Competence development of STE(A)M educators through online tools and communities

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D8: STE(A)M educator competence framework and profile

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Abstract: This document consists of two parts. The first part describes a competence framework for STE(A)M education. Based on this, the second part describes the STE(A)M educator job role, in a way that it is compatible with the ESCO framework.

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Abstract

The aim of this deliverable is twofold: The first is to describe the competence framework for STE(A)M education that was developed, while the second is to present the STE(A)M educator job role(s) in a way that is compatible with the (European Skills, Competences, Qualifications, and Occupations) ESCO framework.

The Introduction provides the scope of the deliverable, its importance, and its contribution towards the project's objectives. It describes the primary outcomes and its coverage both in the time and educational context of the project.

Chapter 2 underlines the need to investigate STEAM educators' competence framework, along with the challenges that educators face during the implementation of STE(A)M-related courses. In addition, the competence-based perspective is described, providing insights regarding the advantages of creating competence frameworks and profiles.

Chapter 3 describes the methodology and theoretical background utilized to develop and evaluate the STE(A)M competence framework. This methodology includes multiple steps in which educators have a central role and exploit their perspectives and opinions.

Chapter 4 presents the initial version of the STE(A)M educator competence framework. The different perspectives, areas, and competences are described, along with the overall schema and connection.

Chapter 5 presents the different STEAM competence framework applications, including those applied during the STEAMonEdu project, the MOOC and blended course design, and the STE(A)M Self-assessment tool.

Chapter 6 presents the evaluation of the framework, providing the methodology, the data analysis and the results.

Chapter 7 presents the revised competence framework based on its evaluation, while the final chapter (8) describes the job profile(s) based on this framework that was developed.

1 Introduction

The competence framework and the profile of STE(A)M educator are two of the main objectives of WP3, "Design of STE(A)M education framework."

The implementation methodology consists of research techniques (e.g. desk research, crowdsourcing, etc.) and creative techniques (e.g. discussion groups, brainstorming), that were instrumented among the community members.

The methodology focuses on developing the competence framework and the profile description for STE(A)M educators. The competence framework is based on DigComp for Edu. The job profile is based on competences and compatible with ESCO and mapped to European qualifications framework (EQF) / national qualifications frameworks (NQFs). The formulated competence framework has been utilized in order to design the professional development program for STE(A)M educators, including a blended course and a Massive Open Online Course (MOOC) (WP4).

The aim of STE(A)M competence framework for educators is two-fold [1]:

- Firstly, educators use it for evaluation purposes as a self-assessment tool to evaluate themselves and find specific competences that they need to improve.
- Secondly, it must allow for both the support and professional development of STE(A)M educators, both as a guide for the formulation of the learning outcomes of specific training programs and as an assessment tool for evaluating the training program.

2 Background

2.1 The need

Occupations of the future have been changing rapidly and the knowledge and skills acquired today are not foreseen to be sufficient while preparing our students for life. According to the research, 65% of people will be employed in new fields of employment, which are not even known today. It is emphasized about these occupations that 21st-century skills, such as digital skills, critical thinking, cooperation, team spirit, innovative and analytical thinking, are required. Building capacities and developing innovative ways of connecting science to society is a priority under the Europe 2020 strategy. Failure to encourage sufficient numbers of students to sustain their interest in science – into and through technical, vocational, undergraduate and graduate/ doctoral studies – could undermine the success of this strategy.

As a result, the demand for professional and associate professional occupations in the fields of Science, Technology, Engineering and Mathematics (STEM) is expected to grow by 13% and 7%, respectively in the period 2015-2025 in Europe, as opposed to a predicted 3% increase in employment for all occupations. At the same time, basic STEM competences are critical for succeeding in most technical, engineering and even managerial jobs. Therefore STEM education is the main competence source for scientists, engineers, and workers with technological skills [2].

Thus, STEM might be necessary for technological progress, but without the Arts it is impossible for students to reach their full potential. The “A” in STEAM is a term that represents liberal arts, language arts, social studies, physical arts, fine arts, and music. STE(A)M education is about applying creative thinking to STEM projects, igniting students’ imagination and creativity through the arts. It also explores where art naturally fits into the STEM subjects [3]. STE(A)M education makes holistic education possible while putting emphasis on learners’ real life and experiences.

STE(A)M education grew out of STEM education and consists of learning experiences that help students realize how to focus and learn by emphasizing logical, mathematical, experimental, and scientific thinking. At the same time, it increases students’ learning motivation by arousing their curiosity about applying scientific and technical learning in real life situations [4]. The STE(A)M movement builds on existing models of interdisciplinary curriculum, where assists students in exploring content areas by foregrounding a problem or issue using multiple inquiry processes, which naturally connect the disciplines through the problem to be solved [5]. Thus, STE(A)M education empowers educators to employ project-based and inquiry-based learning that crosses each of the five disciplines and fosters an inclusive learning environment in which all students are able to engage and contribute. As opposed to traditional models of teaching, educators using the STE(A)M education approach bring the disciplines together. Through this holistic approach, students are able to exercise both sides of their brain at once [6].

But no transition to STEM or STEAM education will ever be possible without educators' active and full involvement. As teaching strategies change, educators need to update their competence profiles to face STE(A)M education challenges [1]. However, guidance for

educators in terms of how to effectively teach STE(A)M-related courses is lacking [7], [8], [9]. That is why it is widely accepted that any STE(A)M education initiative must first invest in upgrading the competences of educators. In this context, we developed an innovative competency framework by adapting existing professional competency frameworks and related research work regarding STE(A)M education [10].

2.2 Challenges of STE(A)M educators

Studies have also shown that educators lack confidence in delivering science materials and find difficulty gaining students' interest in studying science subjects. There is also evidence for a similar association between confidence, anxiety, and efficacy with teacher effectiveness [11], [12]. In addition, STE(A)M educators face several barriers and challenges regarding teaching STE(A)M-related programs, including pedagogical challenges, curriculum challenges, structural challenges, concerns about students, concerns about assessments, and lack of teacher support [9]. Possible support in order to improve their effort to implement STE(A)M-related programs included collaboration with peers, quality curriculum, district support, prior experiences, and effective professional development.

In addition to this, in previous work of Spyropoulou and Kameas [13], [14] examined the STE(A)M educators' views regarding the challenges, the difficulties and the professional development needs. The results showed that educators face several challenges and difficulties, including a lack of adequate training. In another study of Shernoff et al. [15], the findings show that many teachers are interested in integrated approaches to STE(A)M, but do not believe they are well prepared to implement them. Teachers and administrators also suggested that adequate preparation in integrated STE(A)M would entail a considerable rethinking and redesigning of pre-service courses and in-service workshops. An additional study also focused that there is a need for significantly assist STE(A)M educators, aiming to improve STE(A)M teaching practices [5].

Taking into consideration all the above, as well as the fact that STE(A)M approach is being increasingly used, and based on the innovations that promote, it seems that more work needs to be done in order to understand how best to support teachers as they attempt to integrate STEM and Arts into their classroom and further research and discussion on the knowledge, experiences, attitudes and competences that educators need in order to effectively teach integrated STE(A)M courses is needed [1].

2.3 Competence profiles and Frameworks

Competence is the ability to use knowledge, skills, and personal, social, and/or methodological abilities, in work or study situations and professional and personal development [16]. The Cedefop [17] also describes that competence "*is not limited to cognitive elements (involving the use of theory, concepts or tacit knowledge); it also encompasses functional aspects (including technical skills) as well as interpersonal attributes (e.g. social or organisational skills) and ethical values*".

A competence profile is an assessment tool that consists of a list of tools that an employee needs to possess to be successful in a position. Competence profiles assist in effective learning and development by identifying the behaviours, knowledge, skills, and abilities that are

necessary for successful performance in a job [18]. Educators' competence profiles are used to promote "best practices", provide educators with a clear focus of goal setting for professional growth and efficiency, and help guide educator training and institutionalization of professional development activities. UNESCO [19] has developed a competence profile for educators, which includes a description of the necessary knowledge, skills, and perceptions with which an educator should be equipped to efficiently integrate different innovative digital technologies and systems in educational practice. The digital technologies that are approached mainly concern technically the use of mobile computing systems and smart boards, while in terms of applications, the effort focuses mainly on the exploitation of Web 2.0 applications for teaching and learning. European Committee for Standardisation (CEN) has developed the European e-Competence Framework (e-CF), which provides a reference of competences applied within the ICT sector, and understood by ICT user and supply companies, ICT practitioners, managers and human resources departments, the public sector, educational and social partners across Europe. In 2016 the e-CF framework has become a European standard for ICT competences [20].

In addition, European Commission [21] has developed the European Framework for the Digital Competence of Educators (DigCompEdu), which describes a set of digital competences that enable educators to seize the potential of digital technologies for enhancing and innovating education. The DigCompEdu is a scientifically sound framework describing what it means for educators to be digitally competent. It provides a general reference frame to support the development of educator-specific digital competences in Europe. DigCompEdu is directed towards educators at all levels of education, from early childhood to higher and adult education, including general and vocational education and training, special needs education, and non-formal learning contexts [22]. DigCompEdu details 22 competences organised in six Areas as presented in Figure 1. The focus is not on technical skills. Rather, the framework aims to detail how digital technologies can be used to enhance and innovate education and training. The DigCompEdu study builds on previous work carried out to define citizens' Digital Competence in general, and Digitally Competent Education Oragnisations (DigCompOrg). It contributes to the Commission's recently endorsed Skills Agenda for Europe and the Europe 2020 flagship initiative Agenda for New Skills for New Jobs.

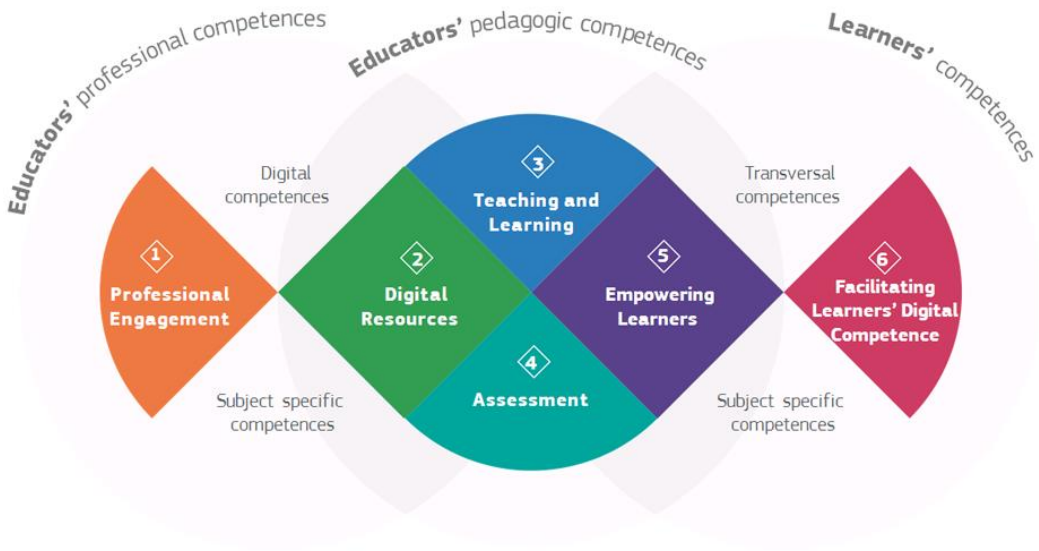

Figure 1: DigCompEdu competence framework (Source: European Commission, EU Science HUD, Digcompedu https://ec.europa.eu/jrc/en/digcompedu)

2.3.1 The SELFIE self-assessment tool

The professional development for educators focuses on empowerment, leadership skills, educators' responsibility for their growth and professionalism, and educators' development of higher order thinking and personal reflection skills [23]. Self-assessment tools are key to educators' ability to implement their professional development. Educators can use information from the self-assessments to identify in a nonthreatening and nonjudgmental context the kinds of changes in practice needed to better serve the learning needs of all students. In this way, teachers can take responsibility for developing their own professional development plan from the very beginning.

The SELFIE tool[1] (Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies) is an example of how a framework could be used in order to be utilized for the development of a self-assessment tool. SELFIE is a free tool designed to help schools embed digital technologies into teaching, learning, and assessment. SELFIE has a strong basis in research and was developed based on the European Commission framework on promoting digital-age learning in educational organisations[2]. The tool has been developed with a team of experts from schools, education ministries and research institutes across Europe. Partner institutions include the European Training Foundation, the European Centre for the Development of Vocational Training (CEDEFOP) and UNESCO's Institute for Information Technologies in Education. It aims to support schools on the use of digital technologies for teaching and learning. It consists of a series of reflection questions and statements for school leaders, teachers and students from upper primary, secondary and vocational schools. Schools can customise the questionnaires and can add up to eight questions of their own. Once participants have replied to the statements, the school receives

[1] https://ec.europa.eu/education/schools-go-digital_en
[2] https://publications.jrc.ec.europa.eu/repository/handle/JRC98209

a detailed report with insights as to how technology is being used. It can help identify gaps and start a discussion in the school and form the basis for an improvement plan.

Recently, the JRC Science Hub[3] of the European Commission has launched the first pilot of the SELFIE for teachers' tool. SELFIE for Teachers is an online tool to help primary and secondary teachers reflect on how they are using digital technologies in their professional practice. Teachers can use the tool to learn more about the digital skills they have and identify areas where they can develop further. It is based on the European Framework for the Digital Competence of Educators. Thus the questions and statements of the self-assessment tool relate to uses of technology in the following areas:

- Professional communication and collaboration
- Personal learning and development
- Finding and creating digital resources
- Teaching and learning practice
- Student assessment
- Facilitating student digital competences

With the same design as SELFIE, by completing the statements, the teacher automatically receives a report on their proficiency level in each of the areas with suggested next steps. This report is for the teacher alone and is not shared unless the teacher chooses to do so. The tool is not designed to assess performance but to empower teachers to reflect on digital technologies use. Based on their results, teachers can design their learning pathways to further develop their digital competence and confidence. The tool can be used by individual teachers or by a team of teachers within the same school.

[3] https://ec.europa.eu/jrc/en

3 Methodology

According to the National Academies of Sciences, Engineering, and Medicine (2017), although educators are at the center of education's expansion into integrated STE(A)M approaches, many of the policies shaping education are formed with little to no input from educators [15]. In addition, during the research on teaching competency, most studies conducted a literature review to establish factors of teaching competency but did not reflect the opinions of educators in the field [24].

Our methodology described in Spyropoulou and Kameas (2020) [25] utilizes a modified Delphi technique, a principal methodology to construct core competency models [26]. Delphi has been used for the development of competency models and to identify the needs of the teaching community in educational research [27]. It refers to multiple rounds of surveys, with groups of participants, which are usually geographically dispersed, and allows them to deal systematically with a complex problem or a task, with the use of quantitative and qualitative data.

At first, based on the literature review and our first phase of research regarding STE(A)M educators' perceptions about challenges, difficulties, training needs and the role of STE(A)M educator [2], [13], a draft STE(A)M Competence Framework has been developed.

For the literature review a set of resources were utilized, including [25]:

- the European Framework for the Digital Competences of Educators (DigCompEdu) [21],
- related procedures regarding STE(A)M education teaching competency [24], [28],
- the European framework of teacher competences [29],
- the report of the STEM competences for the 21st century by UNESCO [7],
- related ICT competency frameworks for teachers [19], and
- the report by OECD regarding teachers' competences [30], and related reports about teacher competences [31] [32].

After the first draft of the framework, an evaluation procedure through discussions was completed within project partners (Greece, Italy, Spain, Germany, Belgium), and, after some adaptations, the first version of the competence framework was produced.

In order to validate this first version and identify areas of possible improvement, a questionnaire-driven online survey was designed, in which participants were asked to answer some self-reflective questions regarding their expertise level in each area, and to share their opinions for the predefined categories and dimensions of the framework, by ranking, adding and/or deleting or rewriting them. By analysing quantitative and qualitative data, a revised competence framework will be produced.

4 The first version of the STE(A)M Educators Competences framework

In Figure 1, the structure of the STE(A)M Educators' competence Framework is presented. At the highest level of the framework are the different perspectives, which represent the different roles that educators have in the education system. Each perspective contains areas, each of which contains a group of competences.

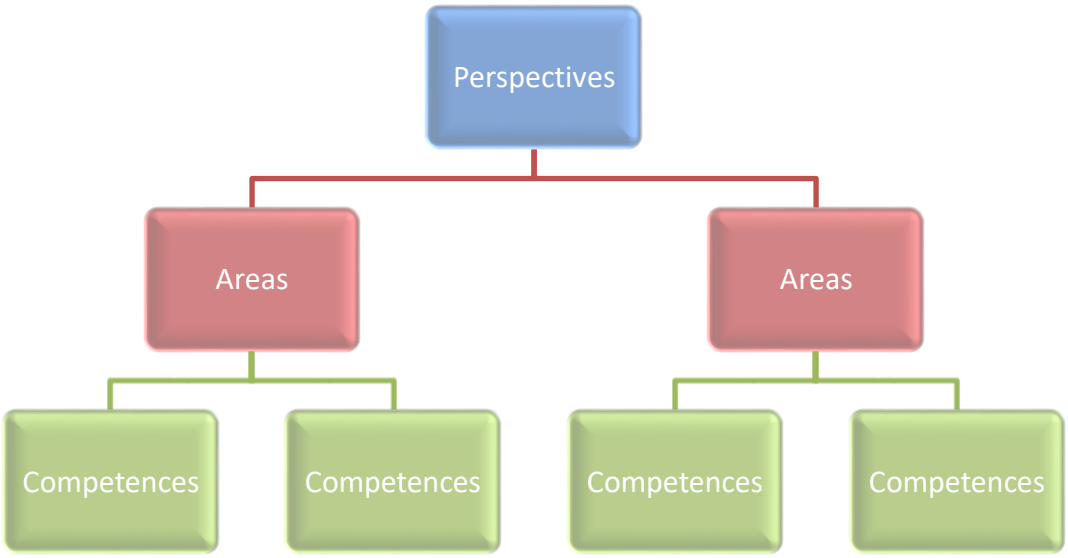

Figure 2: Structure of the framework

The five different perspectives are: [1]:

Educator as teacher-trainer-tutor perspective includes all the required educators' competences during the implementation of an educational procedure that helps students learn. It includes competences related to Pedagogy, Content Knowledge, Instruction, Use of content and tools, Feedback and Assessment and Learner empowerment.

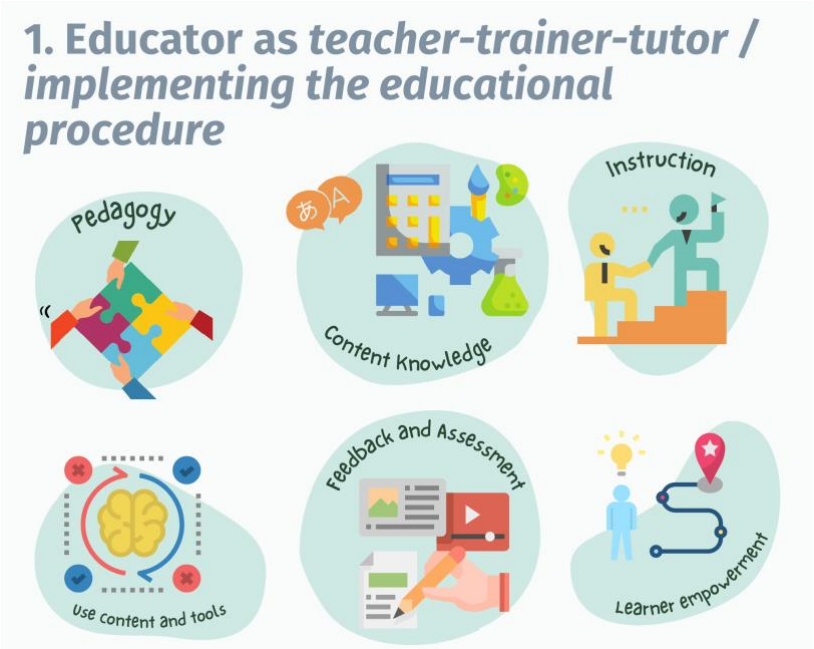

Figure 3: The "Educator as teacher-trainer-tutor" perspective

Educator as a learning designer and creator perspective includes all the required educators' competences related to planning, preparing and developing (a) educational procedures, (b) learning activities and (c) content that are needed in the different phases and settings of STE(A)M-related learning processes. In addition, it features all the supporting competences which aim to boost and facilitate learner development regarding STE(A)M competences.

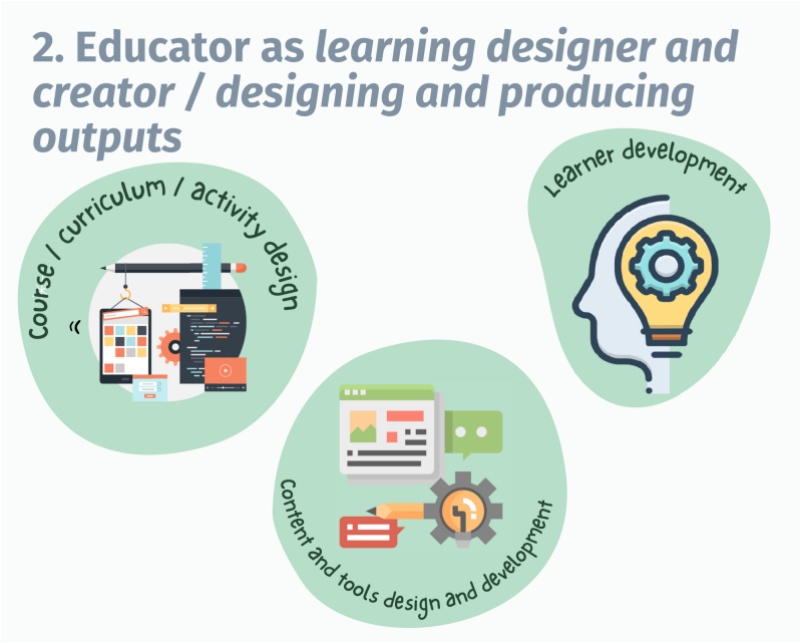

Figure 4: The "Educator as learning designer and creator" perspective

Educator as orchestrator and manager perspective includes all the required educators' competences related to managing and orchestrating (a) the educational procedures, (b) the

content and the digital technologies in teaching and learning (c) the lab and its equipment and (c) group of students or/and other educators during collaborative learning activities.

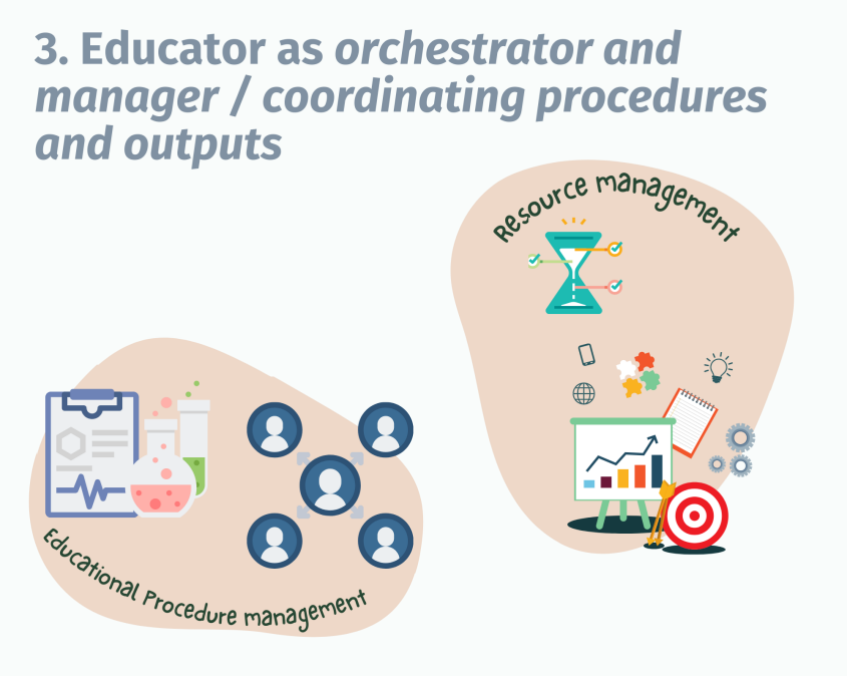

Figure 5: The "Educator as orchestrator and manager" perspective

Educator as community member perspective includes all the required educators' competences related to interacting and engaging with institutional, business, or other STE(A)M-related communities and to applying policies that promote STE(A)M education. With this interaction, educators collaborate and learn (from) other educators and exchange STE(A)M-related experiences.

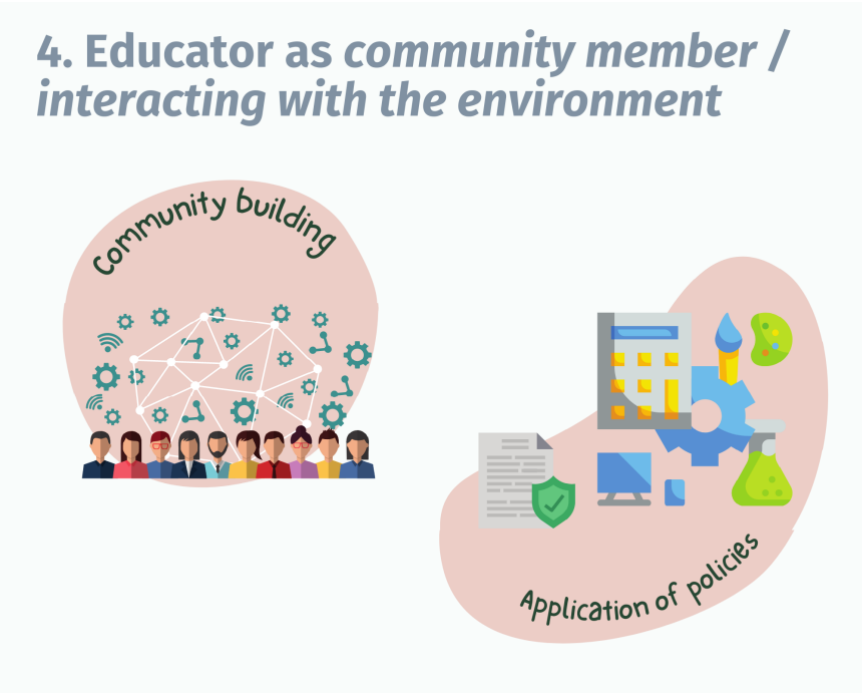

Figure 6: The "Educator as community member" perspective

Educator as professional perspective includes all the required educators' competences related to their professional development alongside transferable and digital skills that are needed during STE(A)M-related activities.

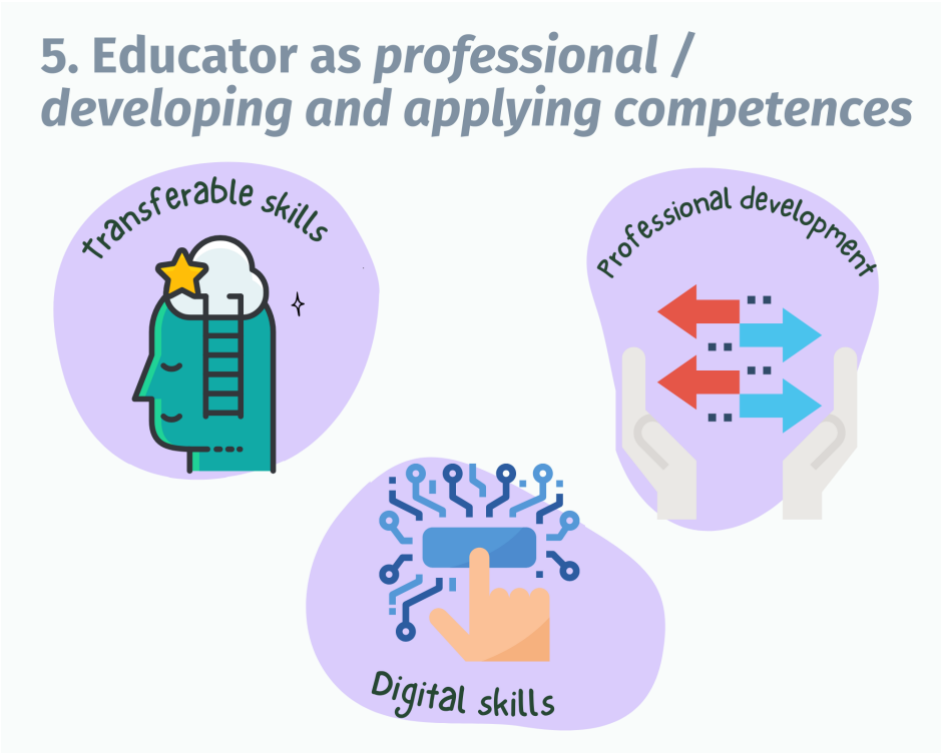

Figure 7: The "Educator as professional" perspective

Table 1 presents in detail the perspectives, areas and competences of the framework, while in Figure 8 the competence framework is depicted graphically. In total, there are 5 different perspectives, 16 areas, and 44 competences, In appendices 1a-1g the STE(A)M educators' competence framework is provided in the 7 different project languages (English, Catalonian, Italian, German, Greek, Romanian, Spanish), along with some examples of statements for each competence.

