WP4 The landscape of STEAM practices

Deliverable 4.2 Mapping of existing STEAM practices

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Deliverable 4.2

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Abstract

As a continuity with the previous deliverables produced by the RoadSTEAMer consortium (*2.1 Socio-economic context and relevant needs; 4.1 Research Framework*), this deliverable will present the landscape of STEAM (Science, Technology, Engineering, Arts, and Mathematics) practices in Europe. The project consortium built this analysis on the outcomes of bibliographic studies conducted under task 4.1 and task 2.1, which respectively led to the definition of 7 criteria to analyse these practices and various areas of socioeconomic needs or challenges they can address and recommendations to do so.

This mapping is done through two different ways:

- a desk research to build on existing data and knowledge;
- the construction and dissemination of a survey for STEAM practitioners to collect data on on-going practices.

Both ways have benefited from collaborative work from all partners involved in order to obtain a really wide view on the current STEAM landscape. The data has been treated focusing on STEAM criteria (produced in deliverable 4.1 *Research Framework*), and socioeconomic needs (identified in deliverable 2.1 *Socio-economic context and relevant needs)*.

This work led to the production of a broad review of existing projects presented in section 2: after introducing the methodology followed, the results of our extended desk research are studied according to socioeconomic recommendations from deliverable 2.1. The third section of this report presents the building and disseminating process of our survey towards STEAM practitioners. Finally section 4 contains the descriptions of current practices collected through our survey dissemination, their analysis regarding STEAM criteria and socioeconomic recommendations and interesting statistics resulting from this data collection.

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1. Introduction

1.1 About Road-STEAMer

The overall aim of the project is to develop a STEAM roadmap for science education in Horizon Europe, i.e. a plan of action that will provide guidance to the EU's key funding programme for research and innovation on how to encourage more interest in STEM through the use of artistic approaches, involving creative thinking and applied arts (the “A” in ‘STEAM’).

The consortium aims to provide Europe with this roadmap, through:

- Collaboration and co-creation with the stakeholder communities of science education, research, innovation and creativity, through intensive exchange, dialogue and mutual learning among them which will produce better knowledge and shared understandings of the relevant opportunities, challenges and needs.

- A bottom-up approach emphasising educational practice and practitioners’ agency rather than high-level conceptualizations of STEAM and generic top-down plans (in reality often just vague statements of intention) for its adoption.

- A specific focus on ways to leverage the power of STEAM approaches, as manifested through exemplary cases and best practices. This approach will enable a bridging of open science and open schooling which can catalyse an increased impact for STEM education as a crucial tool for addressing Europe’s current scientific and societal challenges.

STEAM Education Europe is an open group developed in the framework of the Road-STEAMer EU-funded project. It works both as a forum for the proper exchange of ideas, smart practices in STE(A)M education and policy and as a channel for the sharing of the project's results.

1.2 About this deliverable

Deliverable 4.2 “*Mapping of existing STEAM practices*” represents the second in a series of four reports within Work Package 4 (WP4), entitled "The landscape of STEAM practices." A first step has been fulfilled in defining the boundaries and framework of the project: Deliverable D4.1, "*Research Framework*" laid the foundations of the WP by defining a relevant body of data and extracting initial criteria for our analysis of STEAM practices.

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In deliverable 4.2, the focus will be to build a mapping of existing STEAM practices utilising the carefully crafted criteria established in D4.1 and the socioeconomic needs and challenges highlighted in D2.1. This mapping exercise will allow us to explore and analyse a wide range of practices across secondary schools, tertiary education, and informal learning settings, which may incorporate elements of open science and open schooling approaches. By doing so, we aim to identify strengths and gaps in the STEAM landscape regarding its integration and connection between secondary schools, tertiary education and the business world. For the present report the set of data will be composed of practices found by desk research (the research methodology is described in section 2.1) and of the initial data from a survey submitted to STEAM practitioners within the consortium and its network. The submitted practice's profiles (containing their description and information such as their address and website) will be included in an interactive mapping on the RoadSTEAMer platform.

Looking ahead, T4.3 "*Real-life Use-cases*" will build upon the foundation laid in D4.1 and D4.2 by incorporating real-life use-cases through participatory action research based on existing exemplary practices emerging from the survey data. These workshops will bring new insight on the gathered information.

The first set of practices presented in this deliverable will be completed by the additional practitioner answers gathered through the survey and participatory action research workshops organised in the following year. Finally, T4.4 will analyse and reassess the evaluation framework. This evaluation framework will strongly contribute to the building of a STEAM roadmap providing a satisfactory output for all the targeted stakeholders (research institutions, educational bodies, policy makers, EU policy makers, artists community) planned under Task 3.3.

The next section will briefly introduce the outcomes of previous deliverables, which established the ground floor for the present report.

1.3. State of the art : connections with previous deliverables

This section outlines the key outcomes of the first steps of Work Packages 2 and 4, which focused on identifying respectively the socioeconomic context and needs for STEAM education in Europe and a set of criteria to analyse STEAM practices in different institutions across Europe and beyond. This process was crucial to provide a structured scheme for the subsequent analyses.
Our approach involved the use of the Road-STEAMer co-creation methodology, combining the insights from published literature with contributions from colleagues across the consortium, complemented by co-creation workshops.

