised industrial equipment and the use of sector-specific technical software. Implementation of full-stack development workflows, modelling for construction.
ISCED 6 - 7	Bachelor or Equivalent, Master or Equivalent	Prototyping, performing advanced analysis simulations, and managing laboratory data. Developing and refining machine learning algorithms and overseeing manufacturing or digital production workflows

Dimension 3: Innovation Mindset (attitudes, transversal skills, and interdisciplinarity)

This dimension integrates transversal competences and the “Attitudes” component of the Council Recommendation on Key Competences for Lifelong Learning, while aligning with the “Autonomy and Responsibility” pillar of the EQF. Beyond technical proficiency and application skills, this dimension fosters the interdisciplinary integration and transversal competences required to bridge isolated subject silos and solve complex, real-world problems. It supports learners in developing horizontal competencies such as critical thinking, communication, collaboration, adaptability and ethical awareness, enabling them to work efficiently across different domains, sectors, and societal context.

This dimension defines the purpose, ethics, and strategic impact of fostering interdisciplinary synthesis and transversal skills, such as critical thinking, resilience, and empathy, to transform STEM knowledge and skills into sustainable, human-centred, real-world value. This includes:

- Teaching learners to integrate knowledge from different domains and disciplines, recognising that innovation often occurs at the intersection of different/multiple disciplines. (interdisciplinary synthesis)
- Systematic fostering of critical thinking, creativity, empathy, and adaptability, ensuring technical expertise is grounded in a flexible and creative mindset. (transversal competencies)

- Fostering the courage to view unsuccessful experiments as necessary data points in the journey toward a functional solution. (resilience and iterative design)
- Ensuring that technical interventions are ethically grounded and designed with an understanding of human needs and environmental impacts. (human-centred design and sustainability)
- Developing the agency to spot opportunities, manage resources, and work collaboratively to transform scientific discovery into socio-economic value. (entrepreneurial mindset and action)
- Independently apply skills, self-manage in changing contexts, and supervise, evaluate and improve work (responsibility and autonomy)

Table 3: Dimension 3 – Innovation Mindset, Focus: Fostering interdisciplinary collaboration, transversal proficiency, entrepreneurial intent, and ethical reasoning.

ISCED Level	Educational Context	Examples of Attitudes and Mindset
ISCED 2 - 3	Lower Secondary, Upper Secondary / VET	Exploring how science and mathematics connect with arts or social issues. Developing the habit of asking “why” and “for whom” a technology is designed to foster early ethical awareness. Building the courage to fail by viewing unsuccessful experiments as necessary steps in the iterative design process. Applying Human-Centred Design to ensure that engineering and technical projects address real human needs.
ISCED 4 -5	Post-Secondary Non-Tertiary, Short- Cycle Tertiary / Higher VET	Developing the agency to identify specific social or market opportunities where an interdisciplinary technical approach can provide solutions. Strengthening resilience when navigating technical uncertainty or complex equipment failure. Identifying market needs and understanding how to mobilise resources and intellectual property to meet them.
ISCED 6 - 7	Bachelor or Equivalent, Master or Equivalent	Strategic management of intellectual property and understanding how to protect technical solutions. Transmitting complex technical concepts clearly to non-specialist stakeholders and multidisciplinary partners. Managing the convergence of physical, biological, and digital spheres to solve societal and environmental challenges. Performing comprehensive ethical and environmental impact assessments for emerging technological interventions.

3. Summary Definition: STEM and STEM Skills

The EIT STEM Tech Talent Induction and Girls Go STEM regard **STEM as an integrated multidimensional framework that connects education, practical skill, and entrepreneurial know-how**. This framework is technically anchored in the International Standard Classification of Education core fields of Natural sciences, mathematics, and statistics (05), Information and Communication Technologies (06), and Engineering, manufacturing, and construction (07) but moves beyond teaching subjects in isolation to create an interdisciplinary environment where interdisciplinary knowledge is applied to solve complex problems and support the development of sustainable businesses.

STEM skills are defined as a multidimensional set of capabilities that enable individuals to transform original ideas into real-world solutions. These skills comprise a strong conceptual foundation in the theories and principles of the three focused ISCED fields. They further encompass a procedural dimension focused on the practical ability to use specific tools and methodologies to solve concrete technical problems. Finally, an innovation mindset integrates interdisciplinary and transversal skills such as critical thinking, creativity, and empathy with professional ethics and responsibility, ensuring that technical talent can navigate uncertainty and generate lasting value for society.