STE(A)M educators' Competence Framework
1. Educator as teacher-trainer-tutor / implementing the educational procedure
1.1 Pedagogy
1.1.1 Understand and use teaching and learning techniques that promote STE(A)M education
1.1.2 Apply collaborative learning methods in STE(A)M related activities
1.1.3 Promote self-regulated learning in STE(A)M related activities
1.2 Content Knowledge
1.2.1 Understand what STE(A)M education approach represent and mean
1.2.2 Understand the content knowledge of STE(A)M-related topics
1.3 Instruction

STE(A)M educators' Competence Framework
1.3.1 Provide guidance in STE(A)M related activities
1.3.2 Act as a facilitator in STE(A)M related activities
1.3.3 Act as a mentor in STE(A)M related activities
1.4 Use content and tools
1.4.1 Select and use appropriate content and tools for STE(A)M education
1.4.2 Organize and share appropriate content and tools for STE(A)M education
1.5 Feedback and Assessment
1.5.1 Use assessment strategies for STE(A)M education
1.5.2 Use feedback techniques for STE(A)M education
1.6 Learner empowerment
1.6.1 Ensure accessibility and inclusion in STE(A)M related-educational procedures
1.6.2 Ensure active engagement of learners in STE(A)M related-educational procedures
1.6.3 Ensure differentiation and personalization in STE(A)M related-educational procedures
2. Educator as learning designer and creator / designing and producing outputs
2.1 Course / curriculum / activity design
2.1.1 Understand and develop STE(A)M-related Curriculum
2.1.2 Design STE(A)M-related courses
2.1.3 Design STE(A)M-related educational activities
2.2 Content and tools design and development
2.2.1 Create and modify appropriate content for STE(A)M education
2.2.2 Design and Develop software and apps for STE(A)M education
2.3 Learner development
2.3.1 Facilitate learners' STE(A)M competences
2.3.2 Provide guidance for STE(A)M related career opportunities
3. Educator as orchestrator and manager / coordinating procedures and outputs
3.1 Educational Procedure management
3.1.1 Apply teaching organization methods for STE(A)M education
3.1.2 Apply classroom management methods for STE(A)M education
3.2 Resource management
3.2.1 Apply educational resources management methods for STE(A)M education
3.2.2 Apply Lab management methods for STE(A)M education
3.2.3 Apply human resource management methods for STE(A)M education
4. Educator as community member / interacting with the environment
4.1 Community building
4.1.1 Engage in STE(A)M communities of educators
4.1.2 Engage in institutional-based communities for STE(A)M education
4.1.3 Engage in research and business communities for STE(A)M education
4.2 Application of policies

STE(A)M educators' Competence Framework
4.2.1 Apply policies that promote STE(A)M education approach
4.2.2 Develop policies that promote STE(A)M education approach
5. Educator as professional / developing and applying competences
5.1 Transferable skills
5.1.1 Develop leadership skills
5.1.2 Develop presentation and communication skills
5.1.3 Develop critical thinking and problem-solving skills
5.1.4 Apply ethic skills
5.1.5 Develop team work skills
5.1.6 Apply information management skills
5.1.7 Develop entrepreneurship skills
5.2 Digital skills
5.2.1 Develop digital literacy skills
5.2.2 Manage and use digital tools for STE(A)M education
5.3 Professional development
5.3.1 Adapt self-reflective practices for STE(A)M education
5.3.2 Participate in lifelong learning experiences related to STE(A)M educational approach
5.3.3 Act as a Researcher for STE(A)M education

Table 1: STE(A)M educators Competence Framework Perspectives, Areas and Competences

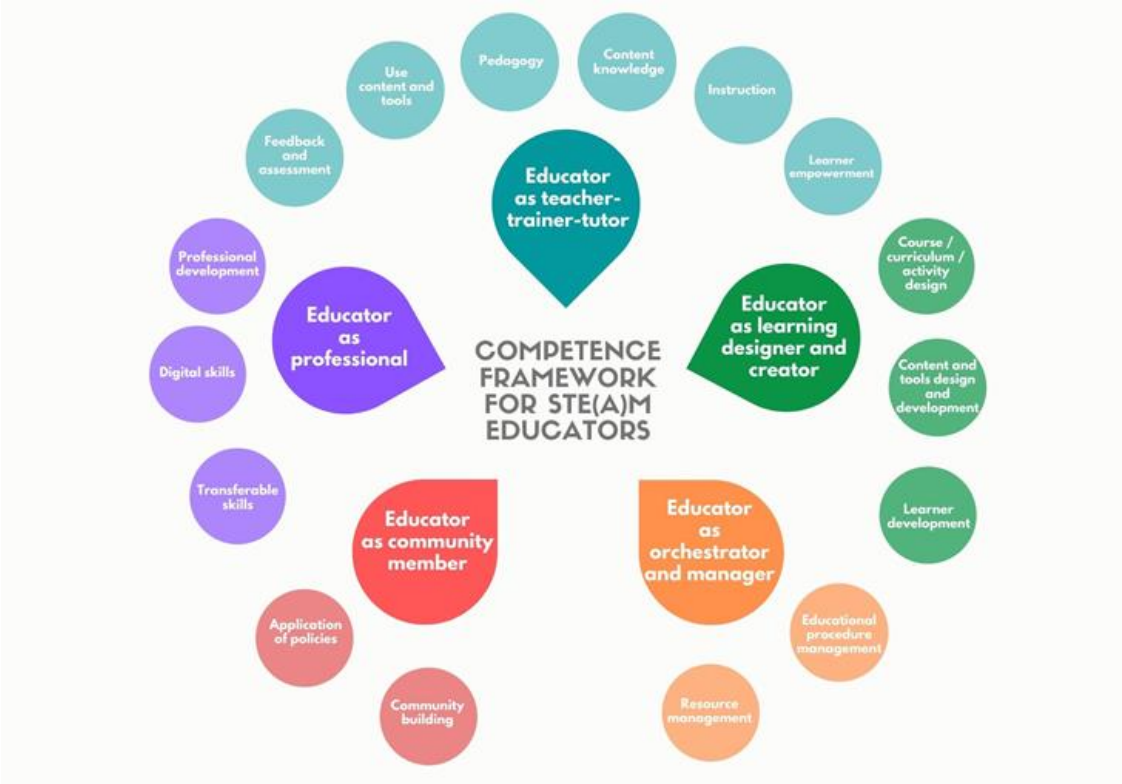

Figure 8: Overview of the Competence Framework for STE(A)M Educators

5 Application of STE(A)M competence framework for educators

Competence-based strategies provide flexibility and personalized learning opportunities with a better learner engagement because the content is relevant to each learner and tailored to his/her unique needs [23]. In addition, this method allows learning individual skills which learners find challenging at their own pace, practicing and refining as much as they need and move rapidly to other skills to which they are more adept [33].

The STE(A)M competence framework for educators has two main aims. The first one is to be usable by educators for evaluation purposes as a self-assessment tool to evaluate themselves and find specific competences that they need to improve. Educators need self-assessment and reflection tools to help them assess fundamental beliefs and assumptions about learning, learners, teaching as well as differences between their perceptions of practice and those held by students in their classroom. More specifically, an example of this exploitation of the STE(A)M competence framework is developing STE(A)M readiness self-assessment tool based on the framework. This tool was designed during the second year of the project that educational organizations and educators could identify their strengths and gaps regarding STE(A)M education. A detailed description of the STE(A)M self-assessment tool is provided in the corresponding deliverables of the STEAMonEDU project [34].

The second aim of the STE(A)M competence framework for educators is to support the professional development of STE(A)M educators, both as a guide for the formulation of the learning outcomes of specific training programs and as an assessment tool for the evaluation of the training program. An example of this exploitation of the framework is the two-phase training programme for STE(A)M educators the the STEAMonEdu project is developing based on the framework. The training program comprises a six-week MOOC and a two-week blended learning course. They are based on the five perspectives of the Competence Framework for STE(A)M educators, which represents the different roles that a STE(A)M educator can have during the educational procedure:

- Educator as a teacher-trainer-tutor
- Educator as a learning designer and creator
- Educator as a orchestrator and manager
- Educator as a community member
- Educator as a professional

A detailed description of the training offer designed based on the STE(A)M competence framework for educators is provided in the corresponding deliverables of the STEAMonEDU project [35].

6 Evaluation of the framework

To evaluate the proposed STE(A)M competence framework, we designed and conducted an online survey with more than 300 participants. The survey aimed to validate and possibly enhance the Competence Framework for STE(A)M educators. We invited educators, researchers, school managers/directors, and policymakers at all levels of education from different organizations and geographic regions to participate in this survey.

The online survey was conducted between the end of November 2020 to end of January 2021.

6.1 Survey Design and Implementation

The main design aspects of the survey were:

- the participants' profile and selection procedure,
- the instruments used for the data collection
- privacy and ethical issues.

6.1.1 Participants

The selection of the appropriate participants was essential for the quality of our study. For that reason, the criteria used for their selection were their expertise on the field, their impact on the field, their availability to complete all the rounds needed and diversity, meaning, selecting participants from different educational levels, geographic regions, and institutions types. Our first aim was to invite educators, but also researchers in STE(A)M education, school managers/directors and policymakers. Each partner was invited to organize some dissemination activities to disseminate the survey, including online workshops and seminars for STE(A)M educators. The number of the targeted participants was 250 participants. However, we finally had 302 participants. Section 6.2.2 summarizes the profile of the 302 participants of the survey.

6.1.2 Instruments

The instruments used for the implementation of the survey were:

- The Information sheet, including the description of the project and its objectives, the reasons that they were selected to participate in the survey, the description of the methodology to be used with guidelines for completing the survey, privacy and ethical issues, as well as potential benefits, potential risk or discomforts, storage of data, anonymity, and confidentiality, right to withdraw, conflict of interest, compensation, participant concerns and reporting.
- The consent form follows the guidelines of the General Data Protection Regulation (EU) 679/2016 ('GDPR').
- The online questionnaire (using the LimeSurvey supported and developed by CTI) to collect the participants' responses. The questionnaire consists of 6 sections and will need approximately 30 minutes to be filled in. More specifically, the online questionnaire consists of the following sections:

Sections 1: Demographics

In section 1, participants were asked about some demographic data, including:

- Gender
- Age
- Country or Region
- Academic Background
- Professional Role
- Years of Experience in teaching
- Years of Experience in STEAM education

Sections 3: Presentation of the STE(A)M Competence Framework

In this section, participants could download the STE(A)M Competence Framework description in seven languages (see Appendix).

Section 4 -8: Questions regarding perspectives, areas and competences of the framework.

In these sections (one section for each perspective), we have asked participants to grade (scale 1-4) each statement (#44) about 3 statements:

- Relevance of the competence [R]
- Importance of the competence [I]
- Clarity of the competence [C]

For each area (#16), an open-ended question was available, where participants were invited to add comments on how they would rephrase or revise competences to better fit within the specific competence area.

Finally, for each perspective (#5), an open-ended question was available, where participants were invited to add comments if they would like to propose additional areas or other comments for each specific perspective.

6.2 Data Analysis

6.2.1 Completeness

All the demographics questions and the close-ended questions in the survey were obligatory; the data set has no missing values. The open-ended questions were not obligatory and some participants left them blank; however, these questions are used for the qualitative analysis. In addition, some participants submitted the survey more than one time. These submissions were identified duplicates were removed (the last submission was kept). In addition, non engage participants or submissions with less than 15 minutes to submit were also removed. Finally, we collected 329 completed surveys, and after clearing the data, we concluded with 302 surveys.

6.2.2 Analysis of Participants Profile

6.2.2.1 Gender and Age

At first, we analysed the distribution of the participants concerning gender and age. As we can see in the following pie chart and diagram, 66.6% (201) of the participants were female. In addition, the majority of the participants (38.4%) are between 41-50, and 85.8% are between 30-60 years old.

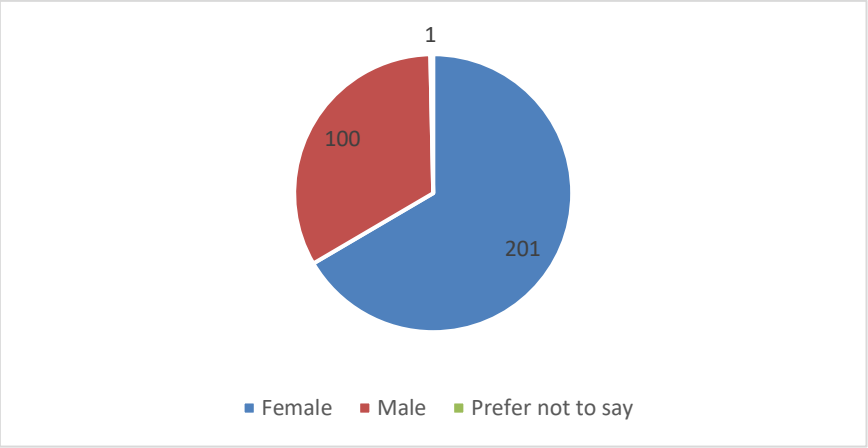

Figure 9: Pie chart with gender distribustion of participants

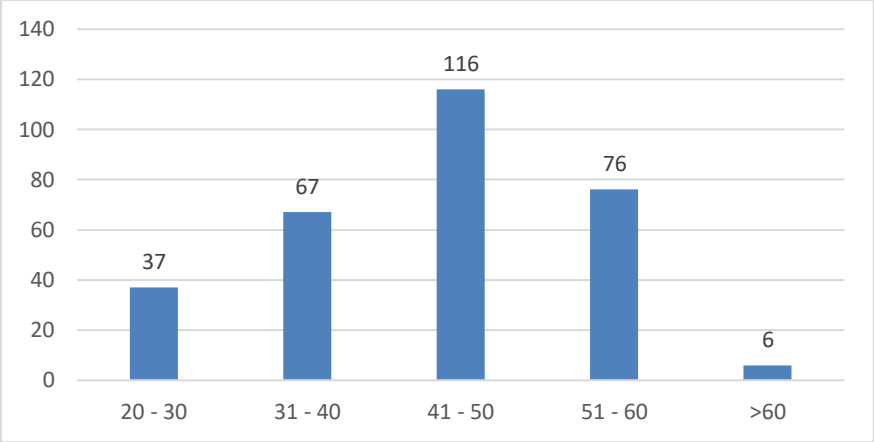

Figure 10: Diagram with age distribution of participants

6.2.2.2 Country or Region

Next, we analysed the geographical distribution of the participants to the survey based on their replies. The following picture and diagram present the distribution of the participants in relation to the country that they belong. As we can see the majority of the participants are from the five countries that the project consortium belongs to. However, participants are from 21 countries in total.

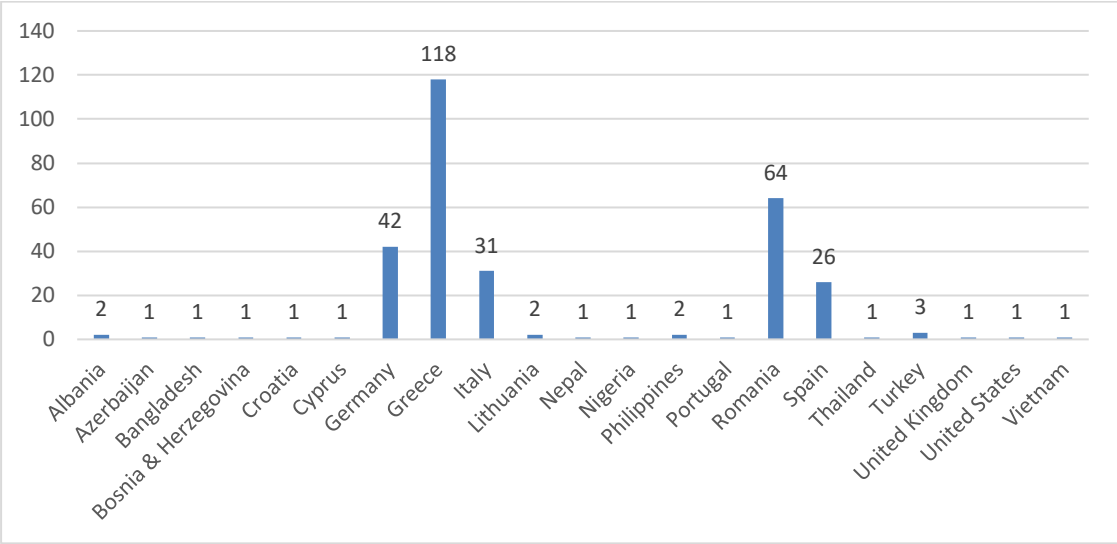

Figure 11: Diagram with country distribution of participants

Figure 12: Map with the country distribution of participants

6.2.2.3 Academic Background and Professional Role

Next, we analysed the distribution of the academic background of the participants and their different professional roles. As shown in Fig. 11, participants are equally distributed regarding their academic background in Humanities/Arts and Social Sciences and Technology and Science sciences. In the professional role, participants could choose on more than one selection. Table 2 presents the results based on the participants' answers.

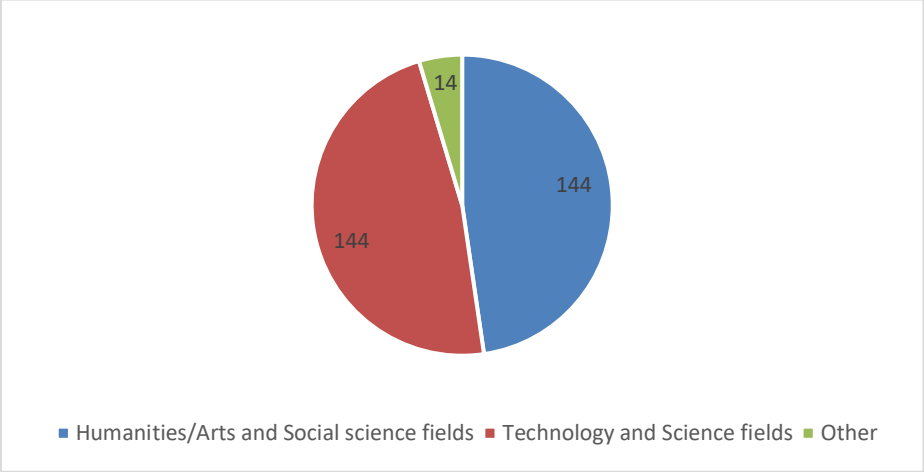

Figure 13: Academic Background distribution of participants

Professional Role	N
Educator	
1. Educator in kindergarten	24
2. Educator in elementary/primary	53
3. Educator in junior in high school/secondary school	130
4. educator in non-formal education	53
5. educator in adult education/lifelong learning education	33
Academic/Researchers in STE(A)M education	
1. Academic involved in teaching Higher Education Courses specifically for STE(A)M education	16
2. Researcher in the field of STE(A)M education	23
Practitioners in STE(A)M education	
1. Professional involved in supporting STE(A)M education initiatives	43
Managers/Policy makers	
1. Formal education manager or director	16
2. Non-formal education manager or director	4
3. Education policy maker	3
Other professional Roles	
1. Postgraduate student in education	5
2. Pre-service teachers	8
3. Researcher in other fields	3
4. ICT consultant	3

Table 2: Professional Role distribution of the participants

6.3 Analysis of the Grades to the competences, areas and perspectives

6.3.1 Reliability Analysis

In this section, a reliability analysis of the closed questions of Sections 4-8 of the Questionnaire as a reliable instrument to validate the proposed STE(A)M Competence Profile framework (including 5 perspectives, 16 areas and 44 statements) is conducted by calculating Cronbach's alpha coefficient which provides a measure of the internal consistency of the set of scale questions. As commonly accepted, Cronbach's alpha index values greater than 0.7 are considered satisfactory. Thus, we calculate the Cronbach's alpha coefficient for all the questions and statements for each area and perspective. From Tables 3 and 4, we can observe a high internal consistency for the perspectives and the areas since the minimum value of α is .885.

Perspective	Cronbach's alpha coefficient (α)
1	.974
2	.946
3	.952
4	.936
5	.962

Table 3: Cronbach's alpha coefficient per perspective

Area	Cronbach's alpha coefficient (α)	Area	Cronbach's alpha coefficient (α)
1.1	.911	**2.3**	.869
1.2	.910	**3.1**	.903
1.3	.913	**3.2**	.937
1.4	.885	**4.1**	.909
1.5	.904	**4.2**	.910
1.6	.913	**5.1**	.941
2.1	.914	**5.2**	.887
2.2	.877	**5.3**	.917

Table 4: Cronbach's alpha coefficient per area

Finally, we calculate the Cronbach's alpha coefficient for the set of all 3 questions within a given statement. Table 5 presents the Cronbach's alpha coefficient for all the questions for each statement in each dimension. From the results we can see that Cronbach's alpha coefficient is consistently between .769 and .877, indicating good internal consistency.

Statements	Cronbach's alpha coefficient (α)	Statements	Cronbach's alpha coefficient (α)
1.1.1	.791	**3.1.1**	.820
1.1.2	.837	**3.1.2**	.860
1.1.3	.838	**3.2.1**	.840
1.2.1	.855	**3.2.1**	.864
1.2.2	.852	**3.2.3**	.877

Statements	Cronbach's alpha coefficient (α)	Statements	Cronbach's alpha coefficient (α)
1.3.1	.769	**4.1.1**	.781
1.3.2	.836	**4.1.2**	.817
1.3.3	.855	**4.1.3**	.813
1.4.1	.818	**4.2.1**	.845
1.4.2	.818	**4.2.2**	.845
1.5.1	.836	**5.1.1**	.838
1.5.2	.871	**5.1.2**	.844
1.6.1	.816	**5.1.3**	.819
1.6.2	.800	**5.1.4**	.878
1.6.3	.813	**5.1.5**	.837
2.1.1	.787	**5.1.6**	.845
2.1.2	.819	**5.1.7**	.846
2.1.3	.834	**5.2.1**	.809
2.2.1	.830	**5.2.2**	.820
2.2.2	.828	**5.3.1**	.842
2.3.1	.822	**5.3.1**	.875
2.3.2	.823	**5.3.3**	.824

Table 5: Cronbach's alpha coefficient per item (competence)

6.3.2 Content Validity

Content validity is the degree to which an instrument has an appropriate sample of items for the construct being measured and is an important procedure in scale development. The content validity index (CVI) is the most widely used index in quantitative evaluation. There are two kinds of CVI: I-CVI and S-CVI/Ave. The first type involves the content validity of individual items and the second involves the content validity of the overall scale (the average). The participants were asked to score each statement's clarity, importance, and relevance using a four-point Likert scale (see section 6.1). To calculate the I-CVI for each item, the proportion of participants who rated either 3 or 4 to the total number of experts was computed [36]. To measure the S-CVI, the average of all I-CVIs was calculated [37]. If this is bigger than 0.75 then the I-CVI is excellent, while the score of 0.7 is acceptable.

Furthermore, data generated from the survey were further analyzed, using Relative Importance Index (RII). The RII was computed as ([38]):

$$RII = \frac{\sum W}{A \times N}$$

where W is the weight given to each factor by the respondents and ranges from 1 to 4; A – the highest weight = 4; N – the total number of respondents. The higher this index is the higher the influence the item imposes on the construction of the survey.

Calculating the indices introduced above, we have the following results.

Perspective 1

In Table 5 we can see that the results for the 302 participants for every item in perspective 1 are over 0.75 for the I-CVI index. Furthermore, the value of S-CVI/Ave is over 0.77, which proves the validity of each statement in perspective 1. The Table also presents the RII index and the RII AVE results. Based on the results, items 1.4.1 and 1.6.2 ranked as the first and second significantly influential factor that accounts for perspective 1.

Items	I-CVI	S-CVI/AVE	RII	RII AVE
1.1.1 [I]	0,889590	0,848580	0,895695	0,867274
1.1.1 [C]	0,829653		0,852649	
1.1.1 [R]	0,826498		0,853477	
1.1.2 [I]	0,883281	0,854890	0,888245	0,869205
1.1.2 [C]	0,845426		0,863411	
1.1.2 [R]	0,835962		0,855960	
1.1.3 [I]	0,835962	0,818086	0,858444	0,850993
1.1.3 [C]	0,807571		0,863411	
1.1.3 [R]	0,810726		0,831126	
1.2.1 [I]	0,864353	0,845426	0,883278	0,866998
1.2.1 [C]	0,823344		0,849338	
1.2.1 [R]	0,84858		0,868377	
1.2.2 [I]	0,845426	0,824395	0,866722	0,853753
1.2.2 [C]	0,810726		0,845199	
1.2.2 [R]	0,817035		0,849338	
1.3.1 [I]	0,851735	0,831756	0,872517	0,849062
1.3.1 [C]	0,832808		0,837748	
1.3.1 [R]	0,810726		0,836921	
1.3.2 [I]	0,839117	0,826498	0,862583	0,851545
1.3.2 [C]	0,835962		0,853477	
1.3.2 [R]	0,804416		0,838576	
1.3.3 [I]	0,804416	0,790747	0,842715	0,833057
1.3.3 [C]	0,798107		0,833609	
1.3.3 [R]	0,769716		0,822848	
1.4.1 [I]	0,88959	0,866456	0,898179	0,887693
1.4.1 [C]	0,85489		0,875828	
1.4.1 [R]	0,85489		0,889073	
1.4.2 [I]	0,861199	0,848580	0,874172	0,863962
1.4.2 [C]	0,84858		0,857616	
1.4.2 [R]	0,835962		0,860099	
1.5.1 [I]	0,835962	0,800210	0,856788	0,832230
1.5.1 [C]	0,804416		0,834437	
1.5.1 [R]	0,760252		0,805464	
1.5.2 [I]	0,858044	0,838065	0,880795	0,858168

Items	I-CVI	S-CVI/AVE	RII	RII AVE
1.5.2 [C]	0,820189		0,846026	
1.5.2 [R]	0,835962		0,847682	
1.6.1 [I]	0,867508		0,878311	
1.6.1 [C]	0,810726	0,832808	0,850993	0,861755
1.6.1 [R]	0,820189		0,855960	
1.6.2 [I]	0,851735		0,888245	
1.6.2 [C]	0,864353	0,862250	0,876656	0,883278
1.6.2 [R]	0,870662		0,884934	
1.6.3 [I]	0,842271		0,854305	
1.6.3 [C]	0,81388	0,828601	0,832781	0,841336
1.6.3 [R]	0,829653		0,836921	

Table 6: Resutls of I-CVI and RII in Perspective 1

Perspective 2

Following the same procedure, table 7 presents the results for Perspective 2. We notice here that the index of I-CVI for the Items 2.2.2 [I] and 2.2.2 [R] appear to be on the boundary of the accept level (0,7), and as a result, the index of S-CVI/Ave is at its lowest value on this Perspective. These results were also confirmed by the index RII as we have the lowest value in this dimension with 0,787252 and 0,782285 respectively. As a result of this 2.2.2 statement appears to be the least influential factor from the rest of the statements. Although the items scores are not below the limit of 0.7 may be needing more analysis on this statement. For perspective 2, items 2.1.3, 2.31 and 2.1.2 seem to be the most important factors for this perspective.

Items	I-CVI	S-CVI/AVE	RII	RII AVE
2.1.1 [I]	0,858044		0,871689	
2.1.1 [C]	0,845426	0,843323	0,856788	0,858444
2.1.1 [R]	0,826498		0,846854	
2.1.2 [I]	0,870662		0,881623	
2.1.2 [C]	0,839117	0,849632	0,858444	0,865618
2.1.2 [R]	0,839117		0,856788	
2.1.3 [I]	0,886435		0,893212	
2.1.3 [C]	0,876972	0,883281	0,867550	0,879691
2.1.3 [R]	0,886435		0,878311	
2.2.1 [I]	0,829653		0,860099	
2.2.1 [C]	0,81388	0,818086	0,840232	0,843267
2.2.1 [R]	0,810726		0,829470	
2.2.2 [I]	0,731861		0,787252	
2.2.2 [C]	0,788644	0,741325	0,825331	0,798289
2.2.2 [R]	0,70347		0,782285	
2.3.1 [I]	0,858044	0,85489	0,877483	0,860532
2.3.1 [C]	0,845426		0,846026	

Items	I-CVI	S-CVI/AVE	RII	RII AVE
2.3.1 [R]	0,861199		0,858086	
2.3.2 [I]	0,835962		0,855132	
2.3.2 [C]	0,804416	0,814932	0,851821	0,844371
2.3.2 [R]	0,804416		0,826159	

Table 7: Resutls of I-CVI and RII in Perspective 2

Perspective 3

In accordance with Perspective 1 and 2 the calculation of I-CVI and s-CVI/Ave indices is shown in Table 8, for the Perspective 3. We notice here that the index of I-CVI for the Items 3.2.3 [R] and 3.2.3 [C] appear to be on the boundary of the accept level (0,7) and as a result the index of S-CVI/Ave is at its lowest value on this Perspective. Moreover, the RII AVE index for 3.2.3 also appears to be low in accordance with the I-CVI result. Although the items scores are not below the limit of 0.7 may be needing more analysis on this statement. Statement 3.1.2 seems to be the most important factor for this perspective.

Items	I-CVI	S-CVI/AVE	RII	RII AVE
3.1.1 [I]	0,832808		0,844371	
3.1.1 [C]	0,785489	0,811777	0,817053	0,829746
3.1.1 [R]	0,817035		0,827815	
3.1.2 [I]	0,829653		0,853477	
3.1.2 [C]	0,798107	0,807571	0,829470	0,840232
3.1.2 [R]	0,794953		0,837748	
3.2.1 [I]	0,84858		0,850166	
3.2.1 [C]	0,77918	0,797056	0,807947	0,819812
3.2.1 [R]	0,763407		0,801325	
3.2.2 [I]	0,794953		0,823675	
3.2.2 [C]	0,753943	0,773922	0,807947	0,811258
3.2.2 [R]	0,772871		0,802152	
3.2.3 [I]	0,77918		0,819536	
3.2.3 [C]	0,735016	0,746583	0,793874	0,799945
3.2.3 [R]	0,725552		0,786424	

Table 8: Resutls of I-CVI and RII in Perspective 3

Perspective 4

Moving at Dimension D4, based on the results in Table x, we notice that the scores of 4.2.2 [I] and 4.2.2 [R] are a little above the limit of 0.7 with 0,725552 and 0,741325, respectively. Also, the index of S-CVI/Ave and RII of the statement 4.2.2 is the lowest value on this Perspective. On the other hand, statement 4.1.1 seems to be the most important factor for this perspective.

Items	I-CVI	S-CVI/AVE	RII	RII AVE
4.1.1 [I]	0,842271	0,824395	0,872517	0,858996
4.1.1 [C]	0,826498		0,862583	

Items	I-CVI	S-CVI/AVE	RII	RII AVE
4.1.1 [R]	0,804416		0,841887	
4.1.2 [I]	0,807571	0,798107	0,834437	0,829194
4.1.2 [C]	0,81388		0,841060	
4.1.2 [R]	0,772871		0,812086	
4.1.3 [I]	0,772871	0,780231	0,806291	0,817881
4.1.3 [C]	0,817035		0,846026	
4.1.3 [R]	0,750789		0,801325	
4.2.1 [I]	0,794953	0,773922	0,826987	0,811810
4.2.1 [C]	0,766562		0,806291	
4.2.1 [R]	0,760252		0,802152	
4.2.2 [I]	0,725552	0,745531	0,794702	0,799393
4.2.2 [C]	0,769716		0,813742	
4.2.2 [R]	0,741325		0,789735	

Table 9: Resutls of I-CVI and RII in Perspective 4

Perspective 5

Finally, table 10, presents the results for perspective 5. We notice that three statements have lower scores for I-CVI and S-CVI/AVE, which are 5.1.1, 5.1.7 and 5.3.3. In the 5.1.1 statement, we notice that because the rest item in this statement is reasonably high, there is no significant influence of the RII AVE as it scores over 0.80. However, the RII AVE for 5.17 and 5.3.3 statements are 0,785596 and 0,798841. Thus, although the items scores for these two statements are not below the limit of 0.7 may need more analysis on this statement. The statements 5.1.5, 5.2.1, 5.2.2 seem to be the most important factor for this perspective.

Items	I-CVI	S-CVI/AVE	RII	RII AVE
5.1.1 [I]	0,741325		0,799669	
5.1.1 [C]	0,785489	0,757098	0,824503	0,806291
5.1.1 [R]	0,744479		0,794702	
5.1.2 [I]	0,870662		0,884934	
5.1.2 [C]	0,829653	0,847529	0,865066	0,873620
5.1.2 [R]	0,842271		0,870861	
5.1.3 [I]	0,88959		0,905629	
5.1.3 [C]	0,839117	0,869611	0,885762	0,897627
5.1.3 [R]	0,880126		0,901490	
5.1.4 [I]	0,839117		0,864238	
5.1.4 [C]	0,820189	0,823344	0,851821	0,854305
5.1.4 [R]	0,810726		0,846854	
5.1.5 [I]	0,895899		0,912252	
5.1.5 [C]	0,858044	0,883281	0,893212	0,906181
5.1.5 [R]	0,895899		0,913079	
5.1.6 [I]	0,867508		0,879139	
5.1.6 [C]	0,81388	0,835962	0,860099	0,864701
5.1.6 [R]	0,826498		0,854866	

Items	I-CVI	S-CVI/AVE	RII	RII AVE
5.1.7 [I]	0,747634		0,789735	
5.1.7 [C]	0,735016	0,727655	0,794702	0,785596
5.1.7[R]	0,700315		0,772351	
5.2.1 [I]	0,895899		0,912252	
5.2.1 [C]	0,864353	0,884332	0,894040	0,904525
5.2.1 [R]	0,892744		0,907285	
5.2.2 [I]	0,880126		0,900662	
5.2.2 [C]	0,873817	0,874869	0,898179	0,896247
5.2.2 [R]	0,870662		0,889901	
5.3.1 [I]	0,85489		0,857616	
5.3.1 [C]	0,810726	0,819138	0,831954	0,837196
5.3.1 [R]	0,791798		0,822020	
5.3.2 [I]	0,829653		0,863411	
5.3.2 [C]	0,801262	0,810726	0,847682	0,852925
5.3.2 [R]	0,801262		0,847682	
5.3.3 [I]	0,735016		0,788079	
5.3.3 [C]	0,804416	0,754995	0,831126	0,798841
5.3.3 [R]	0,725552		0,777318	

Table 10: Resutls of I-CVI and RII in Perspective 5

Summarizing in Table 11, one may raise a concern for the following items that appear all with a low score for the I-CVI, S-CVI/Ave indices, and RII and RII AVE, which may need further analysis.

	Perspective 1	Perspective 2	Perspective 3	Perspective 4	Perspective 5
[I]		2.2.2 [I]		4.2.2 [I]	5.3.3 [I] 5.1.7 [I] 5.1.1 [I]
[C]			3.2.3 [C]		5.1.7 [C]
[R]		2.2.2 [R]	3.2.3 [R]	4.2.2 [R]	5.1.7[R] 5.1.1 [R]

Table 11: Items with low I-CV and RII

We will do further analysis using descriptive statistics. Table 12 shows the mean grades for each question calculated for each item.