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We included some relevant references in the following resumes, but more references and detailed studies can be found in deliverables 2.1 "*Socio-economic context and relevant needs"* and 4.1 *"Research framework".*

1.3.1 Deliverable 2.1: Socio-economic context

The deliverable 2.1 provides a structured summary of recommendations aligned with key societal needs and benefits of the STEAM approach, acknowledging that these recommendations often intersect and that potential barriers, such as the risk of elitism, must be considered. To avoid this risk one of the main recommendations is to view students as citizen scientists, empowering them to acquire and demonstrate essential skills and scientific literacy throughout their lives thanks to STEAM education. The full set of recommendations is detailed in Table 1 in this section, taken from deliverable 2.1.

Table 1: Summary of the recommendations based on Socio-economic context and relevant needs

Societal needs	**Barriers of STEM**	**Benefits of STEAM**	**Recommendations**
1. More scientists	-Science is perceived as difficult; -Not all schools offer STEAM subjects.	-More emotional, appealing and fun by including arts; -Value 'Art' as a way of enhancing self-confidence and facilitate the development of personal opinions and critical thinking; -STEAM as a way to break down STEM stereotypes.	-More research on STEAM education effectiveness (Arts in addition and/or integrated with STEM); -Make science learning inclusive and appealing: teachers have STEAM easy to-use material; -Communicate to schools and teachers the values of the STEAM approach; -Expose students to science careers from the early years; -Expose students to science role models from primary years; -Value STEAM approach: supporting young people to bring these subjects together, a holistic and subject integrative view is necessary.

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2.Alignment of industry and societal needs with education	Provides only technical skills but organisations need skilled workers and soft skills and intercultural abilities-	-Arts integrated in STEM courses promote intercultural and collaborative skills; -Real world problems are multidisciplinary by default	-Open schools (and other real world approaches); -Data on industries and organisations' needs are used to support education policies; -Project-based collaborative learning to develop soft skills and inclusivity -Multidisciplinary and interdisciplinary projects; -Support entrepreneurship and self employment
3.More diversity (gender, ethnic, socio economic, etc.)	Science career is perceived as not in line with identity of women and minorities	-Arts subjects are more appealing and relatable for diverse people; -Diversity improves organisational outcomes.	-Policy to affect structural changes (inclusion, access, diversity, etc…) -Address gaps in abstract thinking/maths from the primary school years; -Replace the leaky pipeline metaphor with epistemic justice -Role models to redefine identities and change culture; -Include families to change science stereotypes; -STEAM focused career training; -More research on moderating factors and career paths to optimise policies (e.g. family's attitude, education and career choices, engagement, parents' STEM experience); -Analyse the impact of national differences in school systems.
4. Increase science literacy for all	Science is perceived as difficult or there is lack of awareness	-STEAM as a way to break down STEM stereotypes; -Match hard topics with arts to lower perceived barriers and increase interest	-Better connection between the needs of the labour market and lifelong learning; -Provide sufficient professional development and training of educational professionals; - Develop digital literacies (note: 'literacies' instead of 'literacy') beyond computer science; - Focus on societal challenges and real problems to promote interest in science; -Integrate the need for scientific thinking also in non-scientific/arts topics;

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			- Acknowledge the imbalance of financial support for 'Arts' and how these issues could be (re-addressed in STEAM); - Promote positive attitudes towards STEAM.

The STEAM approach holds great promise in addressing contemporary challenges, including the need for improved digital and scientific literacy (Zen (1990); Pellaud et al. (2021), Tasquier et al. (2022))., increased inclusivity in scientific fields (Allen-Handy et al. (2021), Saint-Denis (2021),), and equipping individuals with skills to confront global issues like climate change and inequalities (European Commission. Joint Research Centre. (2020), Das (2020)).

However, the current state of the field suggests that we have as yet insufficient knowledge about understanding the effectiveness of STEAM in meeting these challenges (Alexopoulos et al. (2021), Ng & Fergusson (2020)). Key areas requiring further study include disentangling the impact of arts integration from open and collaborative teaching practices and assessing the influence of contextual factors like socio-economic background, ethnicity, age, cultural context, media influence, and personal differences.

For more details, please see deliverable 2.1 "*Socio-economic context and relevant needs"*.

1.3.2 Deliverable 4.1: STEAM Criteria

To identify key criteria to be used in analysing STEAM practices, the University of Exeter team conducted a review of literature focused on studies of STEAM practices with respect to our focus areas, namely open science-open schooling, the role of the Arts, the boundary between secondary and tertiary education, and the interaction between STEAM education and the real world. We also analysed cases and practices suggested by the consortium, who all contributed a wealth of knowledge and experiences. We used a thematic analysis to synthesise this information and sense-checked and revised it using the Road-STEAMer co-creation methodology to lead to a robust and relevant set of criteria. More details about the process that led to these criteria can be found in deliverable 4.1 "*Research Framework*". The following criteria emerged as essential dimensions for analysing and understanding STEAM practices within our project:

- **Collaboration**: Within STEAM practices, collaboration and relationality revolve around fostering meaningful connections among various stakeholders (Colucci-Gray et al. (2017)). These stakeholders encompass not only teachers and students but also external partners, local communities, educational stakeholders, and local citizens. Mechanisms facilitating collaboration include acceptance, technology

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integration, game-based learning, and effective communication (Columbano et al. (2021)). Specific art forms, such as music, may serve as catalysts for collaboration. Teachers play a pivotal role, adopting roles as facilitators, advisors, counsellors, and guides, focusing on problem-solving, authentic tasks, student choice, and technology integration in classroom environments. They collaborate not only with students but also with their fellow educators, emphasising dialogue and the management of classroom environments to promote disciplinary inter-relationships. Various terminologies, including collaboration, group working, teamwork, and interaction, are employed to describe this criterion, often regarded as a 21st-century skill (Bautista (2021)). Some advocate viewing collaboration and relationality as integral components of a broader STEAM culture featuring multi-modality. Expanding this perspective, proponents within the posthuman paradigm extend collaboration and relationality to include not just human interactions but also interactions with the environment and the broader planet, aligning with the need to address challenges in the Anthropocene era (Guyotte (2020).