Items	Mean	Median	Items	Mean	Median	Items	Mean	Median
1.1.1 [I]	3,58	4,00	**1.6.3 [R]**	3,35	3,00	**4.1.3 [C]**	3,38	4,00
1.1.1 [C]	3,41	4,00	**2.1.1 [I]**	3,49	4,00	**4.1.3 [R]**	3,21	3,00
1.1.1 [R]	3,41	4,00	**2.1.1 [C]**	3,43	4,00	**4.2.1 [I]**	3,31	4,00
1.1.2 [I]	3,55	4,00	**2.1.1 [R]**	3,39	4,00	**4.2.1 [C]**	3,23	3,00
1.1.2 [C]	3,45	4,00	**2.1.2 [I]**	3,53	4,00	**4.2.1 [R]**	3,21	3,00
1.1.2 [R]	3,42	4,00	**2.1.2 [C]**	3,43	4,00	**4.2.2 [I]**	3,18	3,00
1.1.3 [I]	3,43	4,00	**2.1.2 [R]**	3,43	4,00	**4.2.2 [C]**	3,25	4,00
1.1.3 [C]	3,33	4,00	**2.1.3 [I]**	3,57	4,00	**4.2.2 [R]**	3,16	3,00
1.1.3 [R]	3,32	3,00	**2.1.3 [C]**	3,47	4,00	**5.1.1 [I]**	3,20	3,00
1.2.1 [I]	3,53	4,00	**2.1.3 [R]**	3,51	4,00	**5.1.1 [C]**	3,30	4,00
1.2.1 [C]	3,40	4,00	**2.2.1 [I]**	3,44	4,00	**5.1.1 [R]**	3,18	3,00
1.2.1 [R]	3,47	4,00	**2.2.1 [C]**	3,36	4,00	**5.1.2 [I]**	3,54	4,00
1.2.2 [I]	3,47	4,00	**2.2.1 [R]**	3,32	3,00	**5.1.2 [C]**	3,46	4,00
1.2.2 [C]	3,38	4,00	**2.2.2 [I]**	3,15	3,00	**5.1.2 [R]**	3,48	4,00
1.2.2 [R]	3,40	4,00	**2.2.2 [C]**	3,30	4,00	**5.1.3 [I]**	3,62	4,00
1.3.1 [I]	3,49	4,00	**2.2.2 [R]**	3,13	3,00	**5.1.3 [C]**	3,54	4,00
1.3.1 [C]	3,35	3,00	**2.3.1 [I]**	3,51	4,00	**5.1.3 [R]**	3,61	4,00
1.3.1 [R]	3,35	4,00	**2.3.1 [C]**	3,38	4,00	**5.1.4 [I]**	3,46	4,00
1.3.2 [I]	3,45	4,00	**2.3.1 [R]**	3,44	4,00	**5.1.4 [C]**	3,41	4,00
1.3.2 [C]	3,41	4,00	**2.3.2 [I]**	3,42	4,00	**5.1.4 [R]**	3,39	4,00
1.3.2 [R]	3,35	4,00	**2.3.2 [C]**	3,41	4,00	**5.1.5 [I]**	3,65	4,00
1.3.3 [I]	3,37	4,00	**2.3.2 [R]**	3,30	3,00	**5.1.5 [C]**	3,57	4,00
1.3.3 [C]	3,33	4,00	**3.1.1 [I]**	3,38	4,00	**5.1.5 [R]**	3,65	4,00
1.3.3 [R]	3,29	4,00	**3.1.1 [C]**	3,27	3,00	**5.1.6 [I]**	3,52	4,00
1.4.1 [I]	3,59	4,00	**3.1.1 [R]**	3,31	3,00	**5.1.6 [C]**	3,44	4,00
1.4.1 [C]	3,50	4,00	**3.1.2 [I]**	3,41	4,00	**5.1.6 [R]**	3,41	4,00
1.4.1 [R]	3,56	4,00	**3.1.2 [C]**	3,32	4,00	**5.1.7 [I]**	3,16	3,00
1.4.2 [I]	3,50	4,00	**3.1.2 [R]**	3,35	4,00	**5.1.7 [C]**	3,18	3,00
1.4.2 [C]	3,43	4,00	**3.2.1 [I]**	3,40	4,00	**5.1.7[R]**	3,09	3,00

Items	Mean	Median	Items	Mean	Median	Items	Mean	Median
1.4.2 [R]	3,44	4,00	**3.2.1 [C]**	3,23	3,00	**[5.2.1 [I]**	3,65	4,00
1.5.1 [I]	3,43	4,00	**[3.2.1 [R]**	3,21	3,00	**5.2.1 [C]**	3,58	4,00
1.5.1 [C]	3,34	4,00	**3.2.2 [I]**	3,29	3,00	**5.2.1 [R]**	3,63	4,00
1.5.1 [R]	3,22	3,00	**3.2.2 [C]**	3,23	3,00	**5.2.2 [I]**	3,60	4,00
1.5.2 [I]	3,52	4,00	**3.2.2 [R]**	3,21	3,00	**5.2.2 [C]**	3,59	4,00
1.5.2 [C]	3,38	4,00	**3.2.3 [I]**	3,28	3,00	**5.2.2 [R]**	3,56	4,00
1.5.2 [R]	3,39	4,00	**3.2.3 [C]**	3,18	3,00	**5.3.1 [I]**	3,43	4,00
1.6.1 [I]	3,51	4,00	**3.2.3 [R]**	3,15	3,00	**5.3.1 [C]**	3,33	4,00
1.6.1 [C]	3,40	4,00	**4.1.1 [I]**	3,49	4,00	**5.3.1 [R]**	3,29	3,00
1.6.1 [R]	3,42	4,00	**4.1.1 [C]**	3,45	4,00	**5.3.2 [I]**	3,45	4,00
1.6.2 [I]	3,55	4,00	**4.1.1 [R]**	3,37	4,00	**5.3.2 [C]**	3,39	4,00
1.6.2 [C]	3,51	4,00	**4.1.2 [I]**	3,34	4,00	**5.3.2 [R]**	3,39	4,00
1.6.2 [R]	3,54	4,00	**4.1.2 [C]**	3,36	4,00	**5.3.3 [I]**	3,15	3,00
[1.6.3 [I]	3,42	4,00	**4.1.2 [R]**	3,25	3,00	**5.3.3 [C]**	3,32	4,00
1.6.3 [C]	3,33	3,00	**4.1.3 [I]**	3,23	3,00	**5.3.3 [R]**	3,11	3,00

Table 12: Mean and median scores of items

Next, we calculate the frequency and percentage of the answers with score 1,2,3 or 4 for every item. The following diagram presents the percentage of the grades for the items with the lower scores.

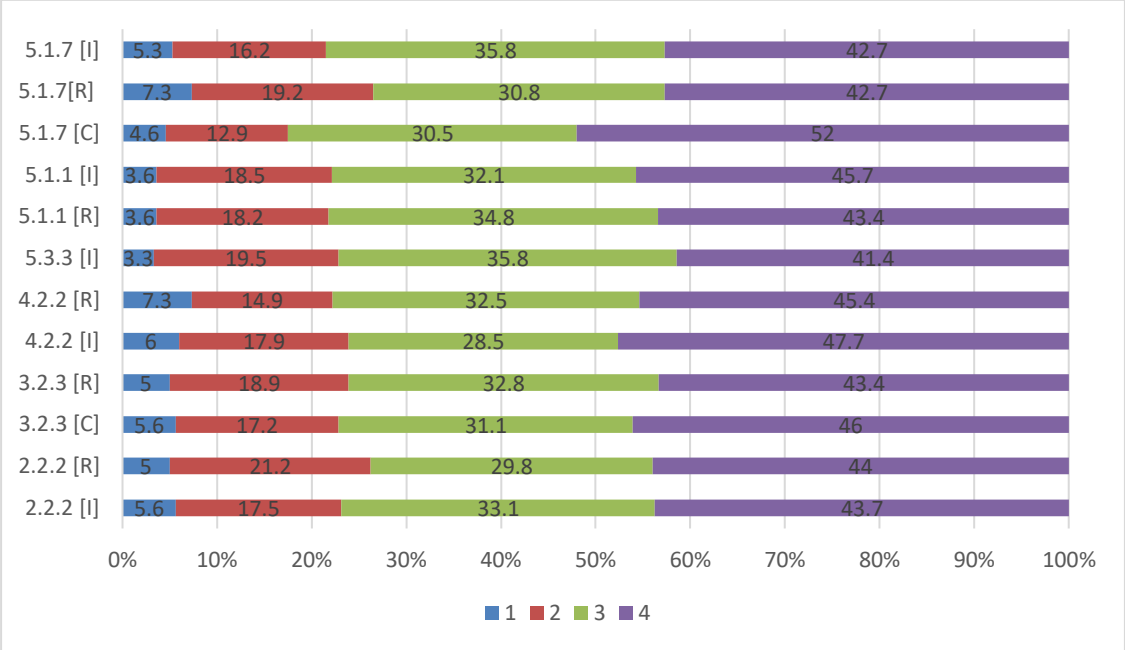

Figure 14: Distribution of the scores in the lower items

Previous results demonstrate that all the items that appeared with a low score of I-CVI, S-CVI/Ave index in the previous section have the lower mean scores. However, there is no item with a mean score lower than 3. In conclusion, during the next steps, we will further study for revision the following statements Regarding:

- Importance of the statement: 5.1.7, 5.3.3,4.2.2, 2.2.2
- Relevance with the framework: 5.1.7, 5.1.1, 2.2.2, 3.2.3, 4.2.2
- Clarity of the statement: 5.1.7, 3.2.3

6.3.3 Recommendations from Quantitative Analysis and Qualitative Analysis

Extending the previous quantitative analysis, a qualitative analysis of the responses was conducted as well. The aim was to provide more complete and holistic processing of the survey input and to substantiate further the revision of the statements, where needed, based on the participants' feedback. Furthermore, diving into the specific comments of the experts and considering their particular suggestions was expected to shed light on understanding possible misconceptions, ambiguities or inaccuracies, and contribute to revising the statements, areas, and perspectives of the STE(A)M Competence Framework in a meaningful manner.

The open-ended questions were formed into two types of open-text questions:

- Their comments about rephrasing or revise of the statements (competences) to better fit within the competence area
- Their comments about additional competence or area for each perspective

In total, 76 out of the 302 participants provided answers to open-ended questions, as they were not mandatory. Table 13 presents the number and percentage of each area's comments and perspective in general received. We can notice that Perspective 1 had the higher number of comments (44% of the comments, while Perspective 4 received the lower comments (10% of the comments).

Areas and Perspectives	Comments	
	(n)	%
Area 1.1	46	44
Area 1.2	38	
Area 1.3	37	
Area 1.4	30	
Area 1.5	31	
Area 1.6	25	
Perspective 1	11	
Area 2.1	22	18
Area 2.2	25	
Area 2.3	30	
Perspective 2	13	
Area 3.1	26	13
Area 3.2	26	
Perspective 3	11	
Area 4.1	21	10
Area 4.2	22	
Perspective 4	9	
Area 5.1	25	15
Area 5.2	17	
Area 5.3	22	
Perspective 5	9	
Sum	496	100

Table 13: Number and percentage of comments on open-ended questions

Following the grounded theory [39], the qualitative outcomes emerged from the free texts of participants and generated corresponding explanations. The Grounded Theory approach provides a methodology that is often used to address questions in a qualitative manner, starting with line-by-line open coding of data and moving towards the emergence of patterns. The continuous analysis supports the researchers in deciding what data to collect next to develop the theory further as it emerges. Thus, analysis of the open-ended questions was characterized by "iterative processes of going back and forth between progressively more focused data and successively more abstract categorizations of them" [40]. More specifically, the thematic analysis method was followed, which is considered the most commonly used and the most helpful method of capturing the complexities of meaning in textual data [41]. The categories that were identified included a) rephrase proposals, which include comments where participants propose different phrases for specific perspective, areas, or competences, b) additional competences, whice include comments where participants suggest the addition of new competence, c) problematic areas, which include comments where participants

describe their their concerns about specific areas or comteptences such as overlap problems or difficutlies to understand the meaning of the competence, d) general comments, which include general comments for specific perspectives.

As result, the following modifications were made:

General changes:

- Separate competences where different verbs where used (e.g. design and develop)
- Specific examples that clarify specific terms are provided in parenthesis, where needed, next to the competence statement
- Competences emerged when they overlapped each other
- Clarify the differences between connected competences and areas (e.g. use of educational material and design educational material)
- For the digital skills, the DigComp used utilized to revise the specific competences
- Addition about the aspect of parents-educator interaction in the community building perspective

As a result, the following modifications were made:

- 1.1.1, 1.1.2, 1.1.3 competences of area 1.1 Pedagogy were re-written with specific examples to separate the different techniques and focus on these three competences.
- In 1.1.3 competence the “self-regulated learning” was changed to “student-centered learning” as proposed by participants
- 1.2 area Content Knowledge changed with the name “STE(A)M education foundations” in order to better represent the aim of its specific area.
- 1.2.1 changed with the name “1.2.1 Understand the differences of STEM education as compared to integrated STEAM education” in order to focus on the integrated approach of STEAM education
- 1.2.2 changed to “1.2.2 Understand the contribution of Arts (A) to STE(A)M” as the “understand the content knowledge of STEAM-related topics” created misunderstandings
- 1.3 area Instruction was transferred in the area Pedagogy as a new competence “1.1.4 Provide guidance and support in STEAM educational activities.”
- 1.4.1 and 1.4.2 competences were separated into 3 different competences regarding identifying, selecting and using appropriate content and tools for STE(A)M education, as 1.4.1 overlaps 1.4.2 to some extent.
- 1.5.1 was re-written into “Use diversity and suitable assessment formats and approaches for both formative and summative assessment.” in order to provide more explanations
- 1.5.2 was re-written into “Provide targeted and timely feedback to learners” in order to provide more explanations

- A new competence was added to include the analysis of learners progress in order to inform teaching and to learn "Analyse learner activity performance and progress in order to inform teaching and learning."
- The title of Perspective 2 from 2. Educator as learning designer and creator / designing and producing outputs re-written into "2. Educator as learning designer and creator / designing and creating learning opportunities."
- 2.1 area title "Course/ curriculum / activity design" changed to "Educational design" in order to fit in all types of education
- In the 2.1.1 competence we removed the verb "develop curriculum" and changed it into "Implement integrated curricula for STEAM education". In addition, the competence moved in the area 1.1 Pedagogy
- 2.1.2 and 2.1.3 competences were re-written into 3 different competences "2.1.1 Design educational content for STE(A)M education", "2.1.2 Develop educational content for STE(A)M education", "2.1.3 Design educational units for STE(A)M education" in order to fit in all types and levels of education
- 2.2 area emerged with 2.1 area in order to reduce overlap competences. The one competence was formulated "Create educational tools for STE(A)M education"
- 2.3.2 comptence re-written into "2.2.2 Provides guidance on STE (A) M related learning experiences" in order to fit in all types and levels of education
- 3.1.1 and 3.1.2 were emerged into one competence "3.1.1 Apply teaching and learning organization methods for STE(A)M education" as 3.1.1 overlaps 3.1.2. Thus, 3.1 area and 3.2 area emerged with the title "3.1 Educational procedure and resource coordination"
- 3.1.3 competnece was re-written into "3.1.3 apply teaching space management methods in STE (A) M education" in order to fit in all types and levels of education
- 3.2.3 competence was separated into 2 competences one for the coordination of learners and one for the coordination of team of educators. Thus the 3.2 area was renamed into "Stakeholders coordination"
- 4.2.2 competence was changed from "develop policies" as suggested and focused on steam education awareness in the whole educational community (learners, parents, eduators etc.)
- 5.1.1, 5.1.5 and 5.16 overlapped the competences 1.1.2, 3.2.3, 2.3.1 thus were emerged
- Competences in the 5.2 area "Digital Skills" were expanded into 5 different competences based on the DigComp as suggested
- 5.3.3 competence was re-written into "Apply action research procedures for reflection and improvement of educational procedures in STEAM education" in order to provide more explanations

7 Revised STE(A)M Competence Framework

Table 14 presents the revised STE(A)M Competence Framework after its evaluation by the community.

STE(A)M educators' Competence Framework
1. Educator as teacher-trainer-tutor / implementing the educational procedure
1.1 Pedagogy
1.1.1 Apply teaching and learning techniques that promote STE(A)M education (e.g. inquiry-based learning, problem-based , game-based learning techniques that enhance complex questions developing critical thinking, exploring social issues and developing solutions to real problems)
1.1.2 Apply teamwork methods and group dynamic techniques for collaborative learning activities (e.g. collaborative techniques which guide learners to cooperate and communicate with each other effectively)
1.1.3 Promote student-centered learning in STE(A)M educational activities (e.g. activities where learners design, reflect, search for information, share ideas and discover creative solutions to problems.)
1.1.4 Provide guidance and support in STEAM educational activities
1.1.5 Implement integrated curricula for STEAM education
1.2 STEAM education foundations
1.2.1 Understand the differences of STEM education as compared to integrated STEAM education
1.2.2 Understand the contribution of Arts (A) to STE(A)M
1.3 Use of content and tools
1.3.1 Identify appropriate content, educational material and tools for STE(A)M education
1.3.2 Select appropriate content, educational material and tools for STE(A)M education
1.3.3 Use appropriate content, educational material and tools for STE(A)M education
1.4 Feedback and Assessment
1.4.1 Use diversity and suitable assessment formats and approaches for both formative and summative assessment
1.4.2 Analyse and learner activity performance and progress in order to inform teaching and learning
1.4.3 Provide targeted and timely feedback to learners
1.5 Learner empowerment
1.5.1 Ensure accessibility and inclusion in STE(A)M related-educational procedures
1.5.2 Ensure active engagement of learners in STE(A)M related-educational procedures
1.5.3 Ensure differentiation and personalization in STE(A)M related-educational procedures
2. Educator as learning designer and creator / designing and creating learning opportunities
2.1 Educational design
2.1.1 Design educational learning objects for STE(A)M education
2.1.2 Develop educational learning objects for STE(A)M education
2.1.3 Design educational units for STE(A)M education
2.1.4 Create educational tools for STE(A)M education

STE(A)M educators' Competence Framework
2.2 Learner development
2.2.1 Facilitate learners' STE(A)M competences
2.2.2 Provide guidance on STE (A) M related learning experiences
3. Educator as orchestrator / coordinating procedures and outputs
3.1 Educational procedure and resource coordination
3.1.1 Apply teaching and learning organization methods for STE(A)M education
3.1.2 Apply educational resources management methods for STE(A)M education
3.1.3 Apply teaching space management methods in STE(A)M education
3.2 Stakeholders coordination
3.2.1 Coordinate learners and group of learners during STE(A)M related activities
3.2.2 Coordinate team of educators during a collaborative STE(A)M teaching procedure
4. Educator as community member / interacting with the environment
4.1 Community building
4.1.1 Engage in STE(A)M communities of educators
4.1.2 Engage in institutional-based communities for STE(A)M education
4.1.3 Engage in research and business communities for STE(A)M education
4.2 Application of policies
4.2.1 Implement policies that promote STE(A)M education
4.2.2 Reinforce STE(A)M education awareness in the educational community (learners, educators, parents etc.)
5. Educator as professional / developing and applying competences
5.1 Transferable skills
5.1.1 Develop presentation and communication skills
5.1.2 Develop critical thinking and problem-solving skills
5.1.3 Apply ethic skills
5.1.4 Develop entrepreneurship skills
5.2 Digital skills
5.2.1 Apply information and data literacy skills
5.2.2 Use digital tools for communication and collaboration in STEAM education
5.2.3 Create digital contnt for STE(A)M education
5.2.4 apply privacy and copyright rules in digital content for STEAM education
5.2.5 Use digital technologies in STEAM education
5.3 Professional development
5.3.1 Adapt self-reflective practices for STE(A)M education
5.3.2 Participate in lifelong learning experiences related to STE(A)M educational approach
5.3.3 Apply action research procedures for reflaction and improvement of educational procedures in STEAM education

Table 14: Revised STE(A)M competence framework

8 The STE(A)M educator job profile(s)

8.1 Introduction to ESCO classification

The ESCO classification (European Multilingual classification of European Skills, Competences, Qualifications and Occupations) identifies and categorises skills, competences, qualifications and occupations relevant for the European labour market and education and training. This classification works as a dictionary, describing, identifying and classifying professional occupations and skills relevant for the EU labour market and education and training [16].

The European Commission has developed ESCO with the aim [42]:

- to improve the communication between the education and training sector and the EU labour market,
- to support geographical and occupational mobility in Europe,
- to make data more transparent and easily available for use by various stakeholders, such as public employment services, statistical organisations and education organisations,
- to facilitate the exchange of data between employers, education providers and job seekers irrespective of language or country,
- to support evidence-based policymaking by enhancing the collection, comparison and dissemination of data in skills intelligence and statistical tools, and enabling better analysis of skills supply and demand in real-time based on big data.

Education and training systems do not always understand which specific skills are required by the labour market. Therefore, different stakeholders can use ESCO concepts and descriptions as a common “language” that allows, for instance, education and training systems to see the labour market skills requests or national classifications systems of occupations and skills better understand and “talk” to each other in Europe. This facilitates the free movement of workers and a more integrated and efficient labour market across Europe. In addition, ESCO concepts and descriptions can help people to understand [43]:

- what knowledge and skills are usually required when working in a specific occupation,
- what knowledge, skills and competences are obtained as a result of a specific qualification,
- what qualifications are demanded or often requested by employers from those searching for work in a specific occupation,
- The use of ESCO concepts can also facilitate the transition to this ever-growing digital labour market, by offering a common “language” on occupations and skills that makes these digital tools communicate and work better together.

The first complete version of the classification (ESCO v1) is composed of 3 pillars: occupations, skills/competences, qualifications and linked to relevant international classifications and frameworks, e.g., International Standard Classification of Occupations European Qualifications Framework. These three pillars are interrelated with each other.

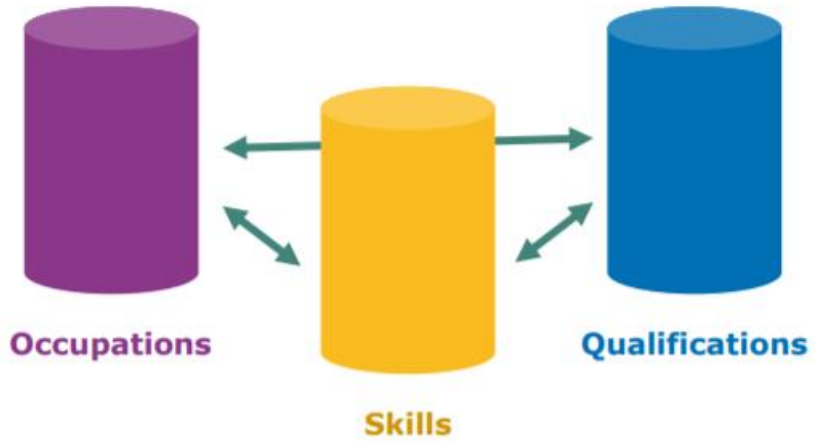

Figure 15: ESCO three pillars and their connection

8.2 The ESCO occupations profiles

Each occupation concept in ESCO describes the meaning of the occupation and provides several valuable pieces of information about it. The core element that defines an ESCO occupation is the main idea or understanding of the occupation and its differences from other occupations [44]. These are captured in the description and scope note. A description in ESCO is a text field providing a short explanation of the meaning of the occupation and how it should be understood. For this reason, a description is always provided for each ESCO occupation.

On the other hand, a scope note in ESCO is sometimes used to make things less ambiguous and clarify its semantic boundaries. For example, it may list the specialisms considered within the scope and those considered out of scope. Then, the occupation profiles provide essential and optional knowledge, skill, and competence concepts [45]:

- **Essential** are those knowledge, skills, and competences usually relevant for an occupation, independent of the work context, employer, or country.
- **Optional** are those knowledge, skills and competences that may be relevant or occur when working in an occupation depending on the employer, working contex tor country. Optional knowledge, skills and competences are very important for job-matching because they reflect the diversity of jobs within the same occupation.

In the following figures (Fig. Figure 16, Figure 17Figure 18), we present the example of the primary school teacher occupation profile in ESCO.

ESCO

European Skills/Competences, qualifications and Occupations

primary school teacher

Discuss this topic in the Online Forum

Code

2341.1

Description

Primary school teachers instruct students on a primary school level. They develop lesson plans in line with curriculum objectives for the variety of subjects they teach, including mathematics, languages, nature studies and music. They monitor the students' learning development and evaluate their knowledge and skills on the subjects taught through tests. They build their course content on the students' knowledge of previous learnings and encourage them to deepen their understanding on the subjects they are interested in. They use class resources and teaching methods to create an inspiring learning environment. Primary school teachers also contribute to school events and communicate with parents and administrative staff.

Alternative label

educator in primary education

music teacher primary school

primary education teacher

primary school music teacher

primary school educator

educator in primary school

teacher in a primary school

primary education professional

teacher in primary education

Regulatory aspect

To see if and how this occupation is regulated in EU Member States, EEA countries or Switzerland please consult the Regulated Professions Database of the Commission. Regulated Professions Database:
http://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_en

Hierarchy

2 - Professionals

Figure 16: primary school teacher occupation profile (part 1)

23 - Teaching professionals

234 - Primary school and early childhood teachers

2341 - Primary school teachers

primary school teacher

Narrower occupations

Steiner school teacher

Essential skills and competences

adapt teaching to student's capabilities
apply intercultural teaching strategies
apply teaching strategies
assess students
assign homework
assist students in their learning
assist students with equipment
demonstrate when teaching
employ pedagogic strategies to facilitate creative engagement
encourage students to acknowledge their achievements
facilitate teamwork between students
give constructive feedback
guarantee students' safety
implement care programmes for children
maintain relations with children's parents
maintain students' discipline
manage children's problems
manage student relationships
observe student's progress
perform classroom management
prepare lesson content
prepare youths for adulthood
support the positiveness of youths
teach primary education class content

Essential Knowledge

assessment processes
curriculum objectives
learning difficulties
primary school procedures
teamwork principles

Optional skills and competences

advise on lesson plans
arrange parent teacher conference
assess the development of youth
assist in children's development of basic personal skills
assist in the organisation of school events
attend to children's basic physical needs
bring out performers' artistic potential
consult students on learning content

Figure 17: primary school teacher occupation profile (part 2)

create craft prototypes
develop course outline
escort students on a field trip
improvise music
keep records of attendance
liaise with educational support staff
maintain musical instruments
manage resources for educational purposes
organise creative performance
oversee extra-curricular activities
perform playground surveillance
play musical instruments
provide after school care
provide lesson materials
recognise indicators of gifted student
select artistic materials to create artworks
supervise craft production
support gifted students
teach arts principles
teach music principles
work with virtual learning environments

Optional Knowledge
behavioural disorders
children's physical development
common children's diseases
developmental psychology
disability types
musical genres
musical instruments
musical notation
musical theory
special needs education
workplace sanitation

Status

released

Concept URI

http://data.europa.eu/esco/occupation/03d79393-7b30-4159-945b-01963eddd302

ESCO is a Europe 2020 initiative.
Current version ESCO v1.0.9 (Last update 02/12/2021)
DG Employment, Social Affairs and Inclusion of the European Commission developed ESCO in collaboration with stakeholders and with the European Centre for the Development of Vocational Training (Cedefop) .

Figure 18: primary school teacher occupation profile (part 3)

8.3 STEAM educator job profile(s)

The current version of the ESCO does not include occupations relevant to STE(A)M educator occupations. Thus, based on the developed STE(A)M competence framework, we proceeded with the following steps to propose STE(A)M educator job profile(s). The methodology that we followed includes:

- Literature review that was implemented during the development phase of the competence framework for STE(A)M educators regarding the barriers and needs of STEAM educators [2], [4], [8], [9], [13]–[15], [46]–[49] and identify issues that should be distinguished, such as:
    - Can a single educator design alone STEAM projects and activities, or is there a need to collaborate with a team of educators?
    - May a single educator implement STEAM projects and activities alone, or is there a need to collaborate with a team of educators?

  - Are any differences in the previous statements based on the level or type of education?
  - May any educator from different disciplines become a STEAM educator with the appropriate training?
  - Are any auxiliary roles helpful and needed for the STE(A)M educator? (Such as STAEM educational pedagogy expert, STEAM educational lab expert etc.)
- Collect views of educators through the MOOC that was implemented (see more details on Deliverable 11: MOOC and Deliverable 12: Report on pilot training of STE(A)M educators) with the use of both quantitative and qualitative data regarding the issues mentioned above
  - Educators participation in forum discussions through the MOOC (answers from 58 participants with 69 posts in total)
  - Close and open-ended questions through the post-evaluation questionnaire of the MOOC (216 answers)
- Summarize outcomes based on the previous steps, including:
  - Different levels and types of education may create different needs and require different knowledge, skills and competences for the educator
  - The design and development of STE(A)M activities should be implemented in collaboration with a team of educators to achieve its full potential.
  - Implementation needs regarding the number of educators and the need for additional roles depend on the difficulty, level, and type of school (for example, small group of students, low grade of expected specialisation)
  - There is no "one STEAM educator" profile that fits all. Any educator from any discipline may become STE(A)M educator with the appropriate training. However, each educator may concentrate on his/her different epistemology of each teaching specialty.
  - The cooperation and collaboration between educators should be based on a well-structured plan and guided by a coordinator
- Utilize the STE(A)M Competence Framework for STE(A)M educators and engage educators that participate in the blended course to the co-development of job profiles following the rules of ESCO, concluding that:
  - The main occupation profiles of STE(A)M educators should be based on educational level and type of education.
    - Pre-school teacher
    - Primary education Teacher
    - Secondary education Teacher
      - Each for teaching specialty
    - Educator in non-formal education
    - Educator in adult education/lifelong learning education
  - In addition, some auxiliary roles would be needed based on specific needs, such as:
    - STE(A)M pedagogy expert: An expert in STE(A)M pedagogical processes that assist the leading educator in implementing an integrated approach to learning and teaching, in utilizing a variety of

practical and equitable teaching approaches in the classroom, and in guiding student inquiry, dialogue, and critical thinking

- STE(A)M technology expert: A STE(A)M technology specialist that collaborates with teachers and school administration to facilitate the use of technology in classrooms and labs
- STE(A)M educator's assistant: An educator with experience in STE(A)M education to assist the leading educator(s) during the implementation of STE(A)M educational projects
- STE(A)M ambassador: A person who guides, provides advice, recourses, and coordinates the communication and collaboration of the group of STE(A)M educators

8.3.1 Example of STEAM educator profile(s) based on ESCO

In this section, we present the proposed profile(s) based on the Competence Framework for STE(A)M educators following the rules of ESCO. In addition, the proposed profile(s) examples include the STE(A)M educator in pre-school, STE(A)M educator in primary school and one profile for STE(A)M educator in secondary education for a specific teaching specialty. This is because the number of educators who participated in the blended course was not enough for all the different levels and types of education. In addition, we present some of the auxiliary roles that we propose.

Name	STE(A)M educator in pre-school
Code	2342.4 (proposed as a narrower occupation for Early childhood educators)
Description	STE(A)M educators in pre-school educate students using approaches that reflect the STE(A)M education philosophy and principles. They focus on teaching approaches that use Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking. STE(A)M educators in primary school instruct students in putting together different disciplines in an integrative way to create an inclusive learning environment that encourages all students to participate, collaborate and problem solve.
Alternative label	STE(A)M pre-school teacher, STE(A)M early childhood teacher
Hierarchy	2 - Professionals 23 - Teaching professionals 234 - Primary school and early childhood teachers 2342 - Early childhood educators
Essential skills and competences	Use teaching and learning techniques that promote STE(A)M education Apply collaborative learning methods in STE(A)M activities Promote self-regulated learning in STE(A)M activities Guide STE(A)M activities Act as a facilitator in STE(A)M activities Act as a mentor in STE(A)M activities Use appropriate content and tools for STE(A)M education

Name	STE(A)M educator in pre-school
	Organize appropriate content for STE(A)M education Share appropriate content and tools for STE(A)M education Use assessment strategies for STE(A)M education Use feedback techniques for STE(A)M education Guarantee accessibility and inclusion in STE(A)M educational procedures Provide active engagement of learners Guarantee differentiation and personalization Design STE(A)M educational activities Modify appropriate content for STE(A)M education Create appropriate content for STE(A)M education Assist learners' STEAM competences Apply teaching organization methods for STE(A)M education Apply classroom management methods Apply educational resources management methods Apply human resource management methods Maintain relations with STE(A)M communities of educators Maintain relations with institutional-based communities for STE(A)M education Maintain relations with research and business communities for STE(A)M education Apply policies that promote STE(A)M education Apply critical and innovative thinking skills Apply interpersonal skills Apply media and information literacy skills Apply global citizenship skills Apply intrapersonal skills Apply digital literacy skills Use digital tools for STE(A)M education Perform self-reflective practices Participate in lifelong learning experiences related to STE(A)M education
Essential Knowledge	STE(A)M education approach Content-knowledge of STE(A)M-related topics Assessment strategies for STE(A)M education Teamwork principles
Optional skills and competences	Organize appropriate tools for STE(A)M education Develop STE(A)M-related curriculum Design STE(A)M courses Design software and apps for STE(A)M education Develop policies that promote STE(A)M education Develop entrepreneurship skills Perform research activities for STE(A)M education Apply lab management methods Apply information management skills
Optional Knowledge	STE(A)M-related career opportunities

Name	STE(A)M educator in pre-school
EQF level	Level 6, Level 7, Level 8

Name	STE(A)M educator in primary school
Code	2341.1.2 (proposed as a narrower occupation for primary school teacher)
Description	STE(A)M educators in primary school educate students using approaches that reflect the STE(A)M education philosophy and principles. They focus on teaching approaches that use Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking. STE(A)M educators in primary school instruct students in putting together different disciplines in an integrative way to create an inclusive learning environment that encourages all students to participate, collaborate and problem solve.
Alternative label	STE(A)M primary school teacher, STEAM teacher, STE(A)M teacher, STE(A)M school teacher
Hierarchy	2 - Professionals 23 - Teaching professionals 234 - Primary school and early childhood teachers 2341 - Primary school teachers 2341.1 - primary school teacher
Essential skills and competences	Use teaching and learning techniques that promote STE(A)M education Apply collaborative learning methods in STE(A)M activities Promote self-regulated learning in STE(A)M activities Guide STE(A)M activities Act as a facilitator in STE(A)M activities Act as a mentor in STE(A)M activities Use appropriate content and tools for STE(A)M education Organize appropriate content and tools for STE(A)M education Share appropriate content and tools for STE(A)M education Use assessment strategies for STE(A)M education Use feedback techniques for STE(A)M education Guarantee accessibility and inclusion in STE(A)M educational procedures Provide active engagement of learners Guarantee differentiation and personalization Design STE(A)M educational activities Modify appropriate content for STE(A)M education Create appropriate content for STE(A)M education Assist learners' STEAM competences

Name	STE(A)M educator in primary school
	Apply teaching organization methods for STE(A)M education Apply classroom management methods Apply educational resources management methods Apply lab management methods Apply human resource management methods Maintain relations with STE(A)M communities of educators Maintain relations with institutional-based communities for STE(A)M education Maintain relations with research and business communities for STE(A)M education Apply policies that promote STE(A)M education Apply critical and innovative thinking skills Apply interpersonal skills Apply media and information literacy skills Apply global citizenship skills Apply intrapersonal skills Apply information management skills Apply digital literacy skills Use digital tools for STE(A)M education Perform self-reflective practices Participate in lifelong learning experiences related to STE(A)M education
Essential Knowledge	STE(A)M education approach Content-knowledge of STE(A)M-related topics Assessment strategies for STE(A)M education STE(A)M-related career opportunities Teamwork principles
Optional skills and competences	Develop STE(A)M-related curriculum Design STE(A)M courses Design software and apps for STE(A)M education Develop software and apps for STE(A)M education Develop policies that promote STE(A)M education Develop entrepreneurship skills Perform research activities for STE(A)M education
Optional Knowledge	-
EQF level	Level 6, Level 7, Level 8

Name	ICT STE(A)M educator in secondary school
Code	2330.1.9.1 (proposed as a narrower occupation for ICT teacher secondary school)
Description	ICT STE(A)M educators in secondary school educate students using approaches that reflect the STE(A)M education philosophy and principles, with the basis on their own field of study, ICT. They focus on teaching approaches that use Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry,

Name	ICT STE(A)M educator in secondary school
	dialogue, and critical thinking. ICT STE(A)M educators in secondary school instruct students in putting together different disciplines in an integrative way to create an inclusive learning environment that encourages all students to participate, collaborate and problem solve.
Alternative label	STE(A)M educator, ICT STEAM teacher
Hierarchy	2 - Professionals 23 - Teaching professionals 233 - Secondary education teachers 2330 - Secondary education teachers 2330.1 - secondary school teacher 2330.1.9 ICT teacher secondary school
Essential skills and competences	Use teaching and learning techniques that promote STE(A)M education Apply collaborative learning methods in STE(A)M activities Promote self-regulated learning in STE(A)M activities Guide STE(A)M activities Act as a facilitator in STE(A)M activities Act as a mentor in STE(A)M activities Use appropriate content and tools for STE(A)M education Organize appropriate content and tools for STE(A)M education Share appropriate content and tools for STE(A)M education Use assessment strategies for STE(A)M education Use feedback techniques for STE(A)M education Guarantee accessibility and inclusion in STE(A)M educational procedures Provide active engagement of learners Guarantee differentiation and personalization Design STE(A)M educational activities Modify appropriate content for STE(A)M education Create appropriate content for STE(A)M education Assist learners' STEAM competences Apply teaching organization methods for STE(A)M education Apply classroom management methods Apply educational resources management methods Apply lab management methods Apply human resource management methods Maintain relations with STE(A)M communities of educators Maintain relations with institutional-based communities for STE(A)M education Maintain relations with research and business communities for STE(A)M education Apply policies that promote STE(A)M education Apply critical and innovative thinking skills Apply media and information literacy skills

Name	ICT STE(A)M educator in secondary school
	Apply intrapersonal skills Apply information management skills Apply digital literacy skills Use digital tools for STE(A)M education Perform self-reflective practices Participate in lifelong learning experiences related to STE(A)M education
Essential Knowledge	STE(A)M education approach Content-knowledge of STE(A)M-related topics Assessment strategies for STE(A)M education STE(A)M-related career opportunities Teamwork principles
Optional skills and competences	Apply global citizenship skills Apply interpersonal skills Develop STE(A)M-related curriculum Design STE(A)M courses Design software and apps for STE(A)M education Develop software and apps for STE(A)M education Develop policies that promote STE(A)M education Develop entrepreneurship skills Perform research activities for STE(A)M education
Optional Knowledge	-
EQF level	Level 6, Level 7, Level 8

Name	STE(A)M pedagogy expert
Code	2359.13 (proposed as a narrower occupation for Teaching professionals not elsewhere classified)
Description	An expert in STE(A)M pedagogical processes that assist the leading educator in implementing an integrated approach to learning and teaching with an STE(A)M educational approach, in utilizing a variety of practical and equitable teaching approaches in the classroom, and guiding student inquiry, dialogue, and critical thinking
Alternative label	STE(A)M pedagogy educator, STE(A)M expert
Hierarchy	2 - Professionals 23 - Teaching professionals 235 - Other teaching professionals 2359 Teaching professionals not elsewhere classified
Essential skills and competences	Use teaching and learning techniques that promote STE(A)M education Apply collaborative learning methods in STE(A)M activities Promote self-regulated learning in STE(A)M activities Act as a facilitator in STE(A)M activities Use appropriate content and tools for STE(A)M education Organize appropriate content and tools for STE(A)M education Use assessment strategies for STE(A)M education Use feedback techniques for STE(A)M education

Name	STE(A)M pedagogy expert
	Guarantee accessibility and inclusion in STE(A)M educational procedures Provide active engagement of learners Guarantee differentiation and personalization Design STE(A)M educational activities Modify appropriate content for STE(A)M education Assist learners' STEAM competences Apply teaching organization methods for STE(A)M education Apply classroom management methods Apply educational resources management methods Apply human resource management methods Maintain relations with STE(A)M communities of educators Maintain relations with institutional-based communities for STE(A)M education communities for STE(A)M education Apply policies that promote STE(A)M education Apply critical and innovative thinking skills Apply media and information literacy skills Apply intrapersonal skills Apply digital literacy skills Apply global citizenship skills Use digital tools for STE(A)M education Perform self-reflective practices Participate in lifelong learning experiences related to STE(A)M education Develop STE(A)M-related curriculum Design STE(A)M courses
Essential Knowledge	STE(A)M education approach Assessment strategies for STE(A)M education Teamwork principles Self-regulated techniques
Optional skills and competences	Apply information management skills Apply interpersonal skills Develop policies that promote STE(A)M education Develop entrepreneurship skills Perform research activities for STE(A)M education Content-knowledge of STE(A)M-related topics Guide STE(A)M activities Act as a mentor in STE(A)M activities Create appropriate content for STE(A)M education Apply lab management methods Maintain relations with research and business
Optional Knowledge	-
EQF level	Level 6, Level 7, Level 8

Name	STE(A)M educator assistant
Code	2359.14 (proposed as a narrower occupation for Teaching professionals not elsewhere classified)
Description	An educator with experience in STE(A)M education to assist the leading educator(s) during the implementation of STE(A)M educational projects
Alternative label	STE(A)M assistant,
Hierarchy	2 - Professionals 23 - Teaching professionals 235 - Other teaching professionals 2359 Teaching professionals not elsewhere classified
Essential skills and competences	Use teaching and learning techniques that promote STE(A)M education Apply collaborative learning methods in STE(A)M activities Promote self-regulated learning in STE(A)M activities Guide STE(A)M activities Act as a mentor in STE(A)M activities Provide active engagement of learners Assist learners' STEAM competences Maintain relations with STE(A)M communities of educators Maintain relations with institutional-based communities for STE(A)M education Maintain relations with research and business communities for STE(A)M education Apply critical and innovative thinking skills Apply media and information literacy skills Apply digital literacy skills Participate in lifelong learning experiences related to STE(A)M education Use digital tools for STE(A)M education
Essential Knowledge	STE(A)M education approach Teamwork principles
Optional skills and competences	Perform self-reflective practices Organize appropriate content and tools for STE(A)M education Share appropriate content and tools for STE(A)M education Use assessment strategies for STE(A)M education Use feedback techniques for STE(A)M education Guarantee accessibility and inclusion in STE(A)M educational procedures Apply teaching organization methods for STE(A)M education Apply classroom management methods Apply educational resources management methods Apply lab management methods Apply human resource management methods Design STE(A)M educational activities Modify appropriate content for STE(A)M education

Name	STE(A)M educator assistant
	Create appropriate content for STE(A)M education Use appropriate content and tools for STE(A)M education Guarantee differentiation and personalization Apply policies that promote STE(A)M education Apply interpersonal skills Apply global citizenship skills Apply intrapersonal skills Apply information management skills
Optional Knowledge	STE(A)M-related career opportunities
EQF level	Level 5

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Appendix1a: STE(A)MComp Edu: The Educators Competence Framework for STE(A)M education [English]

PERSPECTIVE (based on Roles of the educator)	AREAS	DIMENSIONS (Competences)	EXAMPLES OF STATEMENTS
1. Educator as teacher-trainer-tutor / implementing the educational procedure	1.1 Pedagogy	1.1.1 Understand and use teaching and learning techniques that promote STE(A)M education	*To know, understand and use learning theories and teaching methods (such as inquiry-based learning, problem-based learning etc.) that promote STE(A)M educational approach.* *To know, understand and use inquiry-based learning, project-based teaching and other learning techniques with the aim to enhance STE(A)M activities with complex questions, developing critical thinking, exploring social issues and developing solutions to real problems.* *To provide experiential learning with the use of STE(A)M activities related to learners' experiences.* *To use game-based strategies in STE(A)M activities with the aim to improve learners' participation and motivation.*
		1.1.2 Apply collaborative learning methods in STE(A)M education activities	*To know, understand and use group dynamics techniques.* *To know, understand and use teamwork methods and collaborative techniques in order guide learners to effectively cooperate and communicate with each other.* *To organize the classroom environment in order to facilitate collaborative learning methods.*
		1.1.3 Promote self-regulated learning in STE(A)M education activities	*To know, understand and use techniques for self-regulated learning processes where learners design, reflect, search for information, share ideas and discover creative solutions to problems.*
	1.2 Content knowledge	1.2.1 Understand what STE(A)M education represents and means	*To understand STE(A)M education as an integrated approach of STEM subject in combination with Arts, e.g. visual arts, lyrics etc.* *To recognize that STE(A)M Education is an approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking.* *To recognize that STE(A)M education approach aims to prepare active and functioning citizens in a scientifically and technologically society.*

PERSPECTIVE (based on Roles of the educator)	AREAS	DIMENSIONS (Competences)	EXAMPLES OF STATEMENTS
		1.2.2 Has the content knowledge of STE(A)M-related topics	*Content knowledge of the subject matter.* *To apply basic computer skills.* *To apply mathematic skills for calculations and measurements.* *To apply scientific approach to break down a complex scientific system into smaller parts, recognize cause and effect relationships, and defend opinions using facts.* *To associate the basic principles of science, technology, engineering and mathematics with other fields such as history, language, arts, culture, etc.*
	1.3 Instruction	1.3.1 Provide guidance in STE(A)M education activities	*To provide appropriate and targeted guidance and assistance to learners with different forms and formats.*
		1.3.2 Act as a facilitator in STE(A)M education activities	*To act as a facilitator in order to guide and assist students in learning for themselves during STE(A)M related activities.* *To encourage learners and grow a comfortable learning environment.*
		1.3.3 Act as a mentor in STE(A)M education activities	*To act as a mentor, by encouraging students to enjoy STE(A)M related activities and to provide a mentoring support system to student.*
	1.4 Use content and tools	1.4.1 Select and use appropriate content and tools for STE(A)M education	*To select and use suitable educational content and tools to support and enhance STE(A)M teaching and learning.* *To select and use suitable software and apps to support and enhance STE(A)M teaching and learning.* *To select and use STE(A)M educational content related to real life for a clearer understanding and the creation of students' participating incentives.* *To select and use concepts and educational content and tools from non-STEM fields such as art, language etc. in STE(A)M education.* *To use of multimodal text that provides interaction and visual stimulation.* *To know, understand and select and design appropriate educational content based on learners' needs, characteristics, prior knowledge and educational objectives of the course.*

PERSPECTIVE (based on Roles of the educator)	AREAS	DIMENSIONS (Competences)	EXAMPLES OF STATEMENTS
		1.4.2 Organize and share appropriate content and tools for STE(A)M education	*To organize the STE(A)M related content and tools and make it available to learners, parents and other educators if necessary.* *To protect sensitive digital and non-digital content.* *To know, understand and use content privacy and copyright licenses and rules.*
	1.5 Feedback and assessment	1.5.1 Use assessment strategies for STE(A)M education	*To know, understand and to design and use multiple forms of students' performance assessment (individual/group) suitable for STE(A)M related activities.* *To know, understand and to design and manage both formative and summative assessment in ways that are appropriate to the level and purpose of the learning and meet the requirements of accrediting bodies.* *To know, understand and to use self-assessment strategies of leaners suitable for STE(A)M related activities.* *To know, understand and be able to keep detailed and diagnostic records of STE(A)M related activities assessment.*
		1.5.2 Use feedback techniques for STE(A)M education	*To determine learners' course performance by providing regular feedback.* *To monitor learners' misunderstandings, giving feedback and guidance where appropriate.* *To determine the level of learners involvement (e.g. learners' interest and attitudes).*
	1.6 Learner empowerment	1.6.1 Ensure accessibility and inclusion in STE(A)M education	*To ensure access to both STE(A)M resources and activities for all learners, including those with special needs.* *To address inclusion and diversity issues within the classroom during STE(A)M related activities.* *To address prejudice and stereotypes in the STE(A)M fields.*
		1.6.2 Ensure active engagement of learners in STE(A)M education	*To know, understand and be able to use techniques to enhance the interaction of learners and their active participation, providing appropriate guidance and assistance during STE(A)M related activities.*

PERSPECTIVE (based on Roles of the educator)	AREAS	DIMENSIONS (Competences)	EXAMPLES OF STATEMENTS
			To provide guidance to students in order to communicate with each other, and to suggest different points of view by developing an open learning environment for creative problem solving during STE(A)M related activities.
		1.6.3 Ensure differentiation and personalization in STE(A)M education	*To create personalized STE(A)M learning experiences in order to meet learners' different needs*
2. Educator as learning designer and creator / designing and producing outputs	2.1 Course / curriculum / activity design	2.1.1 Understand and develop STE(A)M education curriculum	*To know and understand the principles and practices of the STE(A)M related curriculum.* *To know, understand, select and design STE(A)M related curriculum.*
		2.1.2 Design STE(A)M education courses	*To design and implement educational programs that integrate the scientific fields of STE(A)M and promote STE(A)M educational approach*
		2.1.3Design STE(A)M education activities	*To design and implement STE(A)M educational activities based on real life situations.* *To know, understand, select and design STE(A)M related educational activities based on learners' needs, characteristics, prior knowledge and educational objectives of the course.*
	2.2 Content and tools design and development	2.2.1 Create and modify appropriate content for STE(A)M education	*To create and modify suitable educational content to support and enhance STE(A)M teaching and learning.* *To create and develop a variety of resources (audiovisual material, etc.) to effectively design educational activities that require the integration of concepts and skills from different disciplines.*
		2.2.2 Design and Develop software and apps for STE(A)M education	*To use technology in order to design and develop STE(A)M applications for STE(A)M educational activities.*
	2.3 Learner development	2.3.1 Facilitate learners' STE(A)M competences	*To facilitate learners in order to incorporate learning activities, assignments and assessments which require learners to acquire*

PERSPECTIVE (based on Roles of the educator)	AREAS	DIMENSIONS (Competences)	EXAMPLES OF STATEMENTS
			-cognitive skills *- Information Processing - Data Interpretation and Data Analysis skills* *- Problem Solving and Engineering Thinking skills* *- Scientific Investigation skills* *- Computational Thinking and ICT skills* *- Design Thinking, Creativity and Innovation skills* *- Manipulative and Technological Skills* *- Collaboration and Communication Skills*
		2.3.2 Provide guidance for STE(A)M related career opportunities	*To provide guidance to learners about work and study possibilities related to STEM fields.*
3. Educator as orchestrator and manager / coordinating procedures and outputs	3.1 Educational procedure management	3.1.1 Apply teaching organization methods in STE(A)M education	*To carry out time management of lesson plans based on STE(A)M related activities.* *To coordinate the teaching procedure during STE(A)M related activities.*
		3.1.2 Apply classroom management methods in STE(A)M education	*To organize and prepare classroom and laboratory learning spaces for STE(A)M related activities.* *To handle unexpected situations in the classroom.*
	3.2 Resource management	3.2.1 Apply educational resources management methods in STE(A)M education	*To organize and prepare the necessary materials and educational resources for STE(A)M related activities.* *To manage and protect sensitive digital and non-digital content by applying privacy and copyright rules.*
		3.2.2 Apply laboratory management methods in STE(A)M education	*To organize and prepare the lab equipment for STE(A)M activities.* *To handle unexpected technical problems, repair a machine or debug an operating system that is used for STE(A)M related activities.*
		3.2.3 Apply human resource management methods in STE(A)M education	*To coordinate and manage team of educators during a collaborative teaching procedure.* *To monitor and manage groups during STE(A)M related activities.*

PERSPECTIVE (based on Roles of the educator)	AREAS	DIMENSIONS (Competences)	EXAMPLES OF STATEMENTS
4. Educator as community member / interacting with the environment	4.1 Community building	4.1.1 Engage in communities of STE(A)M educators	*To participate in online and offline communities among STE(A)M educators in order to exchange experiences, knowledge and educational resources.*
		4.1.2 Engage in institutional-based communities about STE(A)M education	*To collaborate with other educational institutions in order to promote STE(A)M practices in schools and society.* *To develop a supportive and empowering environment for the learner and respond to the educational and other needs of learners and fellow educators.*
		4.1.3 Engage in research and business communities about STE(A)M education	*To organize participations in STE(A)M related competitions, events, festivals, online platforms etc. to give students the opportunity to present their work to the general public.* *To cooperate with research and business communities.*
	4.2 Application of policies	4.2.1 Apply policies that promote STE(A)M education	*To apply education policies and procedures for STE(A)M education.* *To promote contextual, institutional and organizational aspects of STE(A)M educational policies.*
		4.2.2 Develop policies that promote STE(A)M education	*To create and promote new educational policies for STE(A)M educational approach.* *To participate in institutional decision related to STE(A)M educational policies.*
5. Educator as professional / developing and applying competences	5.1 Transferable skills	5.1.1 Develop leadership skills	*To lead a STE(A)M related educational project.* *To supervise members of a group during a STE(A)M related educational project and be flexible.*
		5.1.2 Develop presentation and communication skills	*To deliver STE(A)M related content clearly, effectively and with confidence either orally or in writing.* *To communicate (exchange of messages and meaningful dialogue) with learners, parents and third parties for STE(A)M educational approach.*

PERSPECTIVE (based on Roles of the educator)	AREAS	DIMENSIONS (Competences)	EXAMPLES OF STATEMENTS
		5.1.3 Develop critical thinking and problem-solving skills	*To identify and analyze problems in difficult situations and make justifiable evaluation.* *To expand and improve thinking skills such as explanation, analysis and to evaluate a discussion.* *To find ideas and look for alternative solutions.*
		5.1.4 Apply ethic skills	*To analyze and make problem solving decisions related to ethics and STE(A)M education.*
		5.1.5 Develop team work skills	*To collaborate with other educators from other disciplines in order to design and prepare educational programs/resources/activities in STE(A)M content.* *To cooperate (with other educators) to exchange knowledge, experience and to develop collaborative innovative pedagogical practices.*
		5.1.6 Apply information management skills	*To find and manage relevant STE(A)M information from various sources.*
		5.1.7 Develop entrepreneurship skills	*To identify job opportunities related to STE(A)M education.*
	5.2 Digital skills	5.2.1 Develop digital literacy skills	*To critically read and creatively produce academic and professional communication related to STE(A)M education in a range of media.* *To participate in digital networks for learning and research in STE(A)M education.* *To adapt and use digital devices applications and services related to STE(A)M education.* *To study and learn effusively in technology-rich environment, formal and informal.* *To participate in emerging academic professional and research STE(A)M practices that depend on digital systems.* *To find, interpret, evaluate, manage and share digital information* *To use modern technologies to enhance and facilitate communication activities.*

PERSPECTIVE (based on Roles of the educator)	AREAS	DIMENSIONS (Competences)	EXAMPLES OF STATEMENTS
		5.2.2 Manage and use digital tools for STE(A)M education	*To use ICT in STE(A)M education (e.g. appropriate strategies for integrating ICT in STE(A)M education, integrating innovative technology resources etc.).*
	5.3 Professional development	5.3.1 Adapt self-reflective practices for STE(A)M education	*To collect, analyze, interpret data (learning outcomes, evaluation results, self-assessment) to improve STE(A)M teaching/learning.* *To reflect for self-improvement through personal learning as well as through STE(A)M related practice communities.* *To know, understand and be able to interpret and use the assessment results in order to improve the STE(A)M related activities.* *To reflect on one's own performance and respond to constructive criticism based on feedback from learners and supervisors in order to improve one's own performance.*
		5.3.2 Participate in lifelong learning experiences related to STE(A)M education	*To participate in continuous professional development in STE(A)M related topics.* *To engage in personal, academic, occupational and professional growth through pursuing reflective study and research in STE(A)M area.*
		5.3.3 Act as a researcher on STE(A)M education topics	*To monitor the latest developments and educational methods in STEM fields and STE(A)M educational approach.* *To find and read academic and professional texts related to STE(A)M education critically.* *To know, understand and use effective study methods.*

Appendix 1b: STE(A)MComp Edu: The Educators Competence Framework for STE(A)M education [Spanish]

Perspectiva (basado en lo roles de la persona educadora)	Áreas (grupo coherente de competencias)	Dimensiones (Competencias)	Ejemplos de descriptores
1. Persona educadora en tanto que maestra, formadora, tutora y/o que implementa el procedimento educativo	1.1 Pedagogia	1.1.1 Comprende y emplea técnicas de enseñanza y aprendizaje que promueven la educación en el ámbito STE(A)M	Conocer, comprender y utilizar teorías del aprendizaje y métodos de enseñanza (como el aprendizaje basado en la indagación, en problemas, etc.) que promueven el enfoque educativo STE(A)M. Conocer, comprender y utilizar el aprendizaje basado en la indagación, la enseñanza basada en proyectos y otras técnicas de aprendizaje con el objetivo de potenciar las actividades STE(A)M con preguntas complejas, desarrollando el pensamiento crítico, explorando temas sociales y desarrollando soluciones a problemas reales. Proporcionar un aprendizaje experimental con el uso de actividades STE(A)M relacionadas con las experiencias de los participantes. Emplear estrategias basadas en el juego en actividades STE(A)M con el objetivo de mejorar la participación y la motivación de las participantes.
		1.1.2 Aplica métodos de aprendizaje colaborativo en actividades educativas STE(A)M	Conocer, comprender y utilizar técnicas de dinámicas de grupo. Conocer, comprender y emplear métodos de trabajo en equipo y técnicas colaborativa para guiar las participantes a cooperar de manera efectiva y comunicarse entre ellas. Organizar el entorno de la clase con el fin de facilitar los métodos de aprendizaje colaborativo
		1.1.3 Promueve el autoaprendizaje en actividades educativas STE(A)M	Conocer, comprender y emplear técnicas enfocadas a los procesos de auto aprendizaje donde las personas participantes diseñen, reflexionen, busquen información, compartan ideas y descubran soluciones creativas para los problemas.
	1.2 Conocimiento del contenido	1.2.1 Comprende lo que representa y significa la educación STE(A)M	Entender la educación STE(A)M como un enfoque integral que combina el ámbito STEM con las Humanidades, como por ejemplo, artes visuales, líricas, etc. Reconocer que la educación STE(A)M aborda el aprendizaje utilizando la Ciencia, la Tecnología, la Ingeniería, las Humanidades y las Matemáticas como puntos de acceso para orientar la indagación, el diálogo y el pensamiento crítico de las alumnos. Reconocer que el enfoque educativo STE(A)M aspira preparar ciudadanos activos y funcionales para una sociedad científica y tecnológica.

Perspectiva (basado en lo roles de la persona educadora)	Áreas (grupo coherente de competencias)	Dimensiones (Competencias)	Ejemplos de descriptores
		1.2.2 Comprende el contenido de los temas relacionados con la educación STE(A)M	Conocer el contenido de la materia. Aplicar habilidades informáticas básicas. Aplicar habilidades matemáticas para hacer cálculos y mediciones. Aplicar el enfoque científico para descomponer un sistema científico complejo en partes más pequeñas, reconocer las relaciones causa y efecto, y defender opiniones utilizando datos. Asociar los principios básicos de la ciencia, la tecnología, la ingeniería y las matemáticas a otros campos como la historia, la lengua, las artes, la cultura, etc.
	1.3 Instrucción	1.3.1 Proporciona orientación en actividades relacionadas con la educación STE(A)M	Proporcionar la orientación dirigida apropiada y la asistencia necesaria a las personas participantes en diferentes formatos y de diferentes formas.
		1.3.2 Actúa como persona facilitadora en actividades relacionadas con la educación STE(A)M	Actuar como persona facilitadora para orientar y ayudar a las personas participantes a aprender por sí mismas durante las actividades relacionadas con el ámbito STE(A)M. Animar a las participantes y crear un entorno de aprendizaje cómodo.
		1.3.3 Actúa como persona mentora en actividades relacionadas con la educación STE(A)M	Actuar como persona mentora, animando las participantes a disfrutar de las actividades relacionadas con el ámbito STE(A)M, así como proporcionar un sistema de apoyo y orientación al estudiante.
	1.4 Uso de contenido y herramientas	1.4.1 Elige y emplea apropiadamente el contenido y las herramientas de la educación en el ámbito STE(A)M	Elegir y utilizar el contenido educativo adecuado y las herramientas adecuadas para apoyar y promover el aprendizaje y la enseñanza STE(A)M. Elegir y emplear las apps y el software adecuados para apoyar y promover el aprendizaje y la enseñanza STE(A)M. Elegir y utilizar contenido educativo STE(A)M relacionado con la vida real para conseguir una mejor comprensión y crear incentivos de participación para las estudiantes. Elegir y emplear en la educación STE(A)M conceptos y contenido educativo y herramientas de ámbitos no contemplados en las áreas STEM, tales como el arte, la lengua, etc.

Perspectiva (basado en lo roles de la persona educadora)	Áreas (grupo coherente de competencias)	Dimensiones (Competencias)	Ejemplos de descriptores
			Utilizar textos multimodales que proporcionen interacción y estimulación visual. Conocer, comprender y escoger y diseñar el contenido educativo adecuado de acuerdo con las necesidades, las características y los conocimientos previos de los participantes, y los objetivos del curso.
		1.4.2 Organiza y comparte el contenido y las herramientas apropiados para la educación en el ámbito STE(A)M	Organizar el contenido de temática STE(A)M y las herramientas necesarias, y ponerlo al alcance de las participantes, los padres y madres, y de otras personas educadoras, si fuera necesario. Proteger el contenido sensible, tanto digital como no digital. Conocer, comprender y utilizar licencias para salvaguardar la privacidad y el copyright del contenido y el cumplimiento de las normas.
	1.5 Retroalimentación y evaluación	1.5.1 Emplea estrategias de evaluación para la educación en el ámbito STE(A)M	Conocer, comprender y diseñar y emplear diversas formas de evaluación del rendimiento de las personas participantes (individual / de grupo) adecuadas para las actividades relacionadas con el ámbito STE(A)M. Conocer, comprender y diseñar y gestionar tanto la evaluación formativa como la sumativa de manera apropiada, de acuerdo con el nivel y el objetivo del aprendizaje, y cumplir los requerimientos de los organismos de acreditación. Conocer, comprender y emplear estrategias de autoevaluación de las participantes para las actividades relacionadas con el ámbito STE(A)M. Conocer, comprender y ser capaz de mantener expedientes diagnósticos detallados de evaluación de las actividades relacionadas con el ámbito STE(A)M
		1.5.2 Emplea técnicas de retroalimentación para la educación en el ámbito STE(A)M	Determinar el rendimiento de las personas que participan en el curso mediante una retroalimentación regular. Hacer seguimiento de las confusiones de las participantes, aportando retroalimentación y orientación cuando sea necesario. Determinar el grado de implicación de las participantes (p. E. Interés y actitud de las participantes).
	1.6 Empoderamiento de la	1.6.1 Garantiza la accesibilidad y la inclusión en la educación STE(A)M	Garantizar el acceso de todas las personas participantes tanto a los recursos como a las actividades STE(A)M, incluidas las personas con necesidades especiales.

Perspectiva (basado en lo roles de la persona educadora)	Áreas (grupo coherente de competencias)	Dimensiones (Competencias)	Ejemplos de descriptores
	persona estudiante		Abordar incidencias relacionadas con la inclusión y la diversidad surgidas en la clase durante las actividades STE(A)M. Abordar los prejuicios y estereotipos en las áreas STE(A)M.
		1.6.2 Garantiza la participación activa del alumnado en la educación STE(A)M	Conocer, comprender y ser capaz de utilizar técnicas que favorecen la interacción de las estudiantes y su participación activa, ofreciendo orientación y asistencia adecuadas para el desarrollo de las actividades STE(A)M. Aportar orientación a las personas participantes para que se comuniquen entre ellas, y sugerir diferentes puntos de vista mediante la creación de un entorno de aprendizaje abierto y enfocado a la resolución creativa de problemas durante las actividades STE(A)M.
		1.6.3 Garantiza la diferenciación y la personalización de los procedimientos educativos en la educación STE(A)M	Crear experiencias personalizadas de aprendizaje STE(A)M a fin de satisfacer las diferentes necesidades de las participantes.
2. Persona educadora como diseñadora y generadora de aprendizaje / persona que diseña y genera resultados	2.1 Curso / curriculum / diseño de actividades	2.1.1 Comprende y desarrolla el currículum de la educación STE (A) M	Conocer y comprender los principios y las prácticas del currículo relacionado con el ámbito STE(A)M. Conocer, comprender, elegir y diseñar el currículo relacionado con el ámbito STE(A)M.
		2.1.2 Diseña cursos en la educación STE(A)M	Diseñar y llevar a cabo programas educativos que integran las áreas científicas del ámbito STE(A)M y promover el enfoque educativo STE(A)M.
		2.1.3 Diseña actividades educativas en la educación STE(A)M	Diseñar y llevar a cabo actividades educativas en el ámbito STE (A) M basadas en situaciones de la vida real. Conocer, comprender y escoger y diseñar actividades educativas del ámbito STE(A)M basadas en las necesidades, las características y los conocimientos previos de los participantes, y los objetivos educativos del curso.