- **Disciplinary inter-relationships**: This criterion in STEAM practices encompasses several facets. It may involve the inclusion of multiple disciplines within STEAM, allowing for cross-disciplinary exploration and knowledge transfer. It can also manifest as the integration of arts into science, technology, engineering, and mathematics (STEM) curricula, emphasising an interdisciplinary approach (Liu et al. (2022)). More elaborately, it involves forging new connections between subjects or skill areas, fostering interaction between different disciplines, and enabling students to transfer knowledge between them in a transdisciplinary approach (Liston et al. (2022)). Students are encouraged to transfer knowledge across disciplines, often in classrooms emphasising problem-solving, authentic tasks, and technology use. STEAM practices value experimental agency, and foster connections between arts and science creativities. Additionally, it contributes to the understanding of disciplinary identities, with personal relevance informing connections between different subjects.

- **Thinking-Making-Doing**: This aspect of STEAM underscores the interactive nature of these practices. Various forms of thinking come into play within STEAM, including habits of thinking, systems thinking, critical thinking, creative thinking, and divergent and convergent thinking. Importantly, thinking isn't isolated but is intertwined with a broader set of skills, promoting soft skills and 21st-century skills (Graham (2021)). STEAM practices are closely linked to problem-solving, viewed as a creative, cognitive, and interactive process. These practices emphasise hands-on design, production, and real-world learning, reinforcing that STEAM is not purely academic but also practical. Making and doing are integral components, often associated with the "Makers movement," which values individuals as creators and emphasises students' active, constructive, and critical roles in their learning (Bautista, (2021)).

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Additionally, the importance of object-based learning, critique, exhibition, and critical making is highlighted, drawing inspiration from signature pedagogies in the arts (Costantino, (2018)). This interconnectedness of thinking, making, and doing within STEAM contributes to a holistic and dynamic learning experience.

- **Creativity**: Creativity is a fundamental component of STEAM activities, aligning with broader creativity literature. In STEAM, creativity is associated with innovation and the generation of novel ideas and outcomes. It's also linked to playfulness and the concept of "flow," which can be nurtured through STEAM practices (Dredd et al (2021), Martinez (2017)). Problem-solving and open-ended engagement with problems are facets of creativity within STEAM. Some sources depict creativity as a skill developed through STEAM practices, highlighting its role as both a means and an outcome. Creativity is not confined to thinking but extends to doing, where tools like digital technologies and design thinking are creatively employed. This creative approach aids in making interdisciplinary connections and fostering collaboration. Ultimately, creativity serves as a vital means to support various aspects of STEAM practices and is considered both a process and a product of these practices (SciCulture nd, Martinez (2017)).

- **Real-world Connection:** In STEAM practices, there is a strong emphasis on anchoring learning in real-world contexts (Martinez (2017)). This connection often involves tackling contemporary and complex issues like climate change, aligning with broader EU policies such as the EU Strategy for Enhancing Green Skills (European Commission, 2020). Real-world contexts are intricately linked to problem-solving and inquiry-based learning, providing authenticity and purpose to interdisciplinary connections. The civic space is identified as a valuable real-world context that bridges Higher Education learners with the public. It enables learners to connect their personal meaning-making within and between disciplines to the external context, fostering identity development, including empowering girls to see themselves as change-makers (Wan et al (2020). Entrepreneurship is a recurring theme in both EU and international STEAM projects, serving as a means to establish connections between STEAM activities and real-world contexts.

- **Inclusion/Personalisation/Empowerment:** In STEAM, inclusivity takes various forms, stemming from the belief that incorporating the Arts into STEM fosters a wider range of interests and makes STEAM more inclusive than STEM alone (ecraft2Learn (2018)). Acceptance is crucial in designing STEAM activities to ensure all participants, regardless of confidence levels, can fully engage in the process. Inclusion aligns with the theoretical concepts of science capital and identity, where STEAM provides a context for young people to develop their identities and see STEAM as a domain "for them." This active construction of personal meaning in

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STEAM leads to greater self-efficacy, confidence, and motivation for socioscientific learning, promoting empowerment. STEAM's open-ended activities and real-world contexts further enhance inclusion and empowerment, potentially empowering individuals from underrepresented groups, such as girls, to identify as change-makers (Wan et al (2020)). STEAM's emphasis on personalization and empowerment contributes to a more inclusive and engaged learning environment.

Additionally, it's essential to recognise **"Equity"** as an underlying value that should permeate all STEAM practices and transcend all other core criteria. It emphasises fairness and inclusivity in the design, processes, and outcomes of STEAM education. STEAM is viewed as a resistance to traditional disciplinary approaches, advocating for an ethical stance. This involves breaking down hierarchies between disciplines, recognizing the arts alongside STEM subjects, and ensuring equitable access to resources. Additionally, STEAM often empowers students to take the lead in their learning, promoting a more equitable power dynamic by positioning teachers as facilitators.
While STEAM aspires to produce socially equitable responses to global challenges, empirical evidence for this outcome is currently limited. Notably, the emphasis on equity is more prominent in tertiary-level STEAM practices compared to secondary education, though further exploration is needed. While not identified as standalone criteria, we observed that concepts such as digital technologies, open-ended activities, and problem identification and solving are interwoven throughout and across the key criteria.

The comprehensive understanding of these criteria and their interrelationships will guide our analysis of STEAM practices in the following phases of our project, particularly within the scope of Work Package 4. This structured approach will enable us to explore and analyse STEAM practices with depth and precision, contributing valuable insights to the project's overarching goals.

For more references and the detailed study, please see deliverable 4.1 "*Research Framework".*

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2. A review of relevant projects

In this chapter of Deliverable 4.2, we explore the state of the art in STEAM projects. With a focus on Europe while also considering global contributions, this chapter seeks to provide a panoramic view of the diverse landscape of innovative education research that relates with STEAM practices.

Before beginning this state of the art, we acknowledge and thank the contributions of researchers, educators, and institutions who have dedicated their efforts to create and share these results. As we analyse the outcomes of these research endeavours, we seek to extract valuable insights that can inform and enrich our analysis of existing STEAM practices. We included in this report a link to each analysed project, but if you are using a printed document please note that all names and websites (when available) are written in the Annexe 2 table.

Initially, we will introduce a diverse array of research projects related to **STEM, creativity or their relation to socioeconomic needs**, even if they do **not strictly adhere to the definition of STEAM as outlined in our project**. These projects were still considered in this report to draw an **overview of existing practices aside RoadSTEAMer scope** with similar characteristics or outcomes.

After this broad landscape we will present other **projects closely related to STEAM as defined in RoadSTEAMer**. These projects won't be considered in our in-depth analysis (section 4) except if they completed and submitted our questionnaire (see section 3 and Annexe 1). But the insight gained from this desk research will allow us to nuance and make relevant and critical observations of our results.

Before introducing the results of this review, the methodology used is detailed below.

2.1 Methods

In order to gather projects for the following reviews, an overarching method was adopted. The projects considered are no older than 10 years.

We used Google and the EU platform CORDIS databases to carry out its research. Inspired by the outcomes of deliverables evocated in section 1.3, the terms used were:

- STEM + education + innovative, Open Schooling + Secondary/tertiary education, Open Science + STEM education, Open Science + Science and Society, STEM education + creativity, STEM education + 21st century skills/technology, STEM education + responsible citizenship, STEM education + societal challenges, STEM + real-life challenges, STEM + empowerment, STEAM + primary school.

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- STEM education + creativity/arts, STEAM + Open Schooling, STEAM + Open Science, STEAM + education policy, STEAM education + 21st century skills/technology, STEAM education + responsible citizenship, STEAM education + societal challenges, STEAM education + empowerment/inclusivity/equality, STEAM + Science literacy, STEAM + real-life challenges, STEAM + interdisciplinary skills, STEAM + schools systems, STEAM + entrepreneurship.

These terms generated 30 of the projects listed in **Table 2 and 3**. The additional 13 projects were found while reading results and reports of these projects and using the mapping produced by the *System2020* project that aimed to explore innovative learning opportunities beyond traditional classroom settings for children, teenagers and young adults aged from 9 to 20 years old. It seeked to bridge the gap between formal school education and out-of-school learning experiences in STEAM education.

These projects were then separated into 2 groups :

- The **general landscape** (See Table 2): **practices not included in the RoadSTEAMer focus area**. These projects are not directly STEAM projects, or are dealing with areas not included in the RoadSTEAMer area (STEAM for primary schools, or past research projects to include Art in STEM education for example). They are **not part of the current STEAM landscape**. However they present some **relevant characteristics** (such as some of the criteria detailed in section 1.3.1) or a**ddress some of the socioeconomic challenges and needs** (detailed in section 1.3.2). These projects are presented and their relevant aspects are listed in Table 2.

- The **landscape of STEAM projects: these are fully part of the RoadSTEAMer focus area**. We present a description and their outcomes regarding socioeconomic recommendations defined in section 1.3.1 in Table 3. Co-creative workshops will be organised as part of Tasks 4.3 and 4.4 to carry in-depth analysis of these practices, notably regarding STEAM criteria.

To find the full names of these projects and their websites (when available), please refer to the annexe 2.

In section 3 and 4 the **percentages, charts and tables presented are based on projects and practices gathered through the survey** created specifically for this purpose and disseminated in the consortium and in the network of each of its members to STEAM practitioners (see section 3 and Annexe 1). The answers gathered through this survey (30 projects and practices) allowed us to give an in-depth presentation of these projects regarding the **socioeconomic recommendations they fulfil (Table 4)** and **STEAM criteria (Table 5)**.

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2.2 A wide review on research projects

The first part of this review on STEAM practices focuses on initiatives **not directly aligned with the scope of RoadSTEAMer.** They are either not properly STEAM educational practices, either STEAM related but out of the scope of the present project (addressing primary education for example). The following educational initiatives address one or several of the socio-economic challenges outlined in D2.1 or show interesting characteristics for this deliverable.
The significance of examining practices that may not precisely align with the specific focus of the RoadSTEAMer project lies in creating a broader landscape. Our intention is to provide an overview of what exists in order to better position our project within the complex and ever-evolving landscapes of Science education. This - mainly European - perspective will enable us to place STEAM practices within a more comprehensive context.

To avoid an extensive list of detailed descriptions in this section, we have chosen to present the studied projects in the form of a table giving concise descriptions of their content and their relevant characteristics for RoadSTEAMer.

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Table 2 : Practices out of the RoadSTEAMer focus area.