Perspectiva (basado en lo roles de la persona educadora)	Áreas (grupo coherente de competencias)	Dimensiones (Competencias)	Ejemplos de descriptores
	2.2 Diseño y desarrollo de contenido y herramientas	2.2.1 Crea y modifica contenido apropiado para la educación STE(A)M	Crear y modificar contenido educativo adecuado para apoyar y potenciar la enseñanza y el aprendizaje STE(A)M. Crear y desarrollar una variedad de recursos (material audiovisual, etc.) con el fin de diseñar de manera efectiva actividades educativas que requieren la integración de conceptos y habilidades de diferentes disciplinas.
		2.2.2 Diseña y desarrolla software y apps para la educación STE(A)M	Emplear tecnología para diseñar y desarrollar aplicaciones STE(A)M para actividades educativas del ámbito STE(A)M.
	2.3 Desarrollo de la persona participante	2.3.1 Facilita las competencias STE(A)M de las personas Participantes	Asistir las participantes con la incorporación de actividades de aprendizaje, tareas y evaluaciones que requieren que las participantes adquieran habilidades - cognitivas - de procesamiento de información, interpretación de datos y análisis de datos - de resolución de problemas y pensamiento ingeniero - de investigación científica - de pensamiento computacional y tecnológico - de pensamiento creativo, creatividad e innovación - manipulativas y tecnológicas - decolaboración y comunicación
		2.3.2 Proporciona orientación sobre oportunidades de carrera en el ámbito STE(A)M	Proporcionar orientación a las personas participantes sobre posibilidades laborales y formativas relacionadas con las áreas STEM.
3. Persona educadora como organizadora y gestora / persona que coordina procedimientos i resultats	3.1 Dirección de procedimiento educativo	3.1.1 Aplica métodos de organización docente en la educación STE(A)M	Dur a terme la gestió del temps de les planificacions de classe basades en activitats relacionades amb l'àmbit STE(A)M. Coordinar el procediment docent durant les activitats relacionades amb l'àmbit STE(A)M.
		3.1.2 Aplica métodos de gestión del aula en la educación STE(A)M	Organizar y preparar los espacios de aprendizaje en el aula y / o el laboratorio para desarrollar las actividades del ámbito STE (A) M. Resolver situaciones inesperadas en el aula.

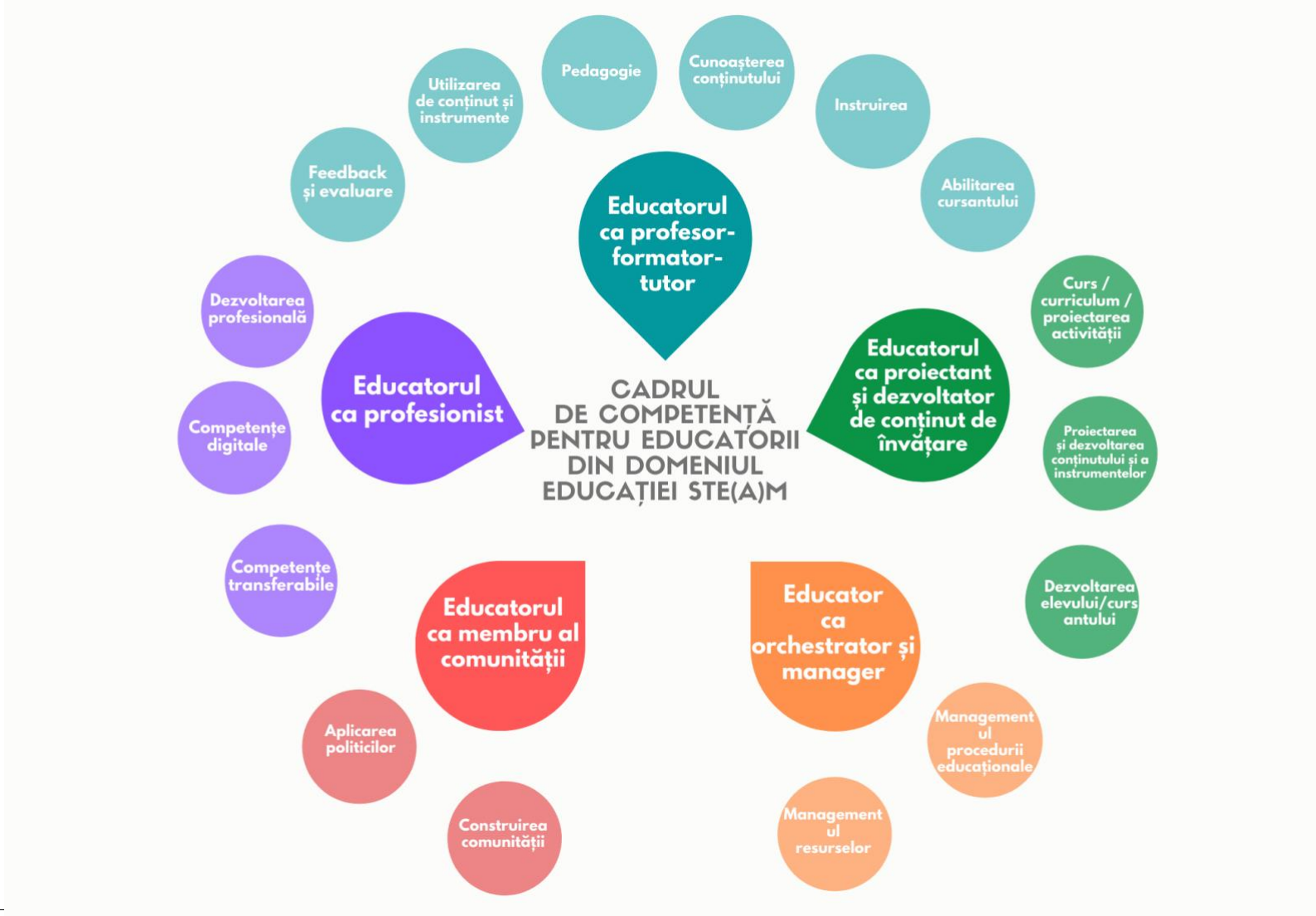
Perspectiva (basado en lo roles de la persona educadora)	Áreas (grupo coherente de competencias)	Dimensiones (Competencias)	Ejemplos de descriptores
	3.2 Gestión de recursos	3.2.1 Aplica métodos de gestión de los recursos educativos en la educación STE(A)M	Organizar y preparar los materiales y los recursos educativos necesarios para las actividades STE(A)M. Gestionar y proteger el contenido sensible, aplicando las normas de privacidad y copyright.
		3.2.2 Aplica métodos de gestión de laboratorio en la educación STE(A)M	Organizar y preparar el equipamiento de laboratorio para las actividades STE(A)M. Resolver problemas técnicos inesperados, reparar una máquina o restablecer un sistema operativo que se utiliza en las actividades STE(A)M.
		3.2.3 Aplica métodos de gestión de recursos humanos en la educación STE(A)M	Coordinar y gestionar el equipo de educadores a lo largo de un proceso docente colaborativo.. Hacer seguimiento y gestionar grupos durante las actividades STE(A)M.
4. Persona educadora como miembro de la comunidad / persona que interactúa con el entorno	4.1 Creación de comunidad	4.1.1 Participa en comunidades educativas en la educación STE(A)M	*Participar en comunidades, en línea y en la vida real, junto con otros educadores del ámbito STE (A) M con el fin de intercambiar experiencias, conocimientos y recursos educativos.*
		4.1.2 Participa en comunidades de carácter institucional en la educación STE(A)M	Colaborar con otras instituciones educativas para promover las prácticas STE(A)M dentro de la escuela y la sociedad. Desarrollar un entorno de apoyo y empoderamiento para las estudiantes y responder a las necesidades educativas y de otras índoles que puedan tener tanto los participantes como las educadoras.
		4.1.3 Participa en comunidades de investigación y negocio orientadas a la educación STE(A)M	Organizar la participación en concursos, eventos, festivales, plataformas en línea, etc., del ámbito STE(A)M para proporcionar a las personas participantes la oportunidad de mostrar su trabajo al público en general. Colaborar con comunidades de investigación y negocio.
	4.2 Aplicación de políticas	4.2.1 Aplica políticas que promuevan la educación STE(A)M	Aplicar políticas y procedimientos educativos enfocados a la educación STE (A) M. Promover aspectos contextuales, institucionales y organizativos de las políticas educativas STE(A)M.

Perspectiva (basado en lo roles de la persona educadora)	Áreas (grupo coherente de competencias)	Dimensiones (Competencias)	Ejemplos de descriptores
		4.2.2 Desarrolla políticas que promuevan la educación STE(A)M	Crear y promover nuevas políticas educativas enfocadas al método educativo STE(A)M. Participar en decisiones institucionales relacionadas con políticas educativas STE(A)M.
5. Persona educadora como profesional / persona que desarrolla y aplica competencias	5.1 Habilitades transferibles	5.1.1 Desarrolla habilidades de liderazgo	Liderar un proyecto educativo del ámbito STE (A) M. Supervisar los miembros de un grupo mientras se lleva a cabo un proyecto educativo STE(A)M, y ser flexible.
		5.1.2 Desarrolla habilidades de comunicación y presentación	Exponer contenido del ámbito STE(A)M con claridad, eficacia y confianza, ya sea de forma oral o escrita. Comunicarse (intercambio de mensajes y diálogo elocuente) con los participantes, los padres y madres y terceras partes en relación al enfoque educativo STE(A)M.
		5.1.3 Desarrolla habilidades de pensamiento crítico y resolución de problemas	Identificar y analizar problemas en situaciones difíciles y hacer evaluaciones justificadas. Ampliar y mejorar las habilidades cognitivas tales como razonamiento, análisis y evaluación de una discusión. Aportar ideas y buscar soluciones alternativas.
		5.1.4 Aplica habilidades éticas	Analizar y tomar decisiones para resolver problemas relacionados con la ética y la educación STE(A)M.
		5.1.5 Desarrolla habilidades de trabajo en equipo	Colaborar con otros educadores de otras disciplinas para diseñar y preparar programas / actividades / recursos educativos de contenido STE(A)M. Cooperar (con otras personas educadoras) para intercambiar conocimientos y experiencia, y desarrollar prácticas pedagógicas collaborativa e innovadoras.
		5.1.6 Aplica habilidades de gestión de la información	Localizar y gestionar información relevante del ámbito STE(A)M a partir de diversas fuentes.
		5.1.7 Desarrolla habilidades de emprendimiento	Identificar oportunidades laborales relacionadas con la educación STE(A)M.
		5.2.1 Desarrolla habilidades de alfabetización digital	Leer con espíritu crítico y producir de forma creativa comunicaciones académicas y profesionales relacionadas con la educación STE(A)M a través de varios medios.

Perspectiva (basado en lo roles de la persona educadora)	Áreas (grupo coherente de competencias)	Dimensiones (Competencias)	Ejemplos de descriptores
	5.2 Habilidades digitales		Participar en redes digitales enfocadas a la investigación y el aprendizaje en el ámbito de la educación STE(A)M. Adaptar y utilizar aplicaciones y servicios de dispositivos digitales en relación a la educación STE(A)M. Estudiar y formarse profusamente en el ámbito tecnológico, ya sea de manera formal o informal. Participar en prácticas académicas, profesionales y de investigación vinculadas a los sistemas digitales que van apareciendo en el ámbito STE(A)M. Localizar, interpretar, evaluar, gestionar y compartir información digital. Utilizar tecnologías modernas para potenciar y facilitar las actividades de comunicación.
		5.2.2 Gestiona y emplea herramientas digitales para la educación STE(A)M	Emplear las telecomunicaciones en la educación STE(A)M (p. E. Estrategias adecuadas para integrar las telecomunicaciones en la educación STE(A)M, integrar recursos tecnológicos innovadores, etc.)
	5.3 Desarrollo profesional	5.3.1 Adapta prácticas de autorreflexión a la educación STE(A)M	Reunir, analizar e interpretar datos (resultados de aprendizaje, resultados de evaluación, autoevaluación) para mejorar la enseñanza / aprendizaje STE(A)M. Reflexionar de cara a la mejora personal a través del autoaprendizaje, así como a través de las comunidades de práctica relacionadas con el ámbito STE(A)M. Conocer, comprender y ser capaz de interpretar y utilizar los resultados de evaluación para mejorar las actividades STE(A)M. Reflexionar sobre el rendimiento propio y responder a la crítica constructiva basada en la retroalimentación recibida de las personas participantes y supervisores para mejorar la aptitud personal.
		5.3.2 Participa en experiencias de aprendizaje continuo relacionadas con el enfoque educativo STE(A)M	Participar en eventos de desarrollo profesional continuo sobre temas relacionados con el ámbito STE(A)M. Comprometerse con el crecimiento personal, académico, ocupacional y profesional dedicándose al estudio reflexivo y la investigación en el ámbito STE(A)M.

Perspectiva (basado en lo roles de la persona educadora)	Áreas (grupo coherente de competencias)	Dimensiones (Competencias)	Ejemplos de descriptores
		5.3.3 Actuar como persona investigadora en temas de educación STE(A)M	Hacer seguimiento de las últimas novedades y métodos educativos en relación a los campos STEM y el enfoque educativo STE(A)M. Buscar y leer con espíritu crítico textos académicos y profesionales relacionados con la educación STE(A)M. Conocer, comprender y emplear métodos de estudio efectivos.

Appendix 1c: STE(A)MComp Edu: The Educators Competence Framework for STE(A)M education [Romanian]



Perspectiva (pe baza rolurilor educatorilor)	Arii (grup coerent de competențe)	Dimensiuni (Competențe)	Exemple de declarații
1. Educatorul ca profesor-formator-tutor / implementarea procedurii educaționale	1.1 Pedagogie	1.1.1 Înțelegerea și utilizarea tehnicilor de predare și de învățare care promovează educația STE(A)M	Să cunoască, să înțeleagă și să utilizeze teoriile învățării și metodele de predare (cum ar fi învățarea bazată pe cercetare, învățarea bazată pe probleme etc.) care promovează abordarea educațională STE(A)M. Să cunoască, să înțeleagă și să utilizeze învățarea bazată pe cercetare, predarea bazată pe proiecte și alte tehnici de învățare cu scopul de a îmbunătăți activitățile STE(A)M cu întrebări complexe, dezvoltând gândirea critică, explorând problemele sociale și dezvoltând soluții la probleme reale. Să ofere învățare experiențială cu utilizarea activităților STE(A)M legate de experiențele cursanților. Să utilizeze strategii bazate pe jocuri în activitățile STE(A)M cu scopul de a îmbunătăți participarea și motivația cursanților.
		1.1.2 Aplicarea unor metode de învățare colaborativă în activitățile de educație STE(A)M	Să cunoască, să înțeleagă și să utilizeze tehnici de dinamică de grup. Să cunoască, să înțeleagă și să utilizeze metode de lucru în echipă și tehnici de colaborare pentru a-i îndruma pe elevi și cursanți să coopereze eficient și să comunice între ei. Să organizeze mediul de clasă pentru a facilita metodele de învățare colaborativă.
		1.1.3 Promovarea învățării autoreglate în activitățile de educație STE(A)M.	Să cunoască, să înțeleagă și să utilizeze tehnici pentru procesele de învățare autoreglate în care elevii proiectează, reflectează, caută informații, împărtășesc idei și descoperă soluții creative la probleme.
	1.2 Cunoașterea conținutului	1.2.1 A înțelege ce reprezintă și ce înseamnă educația STE(A)M	Să înțeleagă educația STE(A)M ca o abordare integrată a subiectului STEM în combinație cu Arte, de ex. arte vizuale, versuri etc. Să recunoască faptul că educația STE(A)M este o abordare a învățării care folosește știința, tehnologia, ingineria, artele și matematica ca puncte de acces pentru îndrumarea cercetării, dialogului și gândirii critice a elevilor. Să recunoască că abordarea educațională STE(A)M are ca scop pregătirea cetățenilor activi care funcționează într-o societate științifică și tehnologică.
		1.2.2 A deține cunoștințel legate de conținutul subiectelor STE(A)M	Cunoașterea conținutului subiectului. Aplicarea cunoștințelor de bază ale calculatorului. Să aplice abilități matematice pentru calcule și măsurători.

Perspectiva (pe baza rolurilor educatorilor)	Arii (grup coerent de competențe)	Dimensiuni (Competențe)	Exemple de declarații
			Să aplice abordarea științifică pentru a descompune un sistem științific complex în părți mai mici, să recunoască relațiile de cauză și efect și să își apere opiniile folosind fapte. Să asocieze principiile de bază ale științei, tehnologiei, ingineriei și matematicii cu alte domenii precum istoria, limbajul, artele, cultura etc..
	1.3 Instruirea	1.3.1 A oferi îndrumări în activitățile de educație STE(A)M	Să ofere elevilor îndrumări adecvate și specifice dar și asistență
		1.3.2 A acționa ca facilitator în activitățile de educație STE(A)M.	Să acționeze ca un facilitator pentru a ghida și a ajuta elevii să învețe singuri în timpul activităților legate de STE(A)M. Să încurajeze cursanții și să dezvolte un mediu de învățare confortabil.
		1.3.3 A acționa ca mentor în activitățile de educație STE(A)M	Să acționeze ca un mentor, încurajând elevii să se bucure de activitățile legate de STE(A)M și să ofere elevului un sistem de sprijin pentru mentorat.
	1.4 Utilizarea de conținut și instrumente	1.4.1 Selectarea și utilizarea conținutului și a instrumentelor adecvate pentru educația STE(A)M	Să selecteze și să utilizeze conținut și instrumente educaționale adecvate pentru a sprijini și îmbunătăți predarea și învățarea STE(A)M. Să selecteze și să utilizeze software și aplicații adecvate pentru a sprijini și îmbunătăți predarea și învățarea STE(A)M. Să selecteze și să utilizeze conținutul educațional STE(A)M legat de viața reală pentru o înțelegere mai clară și crearea stimulentelor participative ale elevilor. Să selecteze și să utilizeze concepte și conținut educațional și instrumente din domenii non-STEM, cum ar fi arta, limbajul etc., în educația STE(A)M. Utilizarea textului multimodal care oferă interacțiune și stimulare vizuală. Să cunoască, să înțeleagă, să selecteze și să proiecteze conținut educațional adecvat pe baza nevoilor, caracteristicilor, cunoștințelor anterioare și obiectivelor educaționale ale cursului.
		1.4.2 Organizarea și partajarea de conținut și instrumente adecvate pentru educația STE(A)M.	Să organizeze conținutul și instrumentele legate de STE(A)M și să le pună la dispoziția cursanților, părinților și altor educatori, dacă este necesar. Protejarea conținutul digital sensibil și non sensibil. Să cunoască, să înțeleagă și să utilizeze confidențialitatea conținutului, licențele și regulile privind drepturile de autor.

Perspectiva (pe baza rolurilor educatorilor)	Arii (grup coerent de competențe)	Dimensiuni (Competențe)	Exemple de declarații
	1.5 Feedback și evaluare	1.5.1 Utilizarea strategiilor de evaluare pentru educația STE(A)M	Să cunoască, să înțeleagă, să proiecteze și să utilizeze mai multe forme de evaluare a performanței elevilor (individuală /de grup) potrivite pentru activitățile legate de STE(A)M. Să cunoască, să înțeleagă, să proiecteze și să gestioneze atât evaluarea formativă, cât și cea sumativă în moduri adecvate nivelului și scopului învățării și care îndeplinesc cerințele organismelor de acreditare. Să cunoască, să înțeleagă și să utilizeze strategii de autoevaluare ale cursanților adecvate pentru activitățile legate de STE(A)M. Să cunoască, să înțeleagă și să poată păstra înregistrări detaliate și diagnostice ale evaluării activităților legate de STE(A)M.
		1.5.2 Utilizarea tehnicilor de feedback pentru educația STE(A)M	Determinarea tehnicilor de performanță ale elevilor în cadrul cursului prin oferirea de feedback în mod regulat. Să monitorizeze neînțelegerile elevilor, oferind feedback și îndrumări acolo unde este cazul. Determinarea gradului de implicare a cursanților (de exemplu, interesul și atitudinile cursanților).
	1.6 Abilitarea cursantului	1.6.1 Asigurarea accesibilității și a incluziunii în educația STE(A)M	Să asigure accesul la resursele și activitățile STE(A)M pentru toți elevii, inclusiv pentru cei cu nevoi speciale. Să abordeze problemele de incluziune și diversitate la clasă în timpul activităților legate de STE(A)M. Să abordeze prejudecățile și stereotipurile din domeniile STE(A)M.
		1.6.2 Asigurarea implicării active a elevilor în educația STE(A)M	Să cunoască, să înțeleagă și să poată utiliza tehnici pentru a îmbunătăți interacțiunea elevilor și participarea activă a acestora, oferind îndrumări și asistență adecvate în timpul activităților legate de STE(A)M. Să ofere îndrumări elevilor pentru a comunica între ei și pentru a sugera diferite puncte de vedere prin dezvoltarea unui mediu de învățare deschis pentru rezolvarea creativă a problemelor în timpul activităților legate de STE(A)M.

Perspectiva (pe baza rolurilor educatorilor)	Arii (grup coerent de competențe)	Dimensiuni (Competențe)	Exemple de declarații
		1.6.3 Asigurarea diferențierii și a personalizării în educațiaSTE(A)M	Să creeze experiențe de învățare STE(A)M personalizate pentru a satisface diferitele nevoi ale cursanților.
2. Educatorul ca proiectant și dezvoltator de conținut de învățare / proiectarea și producerea rezultatelor	2.1 Curs / curriculum / proiectarea activității	2.1.1 Înțelegerea și dezvoltarea unui curriculum educațional STE(A)M	Să cunoască și să înțeleagă principiile și practicile curriculumului asociat STE(A)M. Cunoașterea, înțelegerea, selectarea și proiectare curriculumului asociat STE(A)M.
		2.1.2 Proiectarea cursurilor de educație STE(A)M	Să proiecteze și să implementeze programe educaționale care să integreze domeniile științifice ale STE(A)M și să promoveze abordarea educațională STE(A)M.
		2.1.3 Proiectarea activităților de educație STE(A)M	Să proiecteze și să implementeze activități educaționale STE(A)M bazate pe situații din viața reală. Să cunoască, să înțeleagă, să selecteze și să proiecteze activități educaționale legate de STE(A)M pe baza nevoilor, caracteristicilor, cunoștințelor anterioare ale elevilor și obiectivelor educaționale ale cursului.
	2.2 Proiectarea și dezvoltarea conținutului și a instrumentelor	2.2.1 Crearea și modificarea conținutului adecvat educației STE(A)M	Crearea și modificarea conținutului educațional adecvat pentru a sprijini și îmbunătăți predarea și învățarea STE(A)M. Să creeze și să dezvolte o varietate de resurse (material audiovizual etc.) pentru a proiecta în mod eficient activități educaționale care necesită integrarea conceptelor și abilităților din diferite discipline.
		2.2.2 Proiectarea și dezvoltarea de software și aplicații pentru educația STE(A)M	Să utilizeze tehnologia pentru a proiecta și dezvolta aplicații STE(A)M pentru activități educaționale STE(A)M.
	2.3 Dezvoltarea elevului/cursantului	2.3.1 Facilitarea competențelor STE(A)M	Să faciliteze cursanții pentru a încorpora activități de învățare - Abilități cognitive - Prelucrarea informațiilor - Abilități de interpretare și analiză a datelor - Abilități de rezolvare a problemelor și gândire inginerească - Abilități de investigație științifică - Abilități de gândire computațională și TIC - Abilități de proiectare a gândirii, creativitate și inovare

Perspectiva (pe baza rolurilor educatorilor)	Arii (grup coerent de competențe)	Dimensiuni (Competențe)	Exemple de declarații
			- Abilități manipulative și tehnologice - Abilități de colaborare și comunicare
		2.3.2 Să ofere îndrumare pentru oportunitățile de carieră legate de STE(A)M	Să ofere îndrumări elevilor și cursanților despre posibilitățile de lucru și de studiu legate de domeniile STEM.
3. Educator ca orchestrator și manager / coordonarea procedurilor și rezultatelor	3.1 Managementul procedurii educaționale	3.1.1 Aplicarea metodelor de organizare a predării în educația STE(A)M	Să efectueze gestionarea timpului planurilor de lecție pe baza activităților legate de STE(A)M. Să coordoneze procedura de predare în timpul activităților legate de STE(A)M.
		3.1.2 Aplicarea metodelor de gestionare a clasei în educația STE(A)M.	Să organizeze și să pregătească spații de învățare în clasă și laborator pentru activități legate de STE(A)M. Să facă față situațiilor neașteptate în clasă.
	3.2 Managementul resurselor	3.2.1 Aplicarea metodelor de gestionare a resurselor educaționale în educația STE(A)M.	Să organizeze și să pregătească materialele și resursele educaționale necesare pentru activitățile legate de STE(A)M. Să gestioneze și să protejeze conținutul digital și non-digital sensibil prin aplicarea regulilor de confidențialitate și drepturile de autor.
		3.2.2 Aplicarea metodelor de management de laborator în educația STE(A)M	Să organizeze și să pregătească echipamentul de laborator pentru activitățile STE(A)M. Să rezolve probleme tehnice neașteptate, repararea unui echipament sau depanarea unui sistem de operare care este utilizat pentru activitățile legate de STE(A)M.
		3.2.3 Aplicarea metodelor de gestionare a resurselor umane în educația STE(A)M	*Să coordoneze și să gestioneze echipa de educatori în timpul unei proceduri de predare colaborativă.* Să monitorizeze și să gestioneze grupurile în timpul activităților legate de STE(A)M.
4. Educatorul ca membru al comunității / interacțiunea cu mediul	4.1 Construirea comunității	4.1.1 Implicarea în comunitățile de educatori STE(A)M	*Să adere la comunități online și offline ale educatorilor STE(A)M pentru a face schimb de experiențe, cunoștințe și resurse educaționale.*
		4.1.2 Implicarea în comunități instituționale despre educația STE(A)M.	Să colaboreze cu alte instituții de învățământ pentru a promova practicile STE(A)M în școli și societate. Să dezvolte un mediu de susținere și abilitare pentru elev și să răspundă nevoilor educaționale și de altă natură ale elevilor și colegilor educatori.

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		4.1.3 Implicarea în comunități de cercetare și business despre educația STE(A)M	Să organizeze participări la concursuri, evenimente, festivaluri, platforme online, legate de STE(A)M etc., pentru a oferi elevilor posibilitatea de a-și prezenta munca publicului larg. Să coopereze cu comunitățile de cercetare și de afaceri.
	4.2 Aplicarea politicilor	4.2.1 Aplicarea politicilor care promovează educația STE(A)M	Să aplice politici și proceduri educaționale pentru educația STE(A)M. Promovarea aspectelor contextuale, instituționale și organizaționale ale politicilor educaționale STE(A)M.
		4.2.2 Elaborarea politicilor care promovează educația STE(A)M	Să creeze și să promoveze noi politici educaționale pentru abordarea educațională STE(A)M. Să participe la deciziile instituționale legate de politicile educaționale STE(A)M.
5. Educatorul ca profesionist / dezvoltarea și aplicarea competențelor	5.1 Competențe transferabile	5.1.1 Dezvoltarea abilităților de conducere	Să conducă un proiect educațional legat de STE(A)M. Să supravegheze membrii unui grup în timpul unui proiect educațional legat de STE(A)M și să fie flexibili.
		5.1.2 Dezvoltarea abilităților de prezentare și comunicare	Să furnizeze conținutul legat de educația STE(A)M în mod clar, eficient și cu încredere, atât oral cât și în scris. Să comunice (schimb de mesaje și dialog semnificativ) cu elevii, părinții și terții pentru abordarea educativă STE(A)M.
		5.1.3 Dezvoltarea abilităților de gândire critică și de rezolvare a problemelor	Să identifice și să analizeze problemele în situații dificile și să facă o evaluare justificată. Să extindă și să îmbunătățească abilitățile de gândire, cum ar fi explicația, analiza și evaluarea unei discuții. Să găsească idei și să caute soluții alternative.
		5.1.4 Aplicarea abilităților etice	Să analizeze și să ia decizii de rezolvare a problemelor legate de etică și educația STE(A)M.
		5.1.5 Dezvoltarea abilităților de lucru în echipă	Să colaboreze cu alți educatori din alte discipline pentru a proiecta și pregăti programe / resurse / activități educaționale care au conținut STE(A)M. Să coopereze (cu alți educatori) pentru a face schimb de cunoștințe, experiență și pentru a dezvolta practici pedagogice inovatoare și colaborative.
		5.1.6 Aplicarea abilităților de gestionare a informațiilor	Găsirea și gestionarea informațiilor relevante despre STE(A)M care provin din diverse surse.

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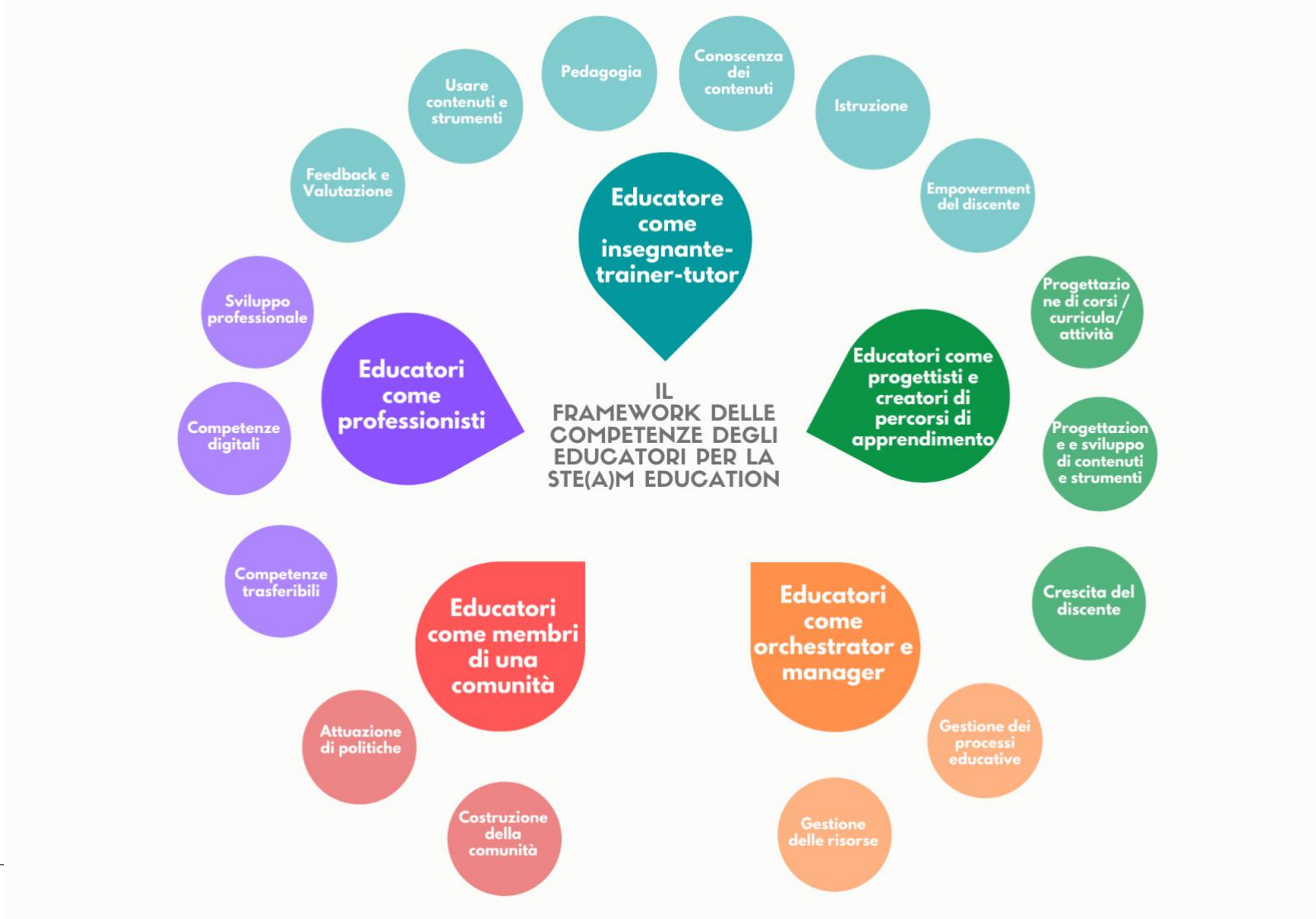
		5.1.7 Dezvoltarea abilităților antreprenoriale	Identificarea oportunităților de muncă legate de educația STE(A)M.
	5.2 Competențe digitale	5.2.1 Dezvoltarea abilităților de alfabetizare digitală	Să citească critic și să producă în mod creativ comunicarea academică și profesională legată de educația STE(A)M. Să participe la rețele digitale pentru învățare și cercetare în domeniul educației STE(A)M. Să adapteze și să utilizeze aplicații și servicii de dispozitive digitale legate de educația STE(A)M. Să studieze și să învețe efectiv într-un mediu bogat în tehnologie, formal și informal. Să participe la practici academice emergente și cercetări STE(A)M care depind de sistemele digitale. Găsirea, interpretarea, evaluarea, gestionarea și partajarea informațiilor digitale. Să utilizeze tehnologiile moderne pentru a spori și facilita activitățile de comunicare.
		5.2.2 Gestionarea și utilizarea instrumentelor digitale pentru educația STE(A)M	Utilizarea TIC în educația STE(A)M (de exemplu, strategii adecvate pentru integrarea TIC în educația STE(A)M, integrarea resurselor tehnologice inovatoare etc.).
	5.3 Dezvoltarea profesională	5.3.1 Adaptarea practicilor auto-reflexive pentru educația STE(A)M	Colectarea, analizarea, interpretarea datelor (rezultatele învățării, rezultatele evaluării, autoevaluarea) pentru a îmbunătăți predarea / învățarea STE(A)M. Să reflecte asupra procesului de auto-îmbunătățire prin învățare personală, precum și prin aderarea la comunitățile de practici legate de STE(A)M. Să cunoască, să înțeleagă și să poată interpreta și utiliza rezultatele evaluării pentru a îmbunătăți activitățile legate de STE(A)M. Să reflecteze asupra propriei performanțe și să răspundă la critici constructive bazate pe feedback-ul venit din partea elevilor și a supraveghetorilor pentru a îmbunătăți propria performanță.
		5.3.2 Participarea la experiențe de învățare pe tot parcursul vieții legate de educația STE(A)M	Să participe la dezvoltarea profesională continuă cu privire la subiecte legate de educația STE(A)M. Să se implice în dezvoltarea personală, academică, ocupațională și profesională, urmărind studii reflexive și cercetări în zona STE(A)M.