Project	Date	Disciplines involved or socioeconomic needs considered	Description and comments
Playing with protons	2014	Physics, innovative educational approach	"Playing with Protons" is an educational initiative spearheaded by the CMS experiment at CERN. It unites primary school educators, experts in science education, and CERN researchers in a collaborative effort to craft innovative strategies that enable primary students to actively participate in physics, exploration, and the cultivation of inventive thinking.
CASE	2017-2019	STEAM in primary education	Incorporating creativity and arts in science education in Primary education ; School teachers formations and materials development ; network creation. Completely related with RoadSTEAMer but in primary education.
Putting the “A” into STEM	2019-2022	Research and training in innovative STEM education, related to art	The project aimed to integrate art into STEM subjects through innovative methods. Since training in STEAM subjects was identified as crucial, the consortium researched structured training courses across Europe to upskill and motivate the staff. Partners were selected based on their expertise in STEAM subjects, allowing staff to observe and implement these subjects in their schools.The primary objective was to boost staff confidence in teaching STEAM subjects, fostering a renewed enthusiasm for these disciplines. The acquired skills and knowledge were then transferred to students, promoting active engagement and collaboration, ultimately empowering students to take control of their learning. Only in the UK.
ER4STEM	2015-2018	STEM, Robotics (industrial design), creativity	The ER4STEM consortium has created a framework (guidelines and tools) to design educational robotic activities combining 21st century skills, robotics, STEM and pedagogy across various subject matters. These materials are aimed at fostering and ease the use of these tools for STEM education.
TransEET	2023-2026	Technology	Transforming Education with emerging technologies (Beginning of the project)
OSOS	2017-2020	STEM,open schooling, innovation, responsible citizenship	OSOS aims at making School a key to innovative ecosystems, implying leaders, teachers, students and the local communities in collective projects, developing open schooling as much as responsible citizenship.

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Project	Date	Disciplines involved or socioeconomic needs considered	Description and comments
PULCHRA	2019-2022	STEM, open schooling, real world challenges, Inquiry-based-learning	Open schooling project focusing on “Cities as urban ecosystems”. This project offered digital support linked to six specific themes, providing guidance and resources to run an OS initiative.
COSMOS	2022-2024	STEM, Open Schooling, socio-scientific inquiry-based-learning- SSIBL	Promoting open schooling through the solving of socio-scientific issues including moral and ethical aspects. (beginning of the project)
MULTIPLIERS	2021-2024	STEM, real-life challenges	Communities of relevant stakeholders build science projects answering real-life challenges, leading the students to interact with a broad spectrum of science experts.
OSHub	2019-2022	STEM, empowerment	Bring STEM to the communities to foster their sustainable development, in initiatives empowering and engaging all citizens - from school children to senior citizens.
Phereclos	2019-2022	STEM, Open Schooling, empowerment	Establishment of a network of “Local Education Cluster” promoting STEM and Open Schooling, fostering their social role. Building of a “Library of good practices” on open schooling education clusters
Make it Open	2020-2023	STEM, Open Schooling	Development of tools (learning scenarios, OS hubs, MOOC, online platform) to ease the adoption of OS concepts and practices in traditional educational institutions.
Surrounded by science	2021-2024	STEM, innovative educational research	This project will analyse the impact of out-of-school science activities and provide a digital toolbox of innovative research instruments to collect data from participants of such activities.
FEDORA	2020-2023	Science education, open schooling, creativity, societal challenges	Aimed to address misalignment between educational systems and societal changes and challenges focusing on interdisciplinarity, creative thinking and open schooling.
REUNICE	2021-2024	Open Science, Science and Society	With the European Universities Alliance EUNICE, this complementary project promotes cooperation between Science and Society, considering and working with all relevant stakeholders.

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Project	Date	Disciplines involved or socioeconomic needs considered	Description and comments
IANUS	2022-2025	Science and Society, Science communication	Foster science literate citizens and develop a relationship based on transparency and trust between society and areas of science, research and innovation.
NEWSERA	2020-2023	Science and Society, Science communication	The NEWSERA project aimed to enhance the communication strategies of citizen science projects to effectively engage diverse audiences, including the general public, academic scientists, policy makers, entrepreneurs, industries, data journalists, and science communicators. The project involved collaboration between researchers experienced in sociology, citizen science practitioners, and science communication experts.
GAPARS	2017-2019	Game design and participative science	The GAPARS project explored the synergy between gaming and science, harnessing the engaging nature of gaming to involve citizens in scientific tasks. By embedding science tasks as minigames within larger gaming environments, the project aimed to increase public interest in science and facilitate complex analyses. It examined motivations of both gamers and scientists, recognizing the potential for citizen science gamers to contribute significantly. GAPARS developed guidelines and software tools to facilitate this partnership, demonstrating its applicability to various scientific problems, including projects like the Human Protein Atlas. The initiative showcased the benefits of merging gaming principles with scientific endeavours, offering a unique approach to citizen science participation.
GREAT	2023-2026	Social engagement of citizens, game design	The GREAT project focuses on exploring the impact of games on European society and innovative applications of games to engage citizens in societal and cultural domains. Combining academic research, practical experimentation, and collaborative design, the project addresses policy issues related to the climate emergency. It employs citizen science methods to investigate the use of games in facilitating dialogue between citizens and policy stakeholders. Case studies and research cycles examine various aspects, with agile methods adapting games from existing platforms for research purposes. Outcomes include research publications, methods for obtaining data for policy stakeholders, technical resources, and guidance for adopting the approach.(Beginning of the project)

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Project	Date	Disciplines involved or socioeconomic needs considered	Description and comments
C4S		STEM, empowerment	Vulnerable communities often go unnoticed as active social agents, and it is imperative to not only create activities for them but also involve them as co-participants. This approach ensures a more comprehensive and inclusive approach to education and aids in promoting anticipatory policy-making. C4S achieves this through science education activities that span both formal and non-formal educational institutions. These activities are designed to raise science awareness and enhance their capacities while sensitising them to exclusionary practices that may occur in the field of science. The project places special emphasis on adopting an intersectional approach to combat gender discrimination, which affects women and girls on multiple levels. The project involves science education activities in six local hubs to raise awareness and promote inclusivity in science education.
Hypatia	2015-2018	STEM, gender equality	This project aimed at providing guidelines for engaging teenagers in STEM in a gender- inclusive way. It produced a toolkit containing several easy to implement activities built to deconstruct gender stereotyped bias.
LEVERS	2023-2026	Environment, inclusivity, empowerment	Engage and inform society through the creation of educational models that are more flexible and inclusive and advance lifelong learning to empower all citizens

We decided to give an in-depth presentation of 2 projects to highlight their specific interest regarding RoadSTEAMer.

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CASE (Creativity and Arts in Science Education) Sept 2020-Dec 2020:

The CASE project aimed to strengthen the profile of primary school teachers by motivating them to undertake a deeper change in their approaches to science education. This was realised through the strengthening of creativity and incorporation of arts education practices in their methods. The project sought to improve achievement in high-level basic and transversal competences.

During its duration, the CASE project successfully designed, communicated, and represented creative inquiry-based science education approaches for primary schools. These approaches were supported by teacher training, workshops, mobility activities, and the development of relevant training materials. The project supported the development of an innovative and sustainable way of learning, benefiting primary students. By the time the project concluded in December 2020, it had also established a network of CASE primary teacher practitioners, creating a community of educators who shared their knowledge and experiences in science education practices.

The need for early STEAM educational practice in preschool and primary school has been highlighted since the first workshop organised by ZSI and UoE (respectively leaders of tasks 2.1 and 4.1) on the 19th of January 2023 (see D2.1 p.45) since disparities in education appear early. This project is a good example of training for teachers of these educational levels. Nevertheless it ended in 2020 and we haven't found other examples of this type of project since then. Some of them can reach these audiences but are not specifically focused on primary students or teachers which might have specific needs (materials and training).

Putting the “A” to STEM (UK):

This project is described in this first part since it was an experimental attempt to introduce art in the STEM domains. It also appeared to be ideal to make the link with the following section on STEAM practices considering its results. The outcomes of this training program were significant. Both staff and students gained new skills and knowledge in STEAM subjects through physical mobility. The project raised awareness of the various forms of art and their integration into school life. Technology was harnessed to support art education through online learning. Mental health and well-being, a priority post-pandemic, benefited from strategies learned in structured training courses. The incorporation of art in teaching created a tranquil environment, reducing stress and anxiety among the school community. Overall, staff gained confidence in using art in daily classroom activities, encouraging students to view art as an essential component of problem-solving and critical thinking. The project successfully merged art with STEM subjects, enhancing the learning experience for both staff and students.

We can conclude this overview of European projects with a few noteworthy points:

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Open Schooling: A significant number of projects (OSOS, PULCHRA, COSMOS, MULTIPLIERS, FEDORA…) focus on open schooling, fostering community engagement and personalised science learning. They pave the way for co-creating educational content, tools, and services for science education, enriching the STEM educational landscape within schools and often bringing a creative aspect in curriculums in the way projects are implemented. But Arts' articulation is not always obvious, being limited to the notion of creative problem solving reflection implemented collaboratively with external partners.

Science and Society Engagement: REUNICE, LEVERS, C4S or IANUS projects incorporate aspects of socio economic needs outlined in D2.1 emphasising lifelong learning, science awareness, and inclusive approaches. They emphasise transparency, trust-building, and cooperation between science and society, using science communication to foster literacy for all. The Critical making project sits close to this subject bringing critical and socially responsible making in FabLabs and maker spaces to promote responsible research & innovation within them.

Gamification in Science: Projects centred around gamification (GAPARS, GREAT) offer an innovative approach to engage citizens in scientific tasks. They infuse elements of fun and engagement into scientific endeavours, attracting wider participation and interest in STEM fields.

Inclusive/Empowering STEM Education: While there is room for growth in this area, the presence of 3 projects dedicated to inclusivity underscores the importance of fostering diversity in STEAM education. One of them addresses mainly gender inequalities. Addressing all kinds of inequalities remains a critical aspect to develop and promote in STEAM practices.

Several projects demonstrate a strong commitment to fostering creativity and enthusiasm among teachers and students in both primary and secondary levels. However, projects regarding tertiary education are almost nonexistent: for university students, the availability of non-traditional educational projects seems to be very poor at global level.

2.3 A focus on projects closely related to RoadSTEAMer

This second desk research section will consider projects **focussing on STEAM**, analysing them utilising the socioeconomic needs and challenges of deliverable 2.1.

Almost every project listed below is aimed (or partially aimed) at promoting positive attitudes towards STEAM, which is a recommendation to increase science literacy for all. We will not elaborate on this in the table since it is a generally shared characteristic.

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Table 3 : Projects within RoadSTEAMer's focus area and the recommendations defined in D2.1 they present.

Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
CREATIONS	More research on STEAM education effectiveness, provide easy-to-use material and promote the values and approach of STEAM	Project-based collaborative learning to develop soft skills and inclusivity, multidisciplinary projects			The CREATIONS project was designed to revolutionise science education by infusing creativity and art into the classroom environment. It aimed to create an engaging learning experience for young students by orchestrating a series of captivating events, including theatre, photography, and exhibitions, where they could actively and playfully immerse themselves in the world of science and research. The project's objectives included **enhancing STEM skills**, simulating scientific work in classrooms, **inspiring scientific careers**, and **empowering teachers**. It emphasised inquiry-based learning, emotional-rich environments. Over the course of its three-year tenure, CREATIONS established a robust pan-European network comprising scientists, teachers, artists, and students.
CSRC	Teachers training to promote the STEAM approach	Communication between the public and the industry, promote interdisciplinary research			Creation of a project of STEAM centre in Cyprus to **promote interdisciplinary research** and **science literacy**, contribute to RRI, provide **educational training**, **communicate and disseminate to the public and industry**.
SALL	Expose students to science careers, value STEAM approach	Open schools (and other real world approaches)	Include families to change science stereotypes	Focus on societal challenges and real problems to promote interest in science	The SALL project aimed at fostering open schooling projects, without clear focus on arts but each project implemented by schools implied a lot of **creativity for problem solving** ; some projects implemented by schools implied artists or researchers and each project had to involve external partners (from local communities or research for example). The aim was to **empower students** and place them as agents of change in their communities, while **enhancing STEM skills**.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
CONNECT	Provide easy-to-use material and promote the values and approach of STEAM	Open schools (and other real world approaches)	Policy to affect structural changes, STEAM focused career training	Better connection between the needs of the labour market and lifelong learning, Focus on societal challenges and real problems to promote interest in science	CONNECT strives to transform science education by integrating open schooling initiatives into the standard curriculum, fostering authentic student engagement. By partnering with universities and enterprises, this innovative model aims to **enhance scientific literacy, inspire students to pursue STEM careers, and promote inclusivity**. CONNECT achieves these goals by embedding science-action gamification projects into the core curriculum, creating engaging learning experiences that prepare students for a science-driven world.
PERFORM	Value STEAM approach: supporting young people to bring these subjects together	Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects		Focus on societal challenges and real problems to promote interest in science, Integrate the need for scientific thinking also in non-scientific/arts topics	In order to stimulate young people's **interest in science and promote STEM careers**, this project incorporated various performing arts practices such as improvisational theatre, stand-up comedy, and science busking to facilitate inquiry-based learning. This culminated in a student-led performance addressing scientific topics of interest. Early career researchers played a vital role in this process, **sharing their research** experiences and guiding students in **reflecting on science** as a practice and its societal significance.
FemSTEAM Mysteries	Provide easy-to-use STEAM material, Expose students to science careers from the early years, Expose students to science role models from primary years		Policy to affect structural changes, Role models to redefine identities and change culture, STEAM focused career training, Replace the leaky pipeline metaphor with epistemic justice		This project aimed to **challenge gender inequality** in STEAM by highlighting the significant contributions of women in these fields, dispelling stereotypes, and providing role models for young girls, while also empowering young boys to support their female peers in **pursuing STEAM careers**. The objectives of "FemSTEAM Mysteries" encompassed showcasing women's vital roles in STEAM, combatting stereotypes among students and teachers, inspiring young girls to pursue STEAM careers through game-based role-model pedagogy, and enhancing essential skills and competencies for all students in STEAM studies and careers through engaging game-based activities and enigmas.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
InSTEAM	More research on STEAM education effectiveness, Provide easy-to-use STEAM material, Communicate to schools and teachers the values of the STEAM approach	Open schooling, Project-based collaborative learning to develop soft skills and inclusivity	Policy to affect structural changes, STEAM focused career training	Focus on societal challenges and real problems to promote interest in science	The InSTEAM project is driven by the ambition to develop a comprehensive set of educational materials designed to **facilitate personalised and inclusive STEAM** learning experiences. Its primary objective is to establish pathways for interdisciplinary environmental STEAM education that are accessible to a broad and diverse audience, effectively **diminishing disparities in digital STEAM education access and engagement.** InSTEAM introduces a multifaceted approach to inclusive impact, encompassing scientific, socioeconomic, open schooling, and cultural dimensions. At its core, the project emphasises the scientific inclusive impact approach, centred on inquiry-based learning principles and the Universal Design for Learning framework. This approach lays the foundation for fostering an environment where individuals from all backgrounds can engage meaningfully in STEAM education while **addressing critical environmental topics**.
E-STEAM	Provide easy-to-use STEAM material, Expose students to science careers and role models from the early years	Open schools (to labour market), Project-based collaborative learning to develop soft skills and inclusivity	Policy to affect structural changes, Role models to redefine identities and change culture, STEAM focused career training, Replace the leaky pipeline metaphor with epistemic justice	Better connection between the needs of the labour market and lifelong learning, Develop digital literacies beyond computer science,	The E-STEAM project was designed to foster **inclusivity and innovation in STEAM education**. Its core objectives encompassed three main areas: - encouraging **gender inclusivity** within STEAM education by establishing **collaborative relationships between schools and the labour market**, particularly through a mentoring program focused on inspiring girls in STEAM fields. - creating a dynamic virtual learning platform, serving as a comprehensive resource hub. This platform will provide practical and innovative learning solutions that complement traditional curricula, making STEAM education **more accessible and engaging**. - disseminating personalised learning activities by advocating for the widespread adoption of the virtual platform. The objective is to enhance the appeal and effectiveness of STEAM education, with a **particular focus on engaging girls**.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