Perspectiva (pe baza rolurilor educatorilor)	Arii (grup coerent de competențe)	Dimensiuni (Competențe)	Exemple de declarații
		5.3.3 A acționa ca un cercetător pe teme de educație STE(A)M	Să monitorizeze cele mai recente evoluții și metode educaționale în domeniile STEM și abordarea educațională STE(A)M. Să găsească și să citească în mod critic texte academice și profesionale legate de educația STE(A)M. Să cunoască, să înțeleagă și să utilizeze metode eficiente de studiu.

Appendix 1d: STE(A)MComp Edu: The Educators Competence Framework for STE(A)M education [Itanlian]



Prospettiva (Basata sui Ruoli degli educatori)	Aree (gruppi coerenti di competenze)	Dimensioni (Competenze)	Esempi
1. Educatore come insegnante-trainer-tutor / implementare i processi educativi	1.1 Pedagogia	1.1.1 Comprendere e utilizzare tecniche di insegnamento e apprendimento che promuovano l'istruzione STE(A)M.	*Conoscere, comprendere e utilizzare teorie dell'apprendimento e metodi di insegnamento (quali inquiry-based learning, problem-based learning, ecc…) che promuovano l'approccio educativo STE(A)M.* *Conoscere, comprendere e utilizzare l'inquiry-based learning, l'insegnamento project-based e altre tecniche di apprendimento con lo scopo di potenziare le attività STE(A)M con problemi complessi, sviluppare il pensiero critico, esplorare questioni sociali e sviluppare soluzioni a problemi reali.* *Fornire apprendimento esperienziale con l'uso di attività STE(A)M collegate alle esperienze del discente.* *Usare strategie ludiche nelle attività STE(A)M con lo scopo di migliorare la partecipazione e la motivazione dei discenti.*
		1.1.2 Applicare metodi di apprendimento collaborativi in attività formative STE(A)M	*Conoscere, comprendere e utilizzare tecniche basate sulle dinamiche di gruppo.* *Conoscere, comprendere e utilizzare metodi di lavoro di squadra e tecniche collaborative per indirizzare i discenti verso una cooperazione e comunicazione reciproca efficace.* *Organizzare l'aula in modo da facilitare i metodi di apprendimento collaborativo.*
		1.1.3 Promuovere l'apprendimento autonomo nelle attività formative STE(A)M	*Conoscere, comprendere e utilizzare techniche per i processi di apprendimento autonomo, dove i discenti progettano, riflettono, ricercano informazioni, condividono idee e scoprono soluzioni creative ai problemi.*
	1.2 Conoscenza dei contenuti	1.2.1 Comprenderere cosa significhi e rappresenti la formazione STE(A)M	*Comprendere l'educazione STE(A)M come un approccio integrato di temi STEM in combinazione con le Arti, es. arti visive, poesia, ecc…* *Riconoscere che l'educazione STE(A)M è un approccio all'apprendimento che utilizza Scienze, Tecnologia, Ingegneria, Arti e Matematica come punti di accesso per guidare il discente verso l'analisi, il dialogo e il pensiero critico* *Riconoscere che l'approccio educativo STE(A)M mira a preparare cittadini attivi e funzionali in una società scientifica e tecnologica.*

Prospettiva (Basata sui Ruoli degli educatori)	Aree (gruppi coerenti di competenze)	Dimensioni (Competenze)	Esempi
		1.2.2 Possiede la conoscenza dei contenuti di tematiche STE(A)M	*Conoscenza dei contenuti della materia.* *Applicare competenze informatiche di base.* *Applicare competenze matematiche per calcoli e misure* *Applicare un approccio scientifico per scomporre un sistema scientifico complesso in parti più piccole, riconoscere relazioni di causa ed effetto e difendere le opinioni con i fatti.* *Associare i principi base di scienze, tecnologia, ingegneria e matematica ad altri campi quali la storia, le lingue, le arti, la cultura, ecc…*
	1.3 Istruzione	1.3.1 Fornire una guida nelle attività formative STE(A)M	*Fornire guida e assistenza appropriate e mirate ai discenti con forme e formati diversificati.*
		1.3.2 Agire come un facilitatore nelle attività formative STE(A)M	*Agire come un facilitatore per guidare e assistere gli studenti nell'apprendimento autonomo durante le attività STE(A)M.* *Incoraggiare i discenti e generare un ambiente di apprendimento confortevole.*
		1.3.3 Agire come mentore nelle attività formative STE(A)M	*Agire come mentore, incoraggiando gli studenti a divertirsi con le attività STE(A)M e procurare un sistema di mentoring di agli studenti.*
	1.4 Usare contenuti e strumenti	1.4.1 Selezionare e utilizzare contenuti e strumenti appropriati per l'istruzione STE(A)M	*Selezionare e utilizzare contenuti e strumenti educativi adeguati per supportare e migliorare l'insegnamento e l'apprendimento di STE(A)M.* *Selezionare e utilizzare software e app adeguati per supportare e migliorare l'insegnamento e l'apprendimento STE(A)M.* *Selezionare e utilizzare i contenuti educativi STE(A)M relativi alla vita reale per una più chiara comprensione e la creazione di incentivi per la partecipazione degli studenti.* *Selezionare e utilizzare concetti, contenuti e strumenti educativi da campi non STEM come arte, lingua ecc. nell'istruzione STE(A)M.* *Utilizzare un testo multimodale che fornisce interazione e stimolazione visiva.* *Conoscere, comprendere, selezionare e progettare contenuti educativi appropriati in base alle esigenze, alle caratteristiche, alle conoscenze pregresse e agli obiettivi educativi del corso.*

Prospettiva (Basata sui Ruoli degli educatori)	Aree (gruppi coerenti di competenze)	Dimensioni (Competenze)	Esempi
		1.4.2 Organizzare e condividere contenuti e strumenti appropriati per l'istruzione STE(A)M	*Organizzare i contenuti e gli strumenti relativi a STE(A)M e renderli disponibili a discenti, genitori e altri educatori, se necessario.* *Proteggere i contenuti sensibili digitali e non digitali.* *Conoscere, comprendere e utilizzare la privacy dei contenuti e le licenze e le regole sul copyright.*
	1.5 Feedback e Valutazione	1.5.1 Usare strategie di valutazione per l'istruzione STE(A)M.	*Conoscere, comprendere e progettare e utilizzare più forme di valutazione delle prestazioni degli studenti (individuale / di gruppo) adatte per le attività STE(A)M.* *Conoscere, comprendere e progettare e gestire la valutazione sia formativa che sommativa in modi che siano appropriati al livello e allo scopo dell'apprendimento e soddisfino i requisiti degli organismi di accreditamento.* *Conoscere, comprendere e utilizzare strategie di autovalutazione dei leaner adatti alle attività STE(A)M.* *Conoscere, comprendere ed essere in grado di conservare registrazioni dettagliate e diagnostiche della valutazione delle attività STE(A)M.*
		1.5.2 Usare tecniche di feedback per l'istruzione STE(A)M	*Determinare le prestazioni del corso degli studenti fornendo feedback regolari.* *Monitorare le incomprensioni degli studenti, fornendo feedback e guida ove appropriato.* *Determinare il grado di coinvolgimento degli studenti (ad es. Interesse e atteggiamenti degli studenti).*
	1.6 Empowerment del discente	1.6.1 Assicurare l'accessibilità e l'inclusione nella formazione STE(A)M.	*Garantire l'accesso sia alle risorse STE(A)M sia alle attività per tutti gli studenti, compresi quelli con bisogni speciali.* *Affrontare i problemi di inclusione e diversità all'interno della classe durante le attività STE(A)M.* *Affrontare pregiudizi e stereotipi nei campi STE(A)M.*

Prospettiva (Basata sui Ruoli degli educatori)	Aree (gruppi coerenti di competenze)	Dimensioni (Competenze)	Esempi
		1.6.2 Assicurare il coinvolgimento attivo dei discenti nella formazione STE(A)M.	*Conoscere, comprendere ed essere in grado di utilizzare tecniche per migliorare l'interazione degli studenti e la loro partecipazione attiva, fornendo una guida e un'assistenza appropriate durante le attività STE(A)M.* *Fornire una guida agli studenti per comunicare tra loro e suggerire diversi punti di vista sviluppando un ambiente di apprendimento aperto per la risoluzione creativa dei problemi durante le attività STE(A)M.*
		1.6.3 Assicurare la diversificazione e personalizzazione nella formazione STE(A)M.	*Creare esperienze di apprendimento STE(A)M personalizzate per soddisfare le diverse esigenze degli studenti*
2. Educatori come progettisti e creatori di percorsi di apprendimento / progettare e realizzare prodotti	2.1 Progettazione di corsi / curricula/ attività	2.1.1 Comprendere e sviluppare curricula per la formazione STE(A)M	*Conoscere e comprendere i principi e le pratiche dei curricula STE(A)M.* *Conoscere, comprendere, selezionare e progettare i curricula STE(A)M.*
		2.1.2 Progettare corsi per la formazione STE(A)M	*Progettare e implementare programmi educativi che integrino i campi scientifici STE(A)M e promuovano l'approccio educativo STE(A)M*
		2.1.3 Progettare attività per la formazione STE(A)M	*Progettare e implementare attività educative STE(A)M basate su situazioni di vita reale.* *Conoscere, comprendere, selezionare e progettare attività educative correlate a STE(A)M in base alle esigenze, alle caratteristiche, alle conoscenze pregresse e agli obiettivi educativi del corso.*
	2.2 Progettazione e sviluppo di	2.2.1 Creare e modificare contenuti appropriati per l'istruzione STE(A)M	*Creare e modificare contenuti educativi adeguati per supportare e migliorare l'insegnamento e l'apprendimento STE(A)M.*

Prospettiva (Basata sui Ruoli degli educatori)	Aree (gruppi coerenti di competenze)	Dimensioni (Competenze)	Esempi
	contenuti e strumenti		*Creare e sviluppare una varietà di risorse (materiale audiovisivo, ecc.) per progettare efficacemente attività educative che richiedono l'integrazione di concetti e abilità di diverse discipline.*
		2.2.2 Progettare e sviluppare software e app per l'educazione STE(A)M	*Utilizzare la tecnologia per progettare e sviluppare applicazioni STE(A)M per attività educative STE(A)M.*
	2.3 Crescita del discente	2.3.1 Facilitare le competenze STE(A)M dei discenti	*Facilitare gli studenti al fine di incorporare attività di apprendimento, compiti e valutazioni che richiedono agli studenti di acquisire* - *Capacità cognitive* - *Elaborazione delle informazioni* - *Capacità di interpretazione e analisi dei dati* - *Capacità di problem solving e pensiero ingegneristico* - *Capacità di ricerca scientifica* - *Pensiero computazionale e abilità ICT* - *Capacità di Design Thinking, Creatività e Innovazione* - *Abilità manipolative e tecnologiche* - *Collaborazione e capacità di comunicazione*
		2.3.2 Orientare verso opportunità di carriera legate ai campi STE(A)M	*Fornire una guida agli studenti sulle possibilità di lavoro e studio relative ai campi STEM.*
3. Educatori come orchestrator e manager / coordinare procedure e prodotti	3.1 Gestione dei processi educative	3.1.1 Applicare metodi di organizzazione dell'insegnamento alla formazione STE(A)M	*To carry out time management of lesson plans based on STE(A)M related activities.* *To coordinate the teaching procedure during STE(A)M related activities.* *Pianificare la durata delle attività dei programmi di lezione basati su attività STE(A)M.* *Coordinare la procedura di insegnamento durante le attività STE(A)M.*

Prospettiva (Basata sui Ruoli degli educatori)	Aree (gruppi coerenti di competenze)	Dimensioni (Competenze)	Esempi
		3.1.2 Applicare metodi di gestione dell'aula alla formazione STE(A)M	*To organize and prepare classroom and laboratory learning spaces for STE(A)M related activities.* *To handle unexpected situations in the classroom.* *Organizzare e preparare spazi di apprendimento in aula e laboratorio per le attività STE(A)M.* *Gestire situazioni impreviste in classe.*
	3.2 Gestione delle risorse	3.2.1 Applicare metodi di gestione delle risorse educative per la formazione STE(A)M	*Organizzare e preparare i materiali e le risorse educative necessarie per le attività STE(A)M.* *Gestire e proteggere i contenuti digitali e non digitali sensibili applicando le norme sulla privacy e sul diritto d'autore.*
		3.2.2 Applicare metodi di gestione delle risorse educative per la formazione STE(A)M	*To organize and prepare the lab equipment for STE(A)M activities.* *To handle unexpected technical problems, repair a machine or debug an operating system that is used for STE(A)M related activities.* *Organizzare e preparare l'attrezzatura di laboratorio per le attività STE(A M.* *Gestire problemi tecnici imprevisti, riparare una macchina o eseguire il debug di un sistema operativo utilizzato per le attività STE(A)M.*
		3.2.3 Applicare metodi di gestione delle risorse umane alla formazione STE(A)M	*Coordinare e gestire il team di educatori durante una procedura di insegnamento collaborativo.* *Monitorare e gestire i gruppi durante le attività STE(A)M.*
4. Educatori come membri di una comunità / interagire con l'ambiente	4.1 Costruzione della comunità	4.1.1 Impegnarsi nelle comunità di educatori STE(A)M	*Partecipare a comunità online e offline tra gli educatori STE(A)M al fine di scambiare esperienze, conoscenze e risorse educative.*
		4.1.2 Impegnarsi in comunità istituzionali per l'istruzione STE(A)M	*Collaborare con altre istituzioni educative al fine di promuovere le pratiche STE(A)M nelle scuole e nella società.*

Prospettiva (Basata sui Ruoli degli educatori)	Aree (gruppi coerenti di competenze)	Dimensioni (Competenze)	Esempi
			Sviluppare un ambiente favorevole e responsabilizzante per lo studente e rispondere ai bisogni educativi e di altro tipo degli studenti e degli altri educatori.
		4.1.3 Impegnarsi in comunità di ricerca e business per l'istruzione STE(A)M	*Organizzare partecipazioni a concorsi, eventi, festival, piattaforme online ecc. relativi a STE(A)M per dare agli studenti l'opportunità di presentare il proprio lavoro al grande pubblico.* *Collaborare con la ricerca e le comunità imprenditoriali.*
	4.2 Attuazione di politiche	4.2.1 Attuare politiche che promuovono la formazione STE(A)M.	*Applicare politiche e procedure educative per l'istruzione STE(A)M.* *Promuovere gli aspetti contestuali, istituzionali e organizzativi delle politiche educative STE(A)M.*
		4.2.2 Sviluppare politiche che promuovono la formazione STE(A)M.	*Creare e promuovere nuove politiche educative per l'approccio educativo STE(A)M.* *Partecipare alle decisioni istituzionali relative alle politiche educative STE(A)M.*
5. Educatori come professionisti / sviluppare e applicare competenze	5.1 Competenze trasferibili	5.1.1 Sviluppare capacità di leadership	*Condurre un progetto educativo STE(A)M.* *Supervisionare i membri di un gruppo durante un progetto educativo STE(A)M ed essere flessibili.*
		5.1.2 Sviluppare capacità di presentazione e comunicazione	*Fornire contenuti STE(A)M in modo chiaro, efficace e sicuro, oralmente o per iscritto.* *Comunicare (scambio di messaggi e dialogo significativo) con studenti, genitori e terze parti per l'approccio educativo STE(A)M.*
		5.1.3 Sviluppare capacità di pensiero critico e risoluzione dei problemi	*Identificare e analizzare i problemi in situazioni difficili e fare una valutazione giustificabile.* *Espandere e migliorare le capacità di pensiero come la spiegazione, l'analisi e la valutazione di una discussione.* *Trovare idee e cercare soluzioni alternative.*
		5.1.4 Applicare capacità etiche	*Analizzare e prendere decisioni di problem solving relative all'etica e all'educazione STE(A)M.*

Prospettiva (Basata sui Ruoli degli educatori)	Aree (gruppi coerenti di competenze)	Dimensioni (Competenze)	Esempi
		5.1.5 Sviluppare capacità di lavoro di gruppo	*Collaborare con altri educatori di altre discipline al fine di progettare e preparare programmi / risorse / attività educative su contenuti STE(A)M.* *Cooperare (con altri educatori) per scambiare conoscenze, esperienze e sviluppare pratiche pedagogiche innovative e collaborative.*
		5.1.6 Applicare capacità di gestione dell'informazione	*Trovare e gestire informazioni STE(A)M pertinenti da varie fonti.*
		5.1.7 Sviluppare capacità imprenditoriali	*Identificare le opportunità di lavoro legate all'istruzione STE(A)M.*
	5.2 Competenze digitali	5.2.1 Sviluppare competenze digitali di base	*Leggere criticamente e produrre in modo creativo comunicazioni accademiche e professionali relative all'istruzione STE(A)M in una vasta gamma di media.* *Partecipare a reti digitali per l'apprendimento e la ricerca nell'istruzione STE(A)M.* *Adattare e utilizzare applicazioni e servizi di dispositivi digitali relativi all'istruzione STE(A)M.* *Studiare e apprendere in modo effusivo in un ambiente ricco di tecnologia, formale e informale.* *Partecipare a pratiche accademiche emergenti professionali e di ricerca STE(A)M che dipendono dai sistemi digitali.* *Per trovare, interpretare, valutare, gestire e condividere informazioni digitali* *Utilizzare le moderne tecnologie per migliorare e facilitare le attività di comunicazione.*
		5.2.2 Gestire e usare strumenti digitali per l'istruzione STE(A)M	*Utilizzare le ICT nell'istruzione STE(A)M (ad esempio strategie appropriate per integrare le ICT nell'istruzione STE(A)M, integrando risorse tecnologiche innovative ecc.).*

Prospettiva (Basata sui Ruoli degli educatori)	Aree (gruppi coerenti di competenze)	Dimensioni (Competenze)	Esempi
	5.3 Sviluppo professionale	5.3.1 Adottare pratiche autoriflessive per l'educazione STE(A)M.	*Raccogliere, analizzare, interpretare i dati (risultati dell'apprendimento, risultati della valutazione, autovalutazione) per migliorare l'insegnamento / apprendimento STE(A)M.* *Riflettere per l'auto-miglioramento attraverso l'apprendimento personale e attraverso le comunità di pratica correlate a STE(A)M.* *Conoscere, comprendere ed essere in grado di interpretare e utilizzare i risultati della valutazione al fine di migliorare le attività STE(A)M.* *Riflettere sulle proprie prestazioni e rispondere a critiche costruttive basate sul feedback di studenti e supervisori al fine di migliorare le proprie prestazioni.*
		5.3.2 Partecipare a esperienze di apprendimento permanente relative alla formazione STE(A)M	*Partecipare allo sviluppo professionale continuo in argomenti correlati a STE(A)M.* *Impegnarsi nella crescita personale, accademica, professionale e professionale attraverso il perseguimento di studi e ricerche riflessive nell'area STE(A)M.*
		5.3.3 Operare come ricercatore su tematiche della formazione STE(A)M	*Monitorare gli ultimi sviluppi e metodi educativi nei campi STEM e l'approccio educativo STE(A)M.* *Trovare e leggere criticamente testi accademici e professionali relativi all'istruzione STE(A)M.* *Conoscere, comprendere e utilizzare metodi di studio efficaci.*

Appendix 1e: STE(A)MComp Edu: The Educators Competence Framework for STE(A)M education [Greek]

Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
1. Ο Εκπαιδευτικός ως δάσκαλος - εκπαιδευτής- καθοδηγητής / στην εφαρμογή της εκπαιδευτικής διαδικασίας	1.1 Παιδαγωγική	1.1.1 Αντιλαμβάνεται και χρησιμοποιεί τεχνικές διδακτικής και μάθησης που προάγουν την εκπαιδευτική προσέγγιση STE(A)M	Να αναγνωρίζει, να κατανοεί και να χρησιμοποιεί θεωρίες μάθησης και μεθόδους διδασκαλίας (όπως: διερευνητική μάθηση, μάθηση μέσω επίλυσης προβλημάτων κ.λπ.) που προωθούν την εκπαιδευτική προσέγγιση STE(A)M. Να γνωρίζει, να κατανοεί και να χρησιμοποιεί τη διερευνητική Μάθηση, τη διδακτική μέσω της μεθόδου Project και άλλες τεχνικές μάθησης με σκοπό την ενίσχυση των δραστηριοτήτων STE(A)M με πολύπλοκες ερωτήσεις, την ανάπτυξη της κριτικής σκέψης, την διερεύνηση κοινωνικών θεμάτων και την προαγωγή λύσεων σε πραγματικά προβλήματα. Να παρέχει βιωματική μάθηση με τη χρήση δραστηριοτήτων STE(A)M βασισμένων στις εμπειρίες των μαθητών. Να χρησιμοποιεί στρατηγικές βασισμένες στο παιχνίδι σε δραστηριότητες STE(A)M με στόχο να αυξήσει τη συμμετοχή και τα κίνητρα των μαθητών.
		1.1.2 Εφαρμόζει μεθόδους συνεργατικής μάθησης σε εκπαιδευτικές δραστηριότητες STE(A)M	Να γνωρίζει, να κατανοεί και να χρησιμοποιεί τεχνικές που αξιοποιούν τη δυναμική της ομάδας Να γνωρίζει, να κατανοεί και να χρησιμοποιεί μεθόδους ομαδικής εργασίας και συνεργατικές τεχνικές με στόχο την καθοδήγηση των μαθητών σε μια αποτελεσματική συνεργασία και επικοινωνία μεταξύ τους. Να οργανώνει το περιβάλλον της σχολικής τάξης με στόχο να προωθήσει μεθόδους συνεργατικής μάθησης
		1.1.3 Προάγει την αυτό-ρυθμιζόμενη μάθηση σε εκπαιδευτικές δραστηριότητες STE(A)M	*Να γνωρίζει, να κατανοεί και να χρησιμοποιεί τεχνικές σε διεργασίες αυτό-ρυθμιζόμενης μάθησης στις οποίες οι μαθητές σχεδιάζουν, σκέφτονται, ερευνούν για πληροφορίες, διαμοιράζονται ιδέες και βρίσκουν δημιουργικές λύσεις σε προβλήματα.*
			Να κατανοεί τη STE(A)M εκπαίδευση ως μια ενοποιημένη προσέγγιση του πεδίου STEM, των θεωρητικών επιστημών και των τεχνών όπως: οι εικαστικές τέχνες, ο λόγος κ.λπ..

Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
	1.2 Γνωστικό περιεχόμενο	1.2.1 Κατανοεί τι αναπαριστά και τι σημαίνει η εκπαιδευτική προσέγγιση STE(A)M	Να αναγνωρίζει ότι η εκπαίδευση STE(A)M αποτελεί μια μαθησιακή προσέγγιση που χρησιμοποιεί τη Φυσική, την Τεχνολογία, τη Μηχανική, τις Τέχνες και τα Μαθηματικά ως αφετηρία για την καθοδήγηση του μαθητή στη διερεύνηση, στον διάλογο και στην κριτική σκέψη. Να αναγνωρίζει ότι η εκπαιδευτική προσέγγιση STE(A)M στοχεύει στην προετοιμασία ενεργών και λειτουργικών πολιτών σε μια κοινωνία με επιστημονικό και τεχνολογικό προσανατολισμό.
		1.2.2 Κατέχει το γνωστικό περιεχόμενο θεμάτων που σχετίζονται με την προσέγγιση STE(A)M	Γνωστικό περιεχόμενο του αντικειμένου Να εφαρμόζει βασικές υπολογιστικές δεξιότητες Να εφαρμόζει μαθηματικές δεξιότητες αναφορικά με υπολογισμούς και μετρήσεις Να εφαρμόζει επιστημονικές προσεγγίσεις στην κατάτμηση ενός πολύπλοκου επιστημονικού συστήματος σε μικρότερα μέρη, να αναγνωρίζει σχέσεις αιτίου και αποτελέσματος και να υποστηρίζει απόψεις χρησιμοποιώντας δεδομένα. Να συνδέει τις βασικές αρχές της επιστήμης, της τεχνολογίας, της μηχανικής και των μαθηματικών με άλλα γνωστικά πεδία όπως: ιστορία, γλώσσα, τέχνες, πολιτισμός κ.λπ..
	1.3 Καθοδήγηση	1.3.1 Παρέχει καθοδήγηση σε εκπαιδευτικές δραστηριότητες STE(A)M	*Να παρέχει κατάλληλη και στοχευμένη καθοδήγηση και βοήθεια στους μαθητές χρησιμοποιώντας διαφορετικές τυπολογίες και σχεδιασμούς*
		1.3.2 Ενεργεί ως διευκολυντής σε εκπαιδευτικές δραστηριότητες STE(A)M	Να ενεργεί ως διευκολυντής με στόχο να καθοδηγεί και να βοηθά τους μαθητές στο να μαθαίνουν για τον εαυτό τους κατά τη διάρκεια δραστηριοτήτων STE(A)M Να ενθαρρύνει τους μαθητές και να δημιουργεί ένα ευχάριστο μαθησιακό περιβάλλον.
		1.3.3 Να ενεργεί ως μέντορας σε εκπαιδευτικές δραστηριότητες STE(A)M	*Να ενεργεί ως μέντορας, ενθαρρύνοντας τους μαθητές να απολαμβάνουν τις STE(A)M δραστηριότητες και να παρέχειουν σύστημα καθοδηγητικής υποστήριξης στο μαθητή*

Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
	1.4 Χρήση περιεχομένου και εργαλείων	1.4.1 Επιλέγει και χρησιμοποιεί το κατάλληλο περιεχόμενο και εργαλεία για την εκπαίδευση STE(A)M	Να επιλέγει και να χρησιμοποιεί το κατάλληλο εκπαιδευτικό περιεχόμενο και εργαλεία στην υποστήριξη και βελτίωση της διδακτικής και μαθησιακής διεργασίας STE(A)M. Να επιλέγει και να χρησιμοποιεί το κατάλληλο λογισμικό και εφαρμογές στην υποστήριξη και βελτίωση της διδακτικής και μαθησιακής διεργασίας STE(A)M. Να επιλέγει και να χρησιμοποιεί εκπαιδευτικό περιεχόμενο STE(A)M που σχετίζεται με την πραγματική ζωή για μια σαφέστερη κατανόηση και για τη δημιουργία ν κινήτρων συμμετοχής των μαθητών. Να επιλέγει και να χρησιμοποιεί έννοιες και εκπαιδευτικό περιεχόμενο ή εργαλεία από πεδία εκτός STEM όπως: τέχνη, γλώσσα κ.λπ. στην εκπαίδευση STE(A)M. Να χρησιμοποιεί πολυτροπικά κείμενα που εξασφαλίζουν αλληλεπίδραση και οπτικό κίνητρο. Να γνωρίζει, να κατανοεί, να επιλέγει και να σχεδιάζει το κατάλληλο εκπαιδευτικό περιεχόμενο με βάση τις ανάγκες, τα χαρακτηριστικά, τις προηγούμενες γνώσεις των μαθητών και την εκπαιδευτική στοχοθεσία του μαθήματος.
		1.4.2 Οργανώνει και διαμοιράζει το κατάλληλο περιεχόμενο και τα εργαλεία για την εκπαίδευση STE(A)M.	Να οργανώνει το σχετικό με το STE(A)M περιεχόμενο και τα εργαλεία και να τα διαθέτει στους μαθητές, τους γονείς και άλλους εκπαιδευτικούς εφόσον χρειάζονται. *Να προστατεύει το ευαίσθητο ψηφιακό και μη ψηφιακό περιεχόμενο.* *Να γνωρίζει, να κατανοεί και να χρησιμοποιεί κατάλληλα το απόρρητο του περιεχομένου και την άδεια των πνευματικών δικαιωμάτων και κανόνων.*
	1.5 Ανατροφοδότηση και αξιολόγηση	1.5.1 Χρησιμοποιεί στρατηγικές αξιολόγησης στην εκπαίδευση STE(A)M	Να γνωρίζει, να κατανοεί, να σχεδιάζει και να χρησιμοποιεί πολλαπλές μορφές αξιολόγησης της απόδοσης του μαθητή (ατομική/ομαδική αξιολόγηση) κατάλληλες για δραστηριότητες που σχετίζονται με το STE(A)M. Να γνωρίζει, να κατανοεί, να σχεδιάζει και να διαχειρίζεται τη διαμορφωτική και την αθροιστική αξιολόγηση με τρόπο κατάλληλο για το επίπεδο και τον σκοπό της μάθησης και να πληροί τις απαιτήσεις των φορέων διαπίστευσης. Να γνωρίζει, να κατανοεί και να χρησιμοποιεί στρατηγικές αυτοαξιολόγησης των μαθητών κατάλληλες για δραστηριότητες σχετικές με το STE(A)M

Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
			Να γνωρίζει, να κατανοεί και να είναι σε θέση να διατηρεί λεπτομερή και διαγνωστικά αρχεία της αξιολόγησης δραστηριοτήτων που σχετίζονται με το STE(A) M.
		1.5.2 Χρησιμοποιεί τεχνικές ανατροφοδότησης στην εκπαίδευση STE(A)M	*Να προσδιορίζει την απόδοση των μαθητών στο μάθημα παρέχοντας συχνή ανατροφοδότηση.* *Να παρακολουθεί τις παρανοήσεις των μαθητών παρέχοντάς τους ανατροφοδότηση και καθοδήγηση όπου απαιτείται.* *Να καθορίζει τον βαθμού συμμετοχής των μαθητών (π.χ., ενδιαφέρον και στάσεις των μαθητών).*
	1.6 Ενδυνάμωση εκπαιδευόμενου	1.6.1 Εξασφαλίζει την πρόσβαση και συμπερίληψη στις εκπαιδευτικές διαδικασίες που σχετίζονται με το STE(A)M.	*Να εξασφαλίζει την πρόσβαση σε STE(A)M πόρους και δράσεις για όλους τους μαθητές συμπεριλαμβανόμενο και εκείνων με ειδικές ανάγκες.* *Να συζητά θέματα συμπερίληψης και διαφορετικότητας εντός της σχολικής τάξης κατά τη διάρκεια δραστηριοτήτων STE(A)M.* *Να συζητά προκαταλήψεις και στερεότητα σε STE(A)M πεδία.*
		1.6.2 Εξασφαλίζει την ενεργή εμπλοκή των εκπαιδευομένων στις εκπαιδευτικές διαδικασίες που σχετίζονται με το STE(A)M.	*Να γνωρίζει, να κατανοεί και να είναι σε θέση να χρησιμοποιεί τεχνικές για την ενίσχυση της αλληλεπίδρασης των μαθητών και της ενεργού συμμετοχής τους, παρέχοντας κατάλληλη καθοδήγηση και βοήθεια κατά τη διάρκεια των δραστηριοτήτων που σχετίζονται με το STE(A)M.* *Να παρέχει καθοδήγηση στους μαθητές προκειμένου να επικοινωνούν μεταξύ τους και να προτείνουν διαφορετικές απόψεις, αναπτύσσοντας ένα ανοιχτό μαθησιακό περιβάλλον για τη δημιουργική επίλυση προβλημάτων κατά τη διάρκεια των δραστηριοτήτων που σχετίζονται με το STE(A)M.*
		1.6.3 Εξασφαλίζει την διαφοροποίηση και την εξατομίκευση στις	*Να δημιουργεί εξατομικευμένες μαθησιακές εμπειρίες STE(A)M προκειμένου να καλύπτει τις διαφορετικές μαθησιακές ανάγκες.*

Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
		εκπαιδευτικές διαδικασίες που σχετίζονται με το STE(A)M.	
2. Ο Εκπαιδευτικός ως σχεδιαστής και δημιουργός μάθησης / σχεδιάζει και παράγει μαθησιακό προϊόν	2.1 Σχεδιασμός μαθήματος / προγράμματος σπουδών / δραστηριότητας	2.1.1 Κατανοεί και αναπτύσσει προγράμματα σπουδών σχετιζόμενα με το STE(A)M	*Να γνωρίζει και να κατανοεί τις αρχές και τις πρακτικές ενός STE(A)M προγράμματος σπουδών.* *Να γνωρίζει, να κατανοεί, να επιλέγει και να σχεδιάζει προγράμματα σπουδών STE(A)M.*
		2.1.2 Σχεδιάζει σχετιζόμενα με STE(AM) μαθήματα	*Να σχεδιάζει και να εφαρμόζει εκπαιδευτικά προγράμματα που ενσωματώνουν τα επιστημονικά πεδία του STE(A)M και να προάγει την εκπαιδευτική προσέγγιση STE(A)M.*
		2.1.3 Σχεδιάζει σχετιζόμενες με STE(AM) δραστηριότητες	*Να σχεδιάζει και να εφαρμόζει STE(A)M εκπαιδευτικές δραστηριότητες που βασίζονται σε καταστάσεις πραγματικής ζωής.* *Να γνωρίζει, να κατανοεί, να επιλέγει και να σχεδιάζει εκπαιδευτικές δραστηριότητες STE(A)M οι οποίες βασίζονται στις ανάγκες, τα χαρακτηριστικά, την πρότερη γνώση των μαθητών και τους εκπαιδευτικούς στόχους του μαθήματος.*
	2.2 Σχεδίαση και ανάπτυξη περιεχομένου και εργαλείων	2.2.1 Δημιουργεί και τροποποιεί το κατάλληλο περιεχόμενο για τη STE(A)M εκπαίδευση	*Να δημιουργεί και να τροποποιεί κατάλληλο εκπαιδευτικό περιεχόμενο για να υποστηρίξει και ενισχύσει τις διδακτικές και μαθησιακές διαδικασίες STE(A)M.* *Να δημιουργεί και να αναπτύσσει μια ποικιλία πόρων (οπτικοακουστικό υλικό, κ.λπ.) για να σχεδιάζει αποτελεσματικά εκπαιδευτικές δραστηριότητες που απαιτούν την ενσωμάτωση εννοιών και δεξιοτήτων από διαφορετικούς επιστημονικούς τομείς.*
		2.2.2 Σχεδιάζει και αναπτύσσει λογισμικά και εφαρμογές για τη STE(A)M εκπαίδευση	*Χρησιμοποιεί την τεχνολογία για να σχεδιάζει και να αναπτύσσει STE(A)M εφαρμογές για STE(A)M εκπαιδευτικές δραστηριότητες.*

Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
	2.3 Ανάπτυξη του εκπαιδευόμενου	2.3.1 Διευκολύνει τις STE(A)M ικανότητες του εκπαιδευομένου	*Να διευκολύνει τους εκπαιδευόμενους να αφομοιώσουν μαθησιακές δραστηριότητες, εργασίες και αποτιμήσεις ώστε να αποκτήσουν:* *- Γνωστικές δεξιότητες* *- Δεξιότητες στην επεξεργασία πληροφοριών* *- Δεξιότητες ερμηνείας και ανάλυσης δεδομένων* *- Δεξιότητες επίλυσης προβλημάτων και μηχανικής σκέψης* *- Δεξιότητες επιστημονικής έρευνας* *- Δεξιότητες υπολογιστικής σκέψης και ΤΠΕ* *- Δεξιότητες σχεδιαστικής σκέψης, δημιουργικότητας και καινοτομίας* *- Διαχειριστικές και Τεχνολογικές Δεξιότητες* *- Δεξιότητες συνεργασίας και επικοινωνίας*
		2.3.2 Παρέχει οδηγίες για σχετικές με STE(A)M εργασιακές ευκαιρίες	*Να παρέχει καθοδήγηση στους εκπαιδευόμενους για δυνατότητες εργασίας και σπουδών συσχετιζόμενες με πεδία STEM*
3. Ο Εκπαιδευτικός ως ενορχηστρωτής και διαχειριστής / συντονιστής διαδικασιών και παραγόμενου έργου	3.1 Διαχείριση εκπαιδευτικών διαδικασιών	3.1.1 Εφαρμόζει μεθόδους οργάνωσης της διδακτικής διεργασίας για εκπαίδευση STE(A)M	Να διαχειρίζεται αποτελεσματικά τον χρόνο στα σχέδια μαθήματος που βασίζονται σε STE(A)M δραστηριότητες. Να συντονίζει τη διδακτική διεργασία κατά τη διάρκεια των STE(A)M δραστηριοτήτων.
		3.1.2 Εφαρμόζει μεθόδους διαχείρισης της σχολικής τάξης για εκπαίδευση STE(A)M	*Να οργανώνει και να προετοιμάζει τον χώρο μάθησης στη σχολική τάξη και στο εργαστήριο για τις σχετιζόμενες με το STE(A)M δραστηριότητες.* *Να διαχειρίζεται απρόσμενες καταστάσεις εντός της σχολικής τάξης*
		3.2.1 Εφαρμόζει μεθόδους διαχείρισης εκπαιδευτικών	*Να οργανώνει και να προετοιμάζει το απαραίτητο υλικό και τους εκπαιδευτικούς πόρους στις STE(A)M δραστηριότητες.*

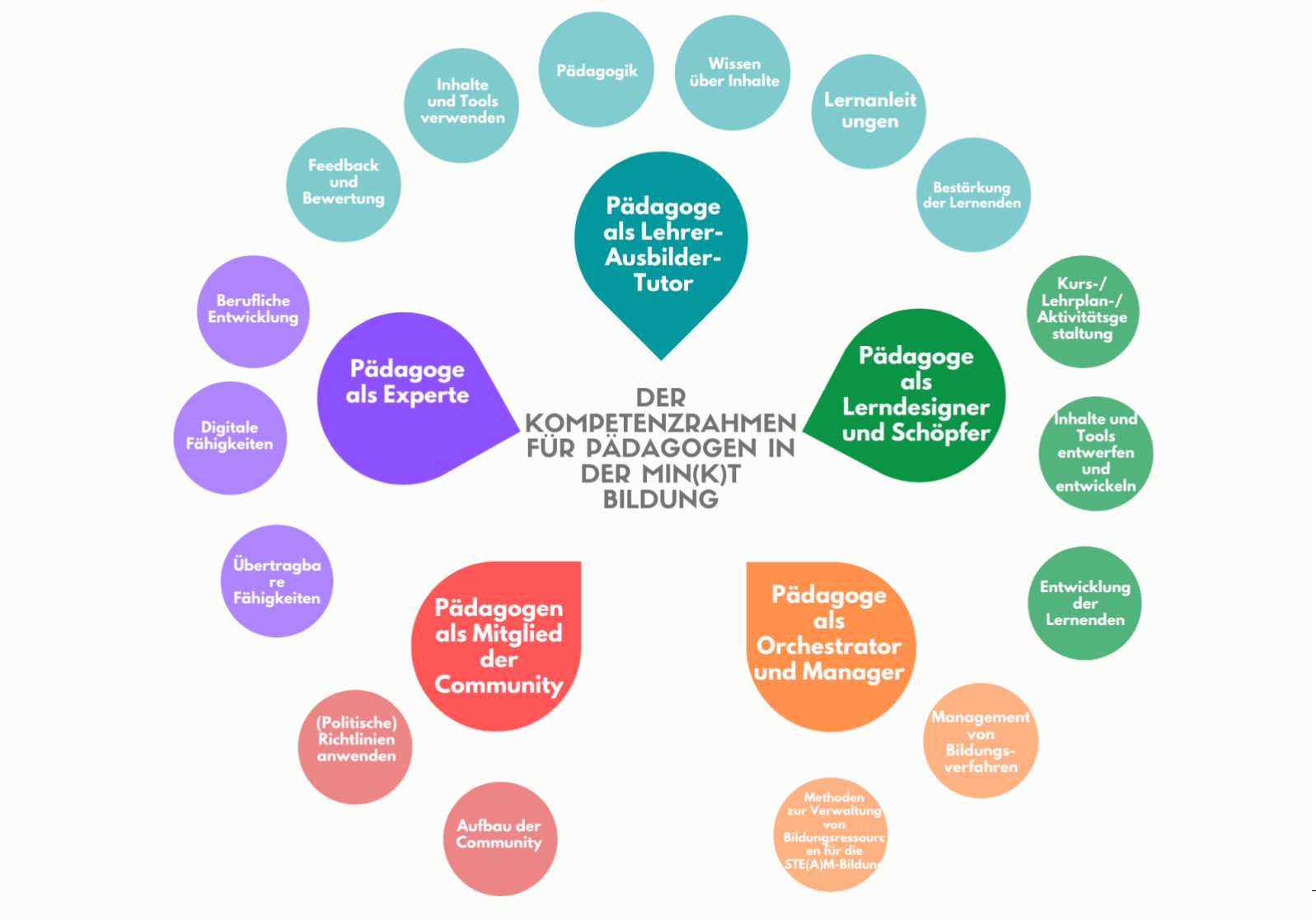
Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
	3.2 Διαχείριση πόρων	πόρων στην εκπαίδευση STE(A)M	*Να διαχειρίζεται και να προστατεύει ευαίσθητα ψηφιακά και μη ψηφιακά περιεχόμενα με την εφαρμογή των κανόνων για τα προσωπικά δεδομένα και τα πνευματικά δικαιώματα.*
		3.2.2 Εφαρμόζει μεθόδους διαχείρισης του εργαστηρίου στην εκπαίδευση STE(A)M	Να οργανώνει και να προετοιμάζει τον εξοπλισμό του εργαστηρίου για STE(A)M δραστηριότητες Να διαχειρίζεται απρόσμενα τεχνικά προβλήματα, να διορθώνει τον εξοπλισμό ή να αφαιρεί κακόβουλο λογισμικό από ένα λειτουργικό σύστημα το οποίο χρησιμοποιείται στις STE(A)M δραστηριότητες.
		3.2.3 Εφαρμόζει μεθόδους διαχείρισης του ανθρώπινων πόρων στην εκπαίδευση STE(A)M	*Να συντονίζει και να διαχειρίζεται ομάδες εκπαιδευτικών κατά τη διάρκεια συνεργατικών διδακτικών διεργασιών.* Να παρακολουθεί και να διαχειρίζεται ομάδες κατά τη διάρκεια STE(A)M δραστηριοτήτων.
4. Ο εκπαιδευτικός ως μέλος της κοινότητας / σε διάδραση με το περιβάλλον	4.1 Οικοδόμηση της κοινότητας	4.1.1 Εμπλέκεται σε STE(A)M κοινότητες εκπαιδευτικών	*Συμμετέχει σε διαδικτυακές και μη κοινότητες εκπαιδευτικών STE(A)M με σκοπό την ανταλλαγή εμπειριών, γνώσεων και εκπαιδευτικών πόρων.*
		4.1.2 Εμπλέκεται σε θεσμικές κοινότητες για εκπαίδευση STE(A)M	*Να συνεργάζεται με άλλους εκπαιδευτικούς θεσμούς με στόχο την προώθηση πρακτικών STE (A)M στα σχολεία και στην ευρύτερη κοινωνία.* *Να αναπτύξει ένα υποστηρικτικό και δυναμικό περιβάλλον για τον μαθητή και να ανταποκρίνεται στις εκπαιδευτικές και στις άλλες ανάγκες των μαθητών και των συναδέλφων εκπαιδευτικών.*
		4.1.3 Εμπλέκεται σε ερευνητικές και επαγγελματικές κοινότητες	*Να οργανώνει συμμετοχές σε σχετιζόμενους με το STE(A)M διαγωνισμούς, εκδηλώσεις, φεστιβάλ και διαδικτυακές πλατφόρμες, με σκοπό να δώσει στους μαθητές την ευκαιρία να παρουσιάσουν την εργασίας τους στο ευρύτερο κοινό.*

Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
		για την εκπαίδευση STE(A)M	
	4.2 Εφαρμογή πολιτικών	4.2.1 Εφαρμόζει πολιτικές που προωθούν την εκπαιδευτική προσέγγιση STE(A)M	*Να εφαρμόζει εκπαιδευτικές πολιτικές και προσεγγίσεις για STE(A)M εκπαίδευση.* *Να προωθεί εννοιολογικές, θεσμικές και οργανωτικές θέσεις εκπαιδευτικής πολιτικής STE(A)M*
		4.2.2 Αναπτύσσει πολιτικές που προωθούν την εκπαιδευτική προσέγγιση STE(A)M.	*Να δημιουργεί και να προωθεί νέες εκπαιδευτικές πολιτικές για την εκπαιδευτική προσέγγιση STE(A)M.* *Να συμμετέχει σε θεσμικές αποφάσεις που σχετίζονται με τις εκπαιδευτικές πολιτικές STE(A)M.*
5. Ο εκπαιδευτικός ως επαγγελματίας / που αναπτύσσει και εφαρμόζει ικανότητες	5.1 Μεταβιβάσιμες δεξιότητες	5.1.1 Αναπτύσσει ηγετικές δεξιότητες	Να ηγείται ένα εκπαιδευτικό πρόγραμμα STE(A)M Να εποπτεύει μια ομάδα κατά τη διάρκεια ενός εκπαιδευτικού προγράμματος STE(A)M.
		5.1.2 Αναπτύσσει δεξιότητες παρουσίασης και επικοινωνιακές δεξιότητες	*Να διαμοιράζει υλικό STE(A)M με ανοιχτότητα, , αποτελεσματικότητα και αυτοπεποίθηση είτε δια του προφορικού είτε δια του γραπτού λόγου* *Να επικοινωνεί (να ανταλλάσσει μηνύματα και να κάνει ουσιαστικό διάλογο) με μαθητές, γονείς και άλλους σχετικά με την προσέγγιση STE(A)M.*
		5.1.3 Αναπτύσσει την κριτική σκέψη και τις δεξιότητες επίλυσης προβλημάτων	*Να προσδιορίζει και να αναλύει προβλήματα σε δύσκολες περιστάσεις και να προβαίνει σε αιτιολογημένες εκτιμήσεις* *Να διευρύνει και να βελτιώνει τις δεξιότητες σκέψης όπως: την εξήγηση και την ανάλυση, και να αξιολογεί μια συζήτηση.* *Να γεννάει ιδέες και να αναζητεί εναλλακτικές λύσεις.*
		5.1.4 Εφαρμόζει δεξιότητες ηθικής	*Να αναλύει και να λαμβάνει αποφάσεις για την επίλυση προβλημάτων σε θέματα ηθικής και εκπαίδευσης STE(A)M*

Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
		5.1.5 Αναπτύσσει δεξιότητες ομαδικής εργασίας	*Να συνεργάζεται με άλλους εκπαιδευτικούς από άλλα επιστημονικά πεδία για τον σχεδιασμό και την προετοιμασία εκπαιδευτικών προγραμμάτων/πόρων/δραστηριοτήτων STE(A)M .* *Να συνεργάζεται (με άλλους εκπαιδευτικούς), να ανταλλάσσει γνώση, εμπειρία και να αναπτύσσει παιδαγωγικές πρακτικές συνεργατικής καινοτομίας*
		5.1.6 Εφαρμόζει δεξιότητες διαχείρισης της πληροφορίας	*Να βρίσκει και να διαχειρίζεται σχετικές με το STE(A)M πληροφορίες από ποικίλες πηγές*
		5.1.7 Αναπτύσσει δεξιότητες επιχειρηματικότητας	*Να προσδιορίζει εργασιακές ευκαιρίες σχετικές με τη STE(A)M εκπαίδευση.*
	5.2 Ψηφιακές δεξιότητες	5.2.1 Αναπτύσσει δεξιότητες ψηφιακού εγγραμματισμού	*Να διαβάζει κριτικά και να δημιουργεί ακαδημαϊκή και επαγγελματική επικοινωνία που σχετίζεται με την εκπαίδευση STE(A)M σε διάφορα μέσα.* *Να συμμετέχει σε ψηφιακά δίκτυα για μάθηση και έρευνα στην εκπαίδευση STE(A)M.* *Να προσαρμόζει και να χρησιμοποιεί σε συσκευές ψηφιακές εφαρμογές και υπηρεσίες που σχετίζονται με την εκπαίδευση STE(A)M.* *Να μελετά και να μαθαίνει αποτελεσματικά σε ένα πλούσιο τεχνολογικά περιβάλλον σε τεχνολογία, τυπικό και άτυπο.* *Να συμμετέχει σε αναδυόμενες ακαδημαϊκές επαγγελματικές και ερευνητικές πρακτικές STE(A)M που εξαρτώνται από ψηφιακά συστήματα.* *Να βρίσκει, να ερμηνεύει, να αξιολογεί, να διαχειρίζεται και να διαμοιράζει ψηφιακές πληροφορίες.* *Να χρησιμοποιεί σύγχρονες τεχνολογίες για την ενίσχυση και διευκόλυνση δραστηριοτήτων επικοινωνίας.*
		5.2.2 Διαχειρίζεται και χρησιμοποιεί ψηφιακά	*Να χρησιμοποιεί τις ΤΠΕ στην εκπαίδευση STE(A)M (π.χ., κατάλληλες στρατηγικές ενσωμάτωσης ΤΠΕ στη STE(A)M εκπαίδευση, ενσωμάτωση καινοτόμων τεχνολογικών πόρων κ. λπ.)*

Οπτική (βασίζεται στους ρόλους του εκπαιδευτικού)	Τομείς	Διαστάσεις (Ικανότητες)	Παραδείγματα Επιδιωκόμενων σκοπών / μαθησιακών αποτελεσμάτων
		εργαλεία για STE(A)M εκπαίδευση	
	5.3 Επαγγελματική ανάπτυξη	5.3.1 Προσαρμόζει πρακτικές αναστοχασμού στη STE(A)M εκπαίδευση	Να *συλλέγει, να αναλύει, να ερμηνεύει δεδομένα (μαθησιακά αποτελέσματα, αποτελέσματα αξιολόγησης, αυτοαξιολόγησης) για τη βελτίωση της διδασκαλίας / μάθησης STE(A)M.* *Να επιδιώκει την αυτο-βελτίωση με την ατομική μελέτη, καθώς και με τη συμμετοχή σε κοινότητες πρακτικής που σχετίζονται με το STE(A)M.* *Να γνωρίζει, να κατανοεί και να είναι σε θέση να ερμηνεύει και να χρησιμοποιεί τα αποτελέσματα της αξιολόγησης προκειμένου να βελτιώσει τις δραστηριότητες που σχετίζονται με το STE(A)M.* *Να αναστοχάζεται τη δική του απόδοση και να ανταποκρίνεται στην εποικοδομητική κριτική η οποία βασίζεται στην ανατροφοδότηση από τους μαθητές και τους επόπτες του προκειμένου να βελτιώσει την απόδοσή του.*
		5.3.2 Συμμετέχει σε δια βίου μάθηση σχετικά με την προσέγγιση STE(A)M	*Να επιδιώκει τη συνεχή επαγγελματική ανάπτυξη σε θέματα σχετικά με το STE(A)M.* *Να ασχολείται με την προσωπική, ακαδημαϊκή, εργασιακή και επαγγελματική του ανάπτυξη, με εμβάθυνση και έρευνα στο πεδίο STE(A)M*
		5.3.3 Δρα ως ερευνητής στην εκπαίδευση STE(A)M	Να παρακολουθεί τις πιο πρόσφατες εξελίξεις και εκπαιδευτικές μεθόδους στους τομείς STEM και στην εκπαιδευτική προσέγγιση STE(A)M. Να αναζητεί και να μελετά ακαδημαϊκά και επαγγελματικά κείμενα που σχετίζονται σχετικάμε την εκπαίδευση STE(A)M. Να γνωρίζει, να κατανοεί και να χρησιμοποιεί αποτελεσματικές μεθόδους μελέτης.

Appendix 1f: STE(A)MComp Edu: The Educators Competence Framework for STE(A)M education [German]



Perspektive (basierend auf den Rollen des Pädagogen)	Bereiche (kohärente Gruppe von Kompetenzen)	Dimension (Kompetenzen)	Beispiele
1. Pädagoge als Lehrer-Ausbilder-Tutor / Durchführung des pädagogischen Ablaufs	1.1 Pädagogik	1.1.1 Lehr- und Lerntechniken verstehen und nutzen, die MIN(K)T-Bildung fördern	Lerntheorien und Lehrmethoden (wie z.B. forschungsbasiertes Lernen, problembasiertes Lernen usw.), die den MIN(K)T-Bildungsansatz fördern, *kennen, verstehen und anwenden*. Auf Recherche basierendes Lernen, projektbasiertes Lehren und andere Lerntechniken kennen, verstehen und anwenden mit dem Ziel, MIN(K)T-Aktivitäten mit komplexen Fragen zu fördern, soziale Fragen zu erforschen, kritisches Denken und Lösungen für reale Probleme zu entwickeln. Erfahrungsorientiertes Lernen bereit stellen durch den Einsatz von MIN(K)T-Aktivitäten, die sich an die Erfahrungen der Lernenden anknüpfen. Verwendung von spielerischen Strategien in MIN(K)T-Aktivitäten mit dem Ziel, die Teilnahme und Motivation der Lernenden zu verbessern.
		1.1.2 Kollaborative Lernmethoden in der MIN(K)T-Bildung anwenden	Gruppendynamische Techniken kennen, verstehen und anwenden. Teamarbeitsmethoden und kollaborative Techniken kennen, verstehen und anwenden, um die Lernenden anzuleiten, effektiv zu kooperieren und miteinander zu kommunizieren. Die Unterrichtsumgebung organisieren, um kollaborative Lernmethoden zu erleichtern.
		1.1.3 Selbstreguliertes Lernen in der MIN(K)T-Bildung fördern	Techniken für selbstregulierte Lernprozesse kennen, verstehen und anwenden, bei denen die Lernenden entwerfen, reflektieren, nach Informationen suchen, Ideen austauschen und kreative Problemlösungen entdecken.
	1.2 Wissen über Inhalte	1.2.1 Verstehen, was MIN(K)T-Bildung darstellt und bedeutet	Die MIN(K)T-Ausbildung verstehen als integrierten Ansatz eines MINT-Fachs in Kombination mit Kunst, z.B. bildende Kunst, Lyrik usw. Anerkennen, dass die MIN(K)T-Ausbildung ein Lernansatz ist, der Wissenschaft, Technologie, Ingenieurwesen, Kunst und Mathematik als Zugangspunkte zur Anleitung von Schülerinnen und Schülern für Forschung, Dialog und kritischem Denken nutzt. Anerkennen, dass der MIN(K))-Bildungsansatz darauf abzielt, aktive und funktionierende Bürger hervorzubringen in einer wissenschaftlich und technologisch orientierten Gesellschaft
		1.2.2 Inhaltliches Wissen über MIN(K)T-bezogene Themen haben	Inhaltliche Kenntnis zur Thematik. Grundlegende Computerkenntnisse anwenden. Mathematische Fähigkeiten für Berechnungen und Messungen anwenden.

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			Anwenden eines wissenschaftlichen Ansatzes, um ein komplexes wissenschaftliches System in kleinere Teile zu zerlegen, Ursache-Wirkungs-Beziehungen zu erkennen und Meinungen anhand von Fakten zu verteidigen. Die Grundprinzipien von Wissenschaft, Technik, Ingenieurwesen und Mathematik mit anderen Bereichen wie Geschichte, Sprache, Kunst, Kultur usw. in Verbindung bringen.
	1.3 Lernanleitungen	1.3.1 Beratung in der MIN(K)T-Bildung anbieten	Angemessene und zielgerichtete Anleitung und Unterstützung für Lernende mit verschiedenen Formen und Formaten anbieten.
		1.3.2 Als Vermittler in der MIN(K)T-Bildung auftreten	Als Vermittler auftreten, um die Lernenden bei MIN(K)T-bezogenen Aktivitäten anzuleiten und ihnen dabei zu helfen, für sich selbst zu lernen. Lernende ermutigen und eine komfortable Lernumgebung schaffen.
		1.3.3 Als Mentor in MIN(K)T-bezogenen Aktivitäten auftreten	Als Mentor auftreten, indem Lernende ermutigt werden, MIN(K)T-bezogene Aktivitäten zu wahrzunehmen, und ein System zur Unterstützung von Mentoren für Lernende zu schaffen.
	1.4 Inhalte und Tools verwenden	1.4.1 Geeignete Inhalte und Tools für die MIN(K)T-Bildung auswählen und verwenden	Geeignete Bildungsinhalte und -instrumente zur Unterstützung und Verbesserung des MIN(K)T-Lehrens und -Lernens auswählen und einsetzen. Geeignete Software und Anwendungen zur Unterstützung und Verbesserung des MIN(K)T-Lehrens und -Lernens auswählen und verwenden. MIN(K)T-Bildungsinhalte mit Bezug zum wirklichen Leben für ein besseres Verständnis und die Schaffung von Teilnahmeanreizen für die Lernenden auswählen und verwenden. Konzepte, Bildungsinhalte und Tools aus Nicht-MINT-Bereichen wie Kunst, Sprache usw. in der MIN(K)T-Bildung auswählen und verwenden. Einen multimodalen Text verwenden, der Interaktion und visuelle Anregung bietet. Geeignete Bildungsinhalte kennen, verstehen, auswählen und entwerfen, die auf den Bedürfnissen, Merkmalen, Vorkenntnissen und Bildungszielen der Lernenden basieren.

Perspektive (basierend auf den Rollen des Pädagogen)	Bereiche (kohärente Gruppe von Kompetenzen)	Dimension (Kompetenzen)	Beispiele
		1.4.2 Geeignete Inhalte und Werkzeuge für die MIN(K)T-Bildung organisieren und austauschen	Die MIN(K)T-bezogenen Inhalte und Werkzeuge organisieren und sie den Lernenden, Eltern und anderen Pädagogen bei Bedarf zur Verfügung stellen. Sensible digitale und nicht-digitale Inhalte schützen. Lizenzen und Regeln zum Schutz der Privatsphäre und des Urheberrechts von Inhalten kennen, verstehen und verwenden.
	1.5 Feedback und Bewertung	1.5.1 Bewertungsstrategien für MIN(K)T-Bildung verwenden	Mehrere Formen der Leistungsbeurteilung von Lernenden (Einzelperson/ Gruppe) kennen, verstehen und gestalten und verwenden, die für MIN(K)T-bezogene Aktivitäten geeignet sind. Sowohl die formative als auch die summative Bewertung kennen, verstehen, gestalten und verwalten können, und zwar in einer Weise, die dem Niveau und Zweck des Lernens angemessen ist und den Anforderungen der Akkreditierungsstellen entspricht. Selbstbewertungsstrategien von Lernenden kennen, verstehen und anwenden, die für MIN(K)T-bezogene Aktivitäten geeignet sind. Detaillierte und diagnostische Aufzeichnungen über die Bewertung von MIN(K)T-bezogenen Aktivitäten kennen, verstehen und führen können.
		1.5.2 Feedback-Techniken für die MIN(K)T-Bildung nutzen	Die Lernleistung der Lernenden durch regelmäßiges Feedback ermitteln. Die Missverständnisse der Lernenden beobachten und gegebenenfalls Feedback und Anleitung geben. Den Grad der Beteiligung der Lernenden bestimmen (z.B. Interesse und Einstellung der Lernenden).
	1.6 Bestärkung der Lernenden	1.6.1 Zugänglichkeit und Inklusion in der MIN(K)T-Bildung gewährleisten	Den Zugang zu MIN(K)T-Ressourcen und -Aktivitäten für alle Lernenden, einschließlich derer mit besonderen Bedürfnissen sicherstellen. Während der MIN(K)T-bezogenen Aktivitäten Eingliederungs- und Diversitätsfragen im Klassenzimmer ansprechen. Mit Vorurteilen und Stereotypen in den MIN(K)T-Bereichen auseinandersetzen.
		1.6.2 Aktives Engagement der Lernenden in der MIN(K)T- Bildung sicherstellen	Techniken kennen, verstehen und anwenden können, um die Interaktion der Lernenden und ihre aktive Teilnahme zu verbessern, indem sie angemessene Anleitung und Unterstützung bei MIN(K)T-bezogenen Aktivitäten anbieten.

Perspektive (basierend auf den Rollen des Pädagogen)	Bereiche (kohärente Gruppe von Kompetenzen)	Dimension (Kompetenzen)	Beispiele
			Den Lernenden Anleitung geben, um miteinander zu kommunizieren und verschiedene Standpunkte vorzuschlagen, indem eine offene Lernumgebung für kreative Problemlösungen während MIN(K)T-bezogener Aktivitäten entwickelt wird.
		1.6.3 Differenzierung und Personalisierung in der MIN(K)T-Bildung gewährleisten	Personalisierte MIN(K)T-Lernerfahrungen erstellen, um den unterschiedlichen Bedürfnissen der Lernenden gerecht zu werden
2. Pädagoge als Lerndesigner und Schöpfer / Gestaltung und Produktion von Outputs	2.1 Kurs-/ Lehrplan-/ Aktivitätsgestaltung	2.1.1 MIN(K)T-Lehrpläne verstehen und entwickeln	Die Prinzipien und Praktiken des MIN(K)T-bezogenen Lehrplans kennen und verstehen. Den MIN(K)T-bezogenen Lehrplan kennen, verstehen, auswählen und gestalten.
		2.1.2 Kurse zur MIN(K)T-Bildung entwerfen	Bildungsprogramme konzeptionieren und umsetzen, die die wissenschaftlichen Bereiche von MIN(K)T integrieren und den MIN(K)T-Bildungsansatz fördern
		2.1.3 Aktivitäten zur MIN(K)T-Bildung entwerfen	MIN(K)T-Bildungsaktivitäten auf der Grundlage von Situationen des realen Lebens konzeptionieren und durchführen. MIN(K)T-bezogene Bildungsaktivitäten kennen, verstehen, auswählen und entwerfen, basierend auf den Bedürfnissen, Eigenschaften, Vorkenntnissen und Bildungszielen der Lernenden.
	2.2 Inhalte und Tools entwerfen und entwickeln	2.2.1 Geeignete Inhalte für die MIN(K)T-Ausbildung erstellen und ändern	Geeignete Bildungsinhalte zur Unterstützung und Verbesserung des MIN(K)T-Lehrens und -Lernens erstellen und ändern. Eine Vielzahl von Ressourcen (audiovisuelles Material usw.) zur effektiven Gestaltung von Bildungsaktivitäten schaffen und entwickeln, die die Integration von Konzepten und Fähigkeiten aus verschiedenen Disziplinen erfordern.
		2.2.2 Software und Anwendungen für die STE(A)M-Bildung entwerfen und entwickeln	Technologien einsetzen, um MIN(K)T-Anwendungen für MIN(K)T-Bildungsaktivitäten zu entwerfen und zu entwickeln.

Perspektive (basierend auf den Rollen des Pädagogen)	Bereiche (kohärente Gruppe von Kompetenzen)	Dimension (Kompetenzen)	Beispiele
	2.3 Entwicklung der Lernenden	2.3.1 Die MIN(K)T-Kompetenzen der Lernenden erleichtern	Die Einbindung von Lernaktivitäten, Aufgaben und Bewertungen erleichtern, die von den Lernenden erworben werden müssen: - Kognitive Fähigkeiten - Informationsverarbeitung - Fähigkeit zur Dateninterpretation und -analyse - Fähigkeiten zur Problemlösung und zum technischen Denken - Fähigkeiten zur wissenschaftlichen Untersuchung - Computergestütztes Denken und IKT-Fähigkeiten - Design Thinking, Kreativität und Innovationsfähigkeiten - Manipulative und technologische Fähigkeiten - Zusammenarbeit und Kommunikationsfähigkeiten
		2.3.2 Zu MIN(K)T-bezogenen Karrieremöglichkeiten beraten	Lernende über Arbeits- und Studienmöglichkeiten im Zusammenhang mit MIN(K)T-Feldern beraten.
3. Pädagoge als Orchestrator und Manager / Koordination von Lernverfahren und Ergebnissen	3.1 Management von Bildungs-verfahren	3.1.1 Lehrorganisationsmethoden für die MIN(K)T-Bildung anwenden	Das Zeitmanagement von Unterrichtsplänen durchführen, das auf MIN(K)T-bezogenen Aktivitäten basiert. Während (MIN(K)T-bezogener Aktivitäten den Unterrichtsablauf koordinieren.
		3.1.2 Methoden für das Klassenraum-Management in der MIN(K)T-Bildung anwenden	Klassenzimmer- und Labor-Lernräumen für MIN(K)T-bezogene Aktivitäten organisieren und vorbereiten. Mit unerwarteten Situationen im Klassenzimmer umgehen.
	3.2 Methoden zur Verwaltung von Bildungsressour	3.2.1 Methoden zum Management von Bildungsressourcen für die MIN(K)T-Bildung anwenden	Die notwendigen Materialien und Bildungsressourcen für MIN(K)T-bezogene Aktivitäten organisieren und vorbereiten. Sensible digitale und nicht-digitale Inhalte durch die Anwendung von Datenschutz- und Urheberrechtsbestimmungen verwalten und schützen.

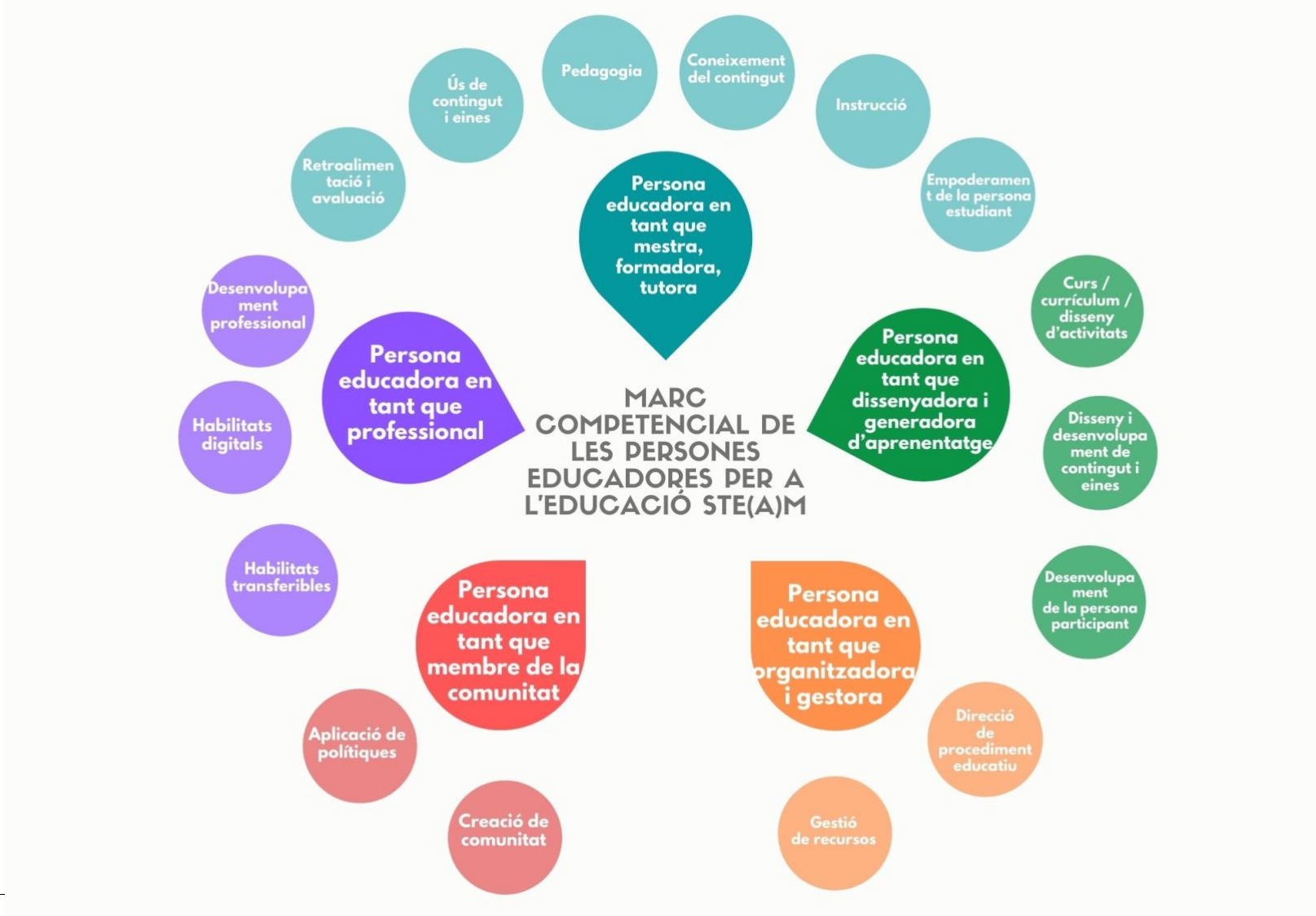
Perspektive (basierend auf den Rollen des Pädagogen)	Bereiche (kohärente Gruppe von Kompetenzen)	Dimension (Kompetenzen)	Beispiele
	cen für die STE(A)M-Bildung	3.2.2 Lernmanagementmethoden für die MIN(K)T-Bildung anwenden	*Die Laborausrüstung für MIN(K)T-Aktivitäten organisieren und vorbereiten.* *Mit unerwarteten technischen Problemen umgehen können, z.B. eine Maschine reparieren oder Fehler eines Betriebssystem beheben, das für MIN(K)T-bezogene Aktivitäten verwendet wird.*
		3.2.3 Personalmanagement-Methoden für die MIN(K)T-Bildung anwenden	*Ein Pädagogen-Team während eines kollaborativen Lehrverfahrens koordinieren und leiten.* *Gruppen während MIN(K)T-bezogener Aktivitäten überwachen und steuern.*
4. Pädagogen als Mitglied der Community	4.1 Aufbau der Community	4.1.1 Sich in MIN(K)T Communities für Pädagogen engagieren	*An Online- und Offline-Communities für MIN(K)T-Pädagogen teilnehmen, um Erfahrungen, Wissen und Bildungsressourcen auszutauschen.*
		4.1.2 Sich in institutionellen Netzwerken für MIN(K)T-Bildung engagieren	*Mit anderen Bildungseinrichtungen zusammenarbeiten, um MIN(K)T-Praktiken in Schulen und Gesellschaft zu fördern.* *Eine unterstützende und befähigende Umgebung für die Lernenden entwickeln und auf die pädagogischen und anderen Bedürfnisse der Lernenden und Miterzieher eingehen.*
		4.1.3 Sich in Forschungs- und Wirtschaftsnetzwerken für MIN(K)T-Bildung engagieren	Die Teilnahme an MIN(K)T-bezogenen Wettbewerben, Veranstaltungen, Festivals, Online-Plattformen usw. organisieren, um den Lernenden die Möglichkeit zu geben, ihre Arbeit der Öffentlichkeit zu präsentieren. Mit Forschungs- und Wirtschaftskreisen zusammenarbeiten.
	4.2 (Politische) Richtlinien anwenden	4.2.1 Richtlinien anwenden, die MIN(K)T-Bildung fördern	Bildungsrichtlinien und -verfahren für die STE(A)M-Ausbildung anwenden. Kontextuelle, institutionelle und organisatorische Aspekte der MIN(K)T-Bildungspolitik fördern.
		4.2.2 Eine Politik entwickeln, die MIN(K)T-Bildung fördert	Eine neue Bildungspolitik für den MIN(K)T-Bildungsansatz schaffen und fördern. An institutionellen Entscheidungen bezüglich der MIN(K)T-Bildungspolitik teilnehmen.

Perspektive (basierend auf den Rollen des Pädagogen)	Bereiche (kohärente Gruppe von Kompetenzen)	Dimension (Kompetenzen)	Beispiele
5. Pädagoge als Experte / Kompetenzen entwickeln und anwenden	5.1 Übertragbare Fähigkeiten	5.1.1 Führungsfähigkeiten entwickeln	MIN(K)T-bezogene Bildungsprojekte leiten. Die Mitglieder einer Gruppe während eines MIN(K)T-bezogenen Bildungsprojekts beaufsichtigen und flexibel sein.
		5.1.2 Präsentations- und Kommunikationsfähigkeiten entwickeln	MIN(K)T-bezogene Inhalte klar, effektiv und vertrauensvoll entweder mündlich oder schriftlich vermitteln. Mit Lernenden, Eltern und Dritten über den MIN(K)T-Bildungsansatz kommunizieren (Botschaften austauschen und sinnvolle Dialoge).
		5.1.3 Kritisches Denken und Problemlösungsfähigkeiten entwickeln	Probleme in schwierigen Situationen identifizieren und analysieren und eine gerechtfertigte Bewertung vornehmen. Die Denkfähigkeiten wie Erklären, Analysieren und Auswerten einer Diskussion erweitern und verbessern. Ideen finden und nach alternativen Lösungen suchen.
		5.1.4 Ethische Fähigkeiten anwenden	Problemlösungsentscheidungen in Bezug auf Ethik und MIN(K)T-Bildung analysieren und treffen.
		5.1.5 Teamfähigkeiten entwickeln	Mit anderen Pädagogen aus anderen Disziplinen zusammenarbeiten, um Bildungsprogramme/Ressourcen/Aktivitäten mit MIN(K)T-Inhalten zu entwerfen und vorzubereiten. Zum Wissens- und Erfahrungsaustausch und zur Entwicklung innovativer pädagogischer Praktiken zusammenarbeiten.
		5.1.6 Fähigkeiten zum Informationsmanagement anwenden	Relevante MIN(K)T-Informationen aus verschiedenen Quellen finden und verwalten.
		5.1.7 Unternehmerische Fähigkeiten entwickeln	Beschäftigungsmöglichkeiten in Zusammenhang mit der MIN(K)T-Bildung ermitteln.
	5.2 Digitale Fähigkeiten	5.2.1 Digitalkompetenzen entwickeln	*Akademische und professionelle Mitteilungen in Zusammenhang mit der MIN(K)T-Bildung aus unterschiedlichen Medien kritisch lesen und kreativ erstellen.* *An digitalen Netzwerken zum Lernen und Forschen in der MIN(K)T-Bildung teilnehmen.*

Perspektive (basierend auf den Rollen des Pädagogen)	Bereiche (kohärente Gruppe von Kompetenzen)	Dimension (Kompetenzen)	Beispiele
			Digitale Geräte, Anwendungen und Dienste in Zusammenhang mit der MIN(K)T-Bildung anpassen und nutzen. *In einem technologisch reichen Umfeld, formell und informell effizient studieren und lernen.* *An aufstrebenden akademischen Berufs- und Forschungspraktiken im MIN(K)T-Bereich teilnehmen, die von digitalen Systemen abhängen.* *Digitale Informationen finden, interpretieren, bewerten, verwalten und austauschen.* *Moderne Technologien zur Verbesserung und Erleichterung von Kommunikationsaktivitäten nutzen.*
		5.2.2 Digitale Tools managen und für die MIN(K)T-Bildung nutzen	IKT in der MIN(K)T-Bildung nutzen (z.B. geeignete Strategien zur Integration von IKT in der MIN(K)T-Bildung, Integration innovativer technologischer Ressourcen usw.).
	5.3 Berufliche Entwicklung	5.3.1 Selbstreflektierende Praktiken für die MIN(K)T-Bildung übernehmen	Daten (Lerner-, Evaluationsergebnisse, Selbsteinschätzung) zur Verbesserung des MIN(K)T-Lehrens und -Lernens sammeln, analysieren und interpretieren. Die Weiterbildung reflektieren durch persönliches Lernen sowie durch MIN(K)T-bezogene Praxiscommunities. Die Ergebnisse der Beurteilung kennen, verstehen und in der Lage sein, sie zu interpretieren und zu nutzen, um die MIN(K)T-bezogenen Aktivitäten zu verbessern. Die eigene Leistung reflektieren und auf konstruktive Kritik reagieren auf der Grundlage des Feedbacks von Lernenden und Betreuern, um die eigene Leistung zu verbessern.
		5.3.2 Erfahrungen des lebenslangen Lernens in Zusammenhang mit MIN(K)T-Bildung machen.	An kontinuierlicher beruflicher Weiterbildung zu MIN(K)T-bezogenen Themen teilnehmen. Persönliches, akademisches, berufliches und professionelles Wachstum fördern durch die Reflektion von Studien und Forschung im MIN(K)T-Bereich.

Perspektive (basierend auf den Rollen des Pädagogen)	Bereiche (kohärente Gruppe von Kompetenzen)	Dimension (Kompetenzen)	Beispiele
		5.3.3 Als Forscher für MIN(K)T-Bildungthemen tätig sein.	Die neuesten Entwicklungen und Bildungsmethoden der MINT-Bereiche und MIN(K)T-Bildung beobachten. Akademische und professionelle Texte mit Bezug zur MIN(K)T-Ausbildung finden und kritisch lesen. Effektive Studienmethoden kennen, verstehen und anwenden.

Appendix 1g: STE(A)MComp Edu: The Educators Competence Framework for STE(A)M education [Catalan]



Perspectiva (basat en els rols de la persona educadora)	Àrees (grup coherent de competències)	Dimensions (Competències)	Exemples de descriptors
1. Persona educadora en tant que mestra, formadora, tutora i/o que implementa el procediment educatiu	1.1 Pedagogia	1.1.1 Compren i empra tècniques d'ensenyament i aprenentatge que promouen l'educació en l'àmbit STE(A)M	Conèixer, comprendre i emprar teories de l'aprenentatge i mètodes d'ensenyament (com ara l'aprenentatge basat en la indagació, el basat en problemes, etc.) que promouen l'enfocament educatiu STE(A)M. Conèixer, comprendre i emprar l'aprenentatge basat en la indagació, l' ensenyament basat en projectes i altres tècniques d'aprenentatge amb l'objectiu de potenciar les activitats STE(A)M amb preguntes complexes, tot desenvolupant el pensament crític, explorant temes socials i desenvolupant solucions a problemes reals. Proporcionar aprenentatge experimental amb l'ús d'activitats STE(A)M relacionades amb les experiències de les persones participants. Emprar estratègies basades en el joc en activitats STE(A)M amb l'objectiu de millorar la participació i la motivació de les participants.
		1.1.2 Aplica mètodes d'aprenentatge col·laboratiu en activitats relacionades amb activitats educatives STE (A) M	Conèixer, comprendre i emprar tècniques de dinàmiques de grup. Conèixer, comprendre i emprar mètodes de treball en equip i tècniques col·laboratives per tal de guiar les participants a cooperar de manera efectiva i comunicar-se entre elles. Organitzar l'entorn de la classe per tal de facilitar els mètodes d'aprenentatge col·laboratiu.
		1.1.3 Promou l'autoaprenentatge en activitats relacionades amb activitats educatives STE (A) M	Conèixer, comprendre i emprar tècniques enfocades als processos d'auto aprenentatge on les persones participants dissenyin, reflexionin, cerquin informació, comparteixin idees i descobreixin solucions creatives per als problemes.
	1.2 Coneixement del contingut	1.2.1 Compren què representa i què significa l'enfocament l'educació STE (A) M	Entendre l'educació STE(A)M com un enfocament integral que combina l'àmbit STEM amb les Humanitats, com per exemple, arts visuals, líriques, etc. Reconèixer que l'educació STE(A)M aborda l'aprenentatge fent servir la Ciència, la Tecnologia, l'Enginyeria, les Humanitats i les Matemàtiques com a punts d'accés per orientar la indagació, el diàleg i el pensament crític de les alumnes. Reconèixer que l'enfocament educatiu STE(A)M aspira a preparar ciutadans actius i funcionals per a una societat científica i tecnològica.

Perspectiva (basat en els rols de la persona educadora)	Àrees (grup coherent de competències)	Dimensions (Competències)	Exemples de descriptors
		1.2.2 Compren el contingut dels temes relacionats amb l'educació STE(A)M	Conèixer el contingut de la matèria. Aplicar habilitats informàtiques bàsiques. Aplicar habilitats matemàtiques per fer càlculs i mesuraments. Aplicar l'enfocament científic per descompondre un sistema científic complex en parts més petites, reconèixer les relacions causa i efecte, i defensar opinions fent servir dades. Associar els principis bàsics de la ciència, la tecnologia, l'enginyeria i les matemàtiques a d'altres camps com ara la història, la llengua, les arts, la cultura, etc.
	1.3 Instrucció	1.3.1 Proporciona orientació en activitats relacionades amb l'educació STE(A)M	Proporcionar l'orientació dirigida apropiada i l'assistència necessària a les persones participants en diferents formats i de diferents formes.
		1.3.2 Actua com a persona facilitadora en activitats relacionades amb l'educació STE(A)M	Actuar com a persona facilitadora per tal d'orientar i ajudar les persones participants a aprendre per elles mateixes durant les activitats relacionades amb l'àmbit STE(A)M. Animar les participants i crear un entorn d'aprenentatge còmode.
		1.3.3 Actua com a persona mentora en activitats relacionades amb l'educació STE(A)M	Actuar com a persona mentora, tot animant les participants a gaudir de les activitats relacionades amb l'àmbit STE(A)M, així com proporcionar un sistema de suport i orientació a l'estudiant.
	1.4 Ús de contingut i eines	1.4.1 Escull i empra apropiadament el contingut i les eines de l'educació en l'educació STE(A)M	Escollir i emprar el contingut educatiu adequat i les eines adequades per donar suport i promoure l'aprenentatge i l'ensenyament STE(A)M. Escollir i emprar les apps i el software adequats per donar suport i promoure l'aprenentatge i l'ensenyament STE(A)M. Escollir i emprar contingut educatiu STE(A)M relacionat amb la vida real per aconseguir una millor comprensió i crear incentius de participació per a les estudiants. Escollir i emprar en l'educació STE(A)M conceptes i contingut educatiu i eines d'àmbits no contemplats en les àrees STEM, com ara l'art, la llengua, etc. Fer servir textos multimodals que proporcionin interacció i estimulació visual.

Perspectiva (basat en els rols de la persona educadora)	Àrees (grup coherent de competències)	Dimensions (Competències)	Exemples de descriptors
			Conèixer, comprendre i escollir i dissenyar el contingut educatiu adequat d'acord amb les necessitats, les característiques i els coneixements previs de les persones participants, i els objectius del curs.
		1.4.2 Organitza i comparteix el contingut i les eines apropiats per a l'educació en l'educació STE(A)M	Organitzar el contingut de temàtica STE(A)M i les eines necessàries, i posar-ho a l'abast de les participants, els pares i mares, i d'altres persones educadores, si fos necessari. Protegir el contingut sensible, tant digital com no digital. Conèixer, comprendre i fer servir llicències per salvaguardar la privacitat i el copyright del contingut i el compliment de les normes.
	1.5 Retroalimentació i avaluació	1.5.1 Empra estratègies d'avaluació per a l'educació en l'educació STE(A)M	Conèixer, comprendre i dissenyar i emprar diverses formes d'avaluació del rendiment de les persones participants (individual/de grup) adequades per a les activitats relacionades amb l'àmbit STE(A)M. Conèixer, comprendre i dissenyar i gestionar tant l'avaluació formativa com la sumativa de manera apropiada, d'acord amb el nivell i l'objectiu de l'aprenentatge, i complir els requeriments dels organismes d'acreditació. Conèixer, comprendre i emprar estratègies d'autoavaluació de les participants per a les activitats relacionades amb l'àmbit STE(A)M. Conèixer, comprendre i ser capaç de mantenir expedients diagnòstics detallats d'avaluació de les activitats relacionades amb l'àmbit STE(A)M.
		1.5.2 Empra tècniques de retroalimentació per a l'educació en l'educació STE(A)M	Determinar el rendiment de les persones que participen al curs mitjançant una retroalimentació regular. Fer seguiment de les confusions de les participants, aportant retroalimentació i orientació quan calgui. Determinar el grau d'implicació de les participants (p. e. interès i actitud de les participants).
	1.6 Empoderament de la persona estudiant	1.6.1 Garanteix l'accessibilitat i la inclusió en els procediments educatius de l'educació STE(A)M	Garantir l'accés de totes les persones participants tant als recursos com a les activitats STE(A)M, incloses les persones amb necessitats especials. Abordar incidències relacionades amb la inclusió i la diversitat sorgides a la classe durant les activitats STE(A)M. Abordar els prejudicis i estereotips en les àrees STE(A)M.

Perspectiva (basat en els rols de la persona educadora)	Àrees (grup coherent de competències)	Dimensions (Competències)	Exemples de descriptors
		1.6.2 Garanteix la implicació activa de les persones participants en els procediments educatius de l'educació STE(A)M	Conèixer, comprendre i ser capaç de fer servir tècniques que afavoreixen la interacció de les estudiants i la seva participació activa, tot oferint orientació i assistència adequades per al desenvolupament de les activitats STE(A)M. Aportar orientació a les persones participants per tal que es comuniquin entre elles, i suggerir diferents punts de vista mitjançant la creació d'un entorn d'aprenentatge obert i enfocat a la resolució creativa de problemes durant les activitats STE(A)M.
		1.6.3 Garanteix la diferenciació i la personalització en els procediments educatius de l'educació STE(A)M	Crear experiències personalitzades d'aprenentatge STE(A)M per tal de satisfer les diferents necessitats de les participants.
2. Persona educadora en tant que dissenyadora i generadora d'aprenentatge / persona que dissenya i genera resultats	2.1 Curs / currículum / disseny d'activitats	2.1.1 Compren i desenvolupa currículum en l'educació STE(A)M	Conèixer i comprendre els principis i les pràctiques del currículum relacionat amb l'àmbit STE(A)M. Conèixer, comprendre, escollir i dissenyar el currículum relacionat amb l'àmbit STE(A)M.
		2.1.2 Dissenya cursos en l'educació STE(A)M	Dissenyar i dur a terme programes educatius que integren les àrees científiques de l'àmbit STE(A)M i promoure l'enfocament educatiu STE(A)M.
		2.1.3 Dissenya activitats educatives en l'educació STE(A)M	Dissenyar i dur a terme activitats educatives en l'àmbit STE(A)M basades en situacions de la vida real. Conèixer, comprendre i escollir i dissenyar activitats educatives de l'àmbit STE(A)M basades en les necessitats, les característiques i els coneixements previs de les persones participants, i els objectius educatius del curs.
	2.2 Disseny i desenvolupament de contingut i eines	2.2.1 Crea i modifica contingut apropiat per a l'educació STE(A)M	Crear i modificar contingut educatiu adequat per donar suport i potenciar l'ensenyament i l'aprenentatge STE(A)M. Crear i desenvolupar una varietat de recursos (material audiovisual, etc.) per tal de dissenyar de manera efectiva activitats educatives que requereixen la integració de conceptes i habilitats de diferents disciplines.

Perspectiva (basat en els rols de la persona educadora)	Àrees (grup coherent de competències)	Dimensions (Competències)	Exemples de descriptors
		2.2.2 Dissenya i desenvolupa software i *apps* per a l'educació STE(A)M	Emprar tecnologia per tal de dissenyar i desenvolupar aplicacions STE(A)M per a activitats educatives de l'àmbit STE(A)M.
	2.3 Desenvolupament de la persona participant	2.3.1 Facilita les competències STE(A)M de les persones participants	Assistir les participants amb la incorporació d'activitats d'aprenentatge, tasques i avaluacions que requereixen que les participants adquireixin habilitats - cognitives - de processament d'informació, interpretació de dades i anàlisi de dades - de resolució de problemes i pensament enginyer - de recerca científica - de pensament computacional i tecnològic - de pensament creatiu, creativitat i innovació - manipulatives i tecnològiques - de col·laboració i comunicació
		2.3.2 Proporciona orientació sobre oportunitats de carrera en l'àmbit STE(A)M	Proporcionar orientació a les persones participants sobre possibilitats laborals i formatives relacionades amb les àrees STEM.
3. Persona educadora en tant que organitzadora i gestora / persona que coordina procediments i resultats	3.1 Direcció de procediment educatiu	3.1.1 Aplica mètodes d'organització docent en l'educació STE(A)M	Dur a terme la gestió del temps de les planificacions de classe basades en activitats relacionades amb l'àmbit STE(A)M. Coordinar el procediment docent durant les activitats relacionades amb l'àmbit STE(A)M.
		3.1.2 Aplica mètodes de programació de classe en l'educació STE(A)M.	Organitzar i preparar els espais d'aprenentatge a l'aula i/o el laboratori per desenvolupar les activitats de l'àmbit STE(A)M. Resoldre situacions inesperades a l'aula.
	3.2 Gestió de recursos	3.2.1 Aplica mètodes de gestió de recursos educatius en l'educació STE(A)M.	Organitzar i preparar els materials i els recursos educatius necessaris per a les activitats STE(A)M. Gestionar i protegir el contingut sensible, tot aplicant les normes de privacitat i copyright.

Perspectiva (basat en els rols de la persona educadora)	Àrees (grup coherent de competències)	Dimensions (Competències)	Exemples de descriptors
		3.2.2 Aplica mètodes de gestió de laboratori en l'educació STE(A)M	Organitzar i preparar l'equipament de laboratori per a les activitats STE(A)M. Resoldre problemes tècnics inesperats, reparar una màquina o restablir un sistema operatiu que s'utilitza en les activitats STE(A)M.
		3.2.3 Aplica mètodes de gestió de recursos humans en l'educació STE(A)M	Coordinar i gestionar l'equip de persones educadores al llarg d'un procés docent col·laboratiu. Fer seguiment i gestionar grups durant les activitats STE(A)M.
4. Persona educadora en tant que membre de la comunitat / persona que interactua amb l'entorn	4.1 Creació de comunitat	4.1.1 Participa en comunitats educatives en l'educació STE(A)M	*Participar en comunitats, en línia i en la vida real, juntament amb altres persones educadores de l'àmbit STE(A)M per tal d'intercanviar experiències, coneixements i recursos educatius.*
		4.1.2 Participa en comunitats de caràcter institucional en l'educació STE(A)M	Col·laborar amb d'altres institucions educatives per tal de promoure les pràctiques STE(A)M dins l'escola i la societat. Desenvolupar un entorn de recolzament i empoderament per a les estudiants i respondre a les necessitats educatives i d'altres índoles que puguin tenir tant les persones participants com les educadores.
		4.1.3 Participa en comunitats de recerca i negoci orientades a l'educació STE(A)M	Organitzar la participació en concursos, esdeveniments, festivals, plataformes en línia, etc., de l'àmbit STE(A)M per tal de proporcionar a les persones participants l'oportunitat de mostrar la seva feina al públic en general. Col·laborar amb comunitats de recerca i negoci.
	4.2 Aplicació de polítiques	4.2.1 Aplica polítiques que promouen l'educació STE(A)M	Aplicar polítiques i procediments educatius enfocats a l'educació STE(A)M. Promoure aspectes contextuals, institucionals i organitzatius de les polítiques educatives STE(A)M.
		4.2.2 Desenvolupa polítiques que promouen l'educació STE(A)M	Crear i promoure noves polítiques educatives enfocades al mètode educatiu STE(A)M. Participar en decisions institucionals relacionades amb polítiques educatives STE(A)M.
5. Persona educadora en tant que professional /	5.1 Habilitats transferibles	5.1.1 Desenvolupa habilitats de lideratge	Liderar un projecte educatiu de l'àmbit STE(A)M. Supervisar els membres d'un grup mentre es du a terme un projecte educatiu STE(A)M, i ser flexible.

Perspectiva (basat en els rols de la persona educadora)	Àrees (grup coherent de competències)	Dimensions (Competències)	Exemples de descriptors
persona que desenvolupa i aplica competències		5.1.2 Desenvolupa habilitats de comunicació i presentació	Exposar contingut de l'àmbit STE(A)M amb claredat, eficàcia i confiança, ja sigui de forma oral o escrita. Comunicar-se (intercanvi de missatges i diàleg eloqüent) amb les persones participants, els pares i mares i terceres parts en relació a l'enfocament educatiu STE(A)M.
		5.1.3 Desenvolupa habilitats de pensament crític i resolució de problemes	Identificar i analitzar problemes en situacions difícils i fer-ne avaluacions justificades. Ampliar i millorar les habilitats cognitives com ara raonament, anàlisi i avaluació d'una discussió. Aportar idees i buscar solucions alternatives.
		5.1.4 Aplica habilitats ètiques	Analitzar i prendre decisions per resoldre problemes relacionats amb l'ètica i l'educació STE(A)M.
		5.1.5 Desenvolupa habilitats de treball en equip	Col·laborar amb d'altres persones educadores d'altres disciplines per tal de dissenyar i preparar programes/activitats/recursos educatius de contingut STE(A)M. Cooperar (amb altres persones educadores) per intercanviar coneixements i experiència, i desenvolupar pràctiques pedagògiques col·laboratives i innovadores.
		5.1.6 Aplica habilitats de gestió de la informació	Localitzar i gestionar informació rellevant de l'àmbit STE(A)M a partir de diverses fonts.
		5.1.7 Desenvolupa habilitats d'emprenedoria	Identificar oportunitats laborals relacionades amb l'educació STE(A)M.
	5.2 Habilitats digitals	5.2.1 Desenvolupa habilitats d'alfabetització digital	Llegir amb esperit crític i produir de forma creativa comunicacions acadèmiques i professionals relacionades amb l'educació STE(A)M a través de diversos mitjans. Participar en xarxes digitals enfocades a la recerca i l'aprenentatge en l'àmbit de l'educació STE(A)M. Adaptar i emprar aplicacions i serveis de dispositius digitals en relació a l'educació STE(A)M. Estudiar i formar-se profusament en l'àmbit tecnològic, ja sigui de manera formal o informal. Participar en pràctiques acadèmiques, professionals i de recerca vinculades als sistemes digitals que van apareixent en l'àmbit STE(A)M.

Perspectiva (basat en els rols de la persona educadora)	Àrees (grup coherent de competències)	Dimensions (Competències)	Exemples de descriptors
			Localitzar, interpretar, avaluar, gestionar i compartir informació digital. Emprar tecnologies modernes per potenciar i facilitar les activitats de comunicació.
		5.2.2 Gestiona i empra eines digitals per a l'educació STE(A)M	Emprar les telecomunicacions en l'educació STE(A)M (p. e. estratègies adequades per integrar les telecomunicacions en l'educació STE(A)M, integrar recursos tecnològics innovadors, etc.)
	5.3 Desenvolupament professional	5.3.1 Adapta pràctiques d'autoreflexió a l'educació STE(A)M	Aplegar, analitzar i interpretar dades (resultats d'aprenentatge, resultats d'avaluació, autoavaluació) per millorar l'ensenyament/aprenentatge STE(A)M. Reflexionar de cara a la millora personal a través de l'autoaprenentatge, així com a través de les comunitats de pràctica relacionades amb l'àmbit STE(A)M. Conèixer, comprendre i ser capaç d'interpretar i emprar els resultats d'avaluació per millorar les activitats STE(A)M. Reflexionar sobre el rendiment propi i respondre a la crítica constructiva basada en la retroalimentació rebuda de les persones participants i supervisores per tal de millorar l'aptitud personal.
		5.3.2 Participa en experiències d'aprenentatge continu relacionades amb l'enfocament educatiu STE(A)M	Participar en esdeveniments de desenvolupament professional continu sobre temes relacionats amb l'àmbit STE(A)M. Comprometre's amb el creixement personal, acadèmic, ocupacional i professional dedicant-se a l'estudi reflexiu i la recerca en l'àmbit STE(A)M.
		5.3.3 Actua com a persona investigadora en temes de l'educación STE (A) M	Fer seguiment de les darreres novetats i mètodes educatius en relació als camps STEM i l'enfocament educatiu STE(A)M. Buscar i llegir amb esperit crític textos acadèmics i professionals relacionats amb l'educació STE(A)M. Conèixer, comprendre i emprar mètodes d'estudi efectius.