CoM'n'Play - Science	More research on STEAM education effectiveness, Provide easy-to-use STEAM material, Value STEAM approach: supporting young people to bring these subjects together		More research on moderating factors and career paths to optimise policies		CoM'n'Play-Science aimed to explore informal science learning among young Europeans through coding, making, and play activities beyond traditional classrooms. It investigated both intentionally organised informal learning activities and learning that occurs incidentally during everyday coding, making, and play. The project was aligned with contemporary discourses on STEAM education, RRI, and science capital. It delved into diverse practices, surveyed participants, and engaged in intensive research. It focused on **young learners' attitudes, values, and dispositions toward science, scientists, and science-related information**.
ArtBot and Learn to Machine Learn project	Provide easy-to-use STEAM material	Develop digital literacies	STEAM focused literacy	Better connection between the needs of the labour market and lifelong learning,	ArtBot is an educational game suitable for players of all ages, providing a hands-on introduction to the fundamentals of Artificial Intelligence (AI). In this engaging quest, players are tasked with recovering stolen art objects hidden within intricate dungeon mazes. The game offers a unique opportunity to explore the concepts of supervised and reinforcement learning while training an AI assistant to identify and locate these hidden treasures. ArtBot has been meticulously crafted with educators and students in focus, offering an accessible yet immersive experience that delves into the workings of AI processes and the potential for biases within them. It encourages exploration and **understanding of Machine Learning principles**, making it an invaluable tool for STEAM education. The game was developed in the framework of the Learn to Machine Learn project aiming at the development of educational material to support **Artificial Intelligence literacy**.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
WASO	Expose students to science careers from the early years, Expose students to science role models from primary years, Value STEAM approach	Open schools, Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects		Integrate the need for scientific thinking also in non-scientific/arts topics, Promote positive attitudes towards STEAM	The Write a Science Opera (WASO) project revolutionises inquiry-based music and science education. Here, students of various ages, guided by teachers, opera artists, and scientists, become the architects of an educational performance. Building on the renowned "Write an Opera" method, WASO injects science education into the equation, enlisting scientists to spearhead an inquiry-based creative process that showcases the profound connections between science and the arts. This initiative embodies the following key features: - Seamlessly intertwining inquiry-based arts, science, and education to **unlock novel opportunities for cross-disciplinary engagement**. - Establishing a fertile ground and framework for **innovative questioning and knowledge generation within the classroom.** WASO fundamentally alters how we perceive the intersection of science and the arts, offering an inventive avenue for transformative and transversal learning experiences.
GSO	Expose students to science careers from the early years, Expose students to science role models from primary years, Value STEAM approach	Open schools, Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, Role models to redefine identities and change culture	Integrate the need for scientific thinking also in non-scientific/arts topics, Promote positive attitudes towards STEAM	The GSO project aims to produce annual Global Science Opera productions that blend science, art, and technology in a **collaborative and democratic process**. Participants, including schools, universities, opera houses, and science institutions, engage in a **flat hierarchy**, fostering interactions between diverse stakeholders. This approach **promotes democracy, respect, and friendship within the community**.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
GSO4 SCHOOL	Expose students to science careers from the early years, Expose students to science role models from primary years, Value STEAM approach	Open schools, Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, Role models to redefine identities and change culture	Integrate the need for scientific thinking also in non-scientific/arts topics, Promote positive attitudes towards STEAM	GSO4SCHOOL is a dynamic initiative aimed at creating a network of students and teachers from diverse backgrounds who collaborate on transdisciplinary projects integrating science and the arts. This project builds upon the Global Science Opera concept and seeks to engage school students and educators in cultural, educational, and scientific exploration. It prioritises **inclusivity and aims to address diversity** in school education, **fostering social, civic, intercultural competencies, and media literacy.** By promoting creativity, collaboration, and inquiry-based learning, GSO4SCHOOL establishes a European network that reaches **underserved communities and isolated regions**. This initiative empowers project participants to become outreach agents beyond the project's duration, sustaining its activities in the future.
SciculturedD	More research on STEAM education effectiveness, Provide easy-to-use STEAM material, Value STEAM approach	Real world approaches, Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, Replace the leaky pipeline metaphor with epistemic justice, STEAM focused career training	Provide sufficient professional development and training of educational professionals, Focus on societal challenges and real problems to promote interest in science, Integrate the need for scientific thinking also in non-scientific/arts topics	SciCultureD is an evolution of its predecessor, SciCulture (2018-2021). It seeks to address **contemporary challenges** by fostering innovative transdisciplinary education, connecting learners, educators, artists, scientists, and entrepreneurs. SciCultureD's journey is marked by a dedication to **empowering learners**, inspiring innovation, and addressing **real-world challenges** through the lens of transdisciplinary education.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
STE(A)M Truck	Value STEAM approach: supporting young people to bring these subjects together,	Project-based collaborative learning to develop soft skills and inclusivity	Policy to affect structural changes		STE(A)M Truck, a non-profit organisation in Atlanta, is dedicated to engaging youth, educators, and communities in immersive STEAM experiences. Their mission is to **inspire creativity and empower individuals** to shape their ideal futures and communities. Through a fleet of mobile innovation labs, STE(A)M Truck offers hands-on, high-tech, and low-tech STEAM opportunities, **bridging gaps in communities where these experiences are limited**. They provide access to expertise, materials, and equipment, enabling students to engage in hands-on learning and collaborate with teachers to incorporate STEAM problem-based learning into their education. STE(A)M Truck is committed to **making STEAM education accessible and impactful for all**.
STEAMing	More research on STEAM education effectiveness, Value STEAM approach	Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, STEAM focused career training, More research on moderating factors and career paths to optimise policies	Provide sufficient professional development and training of educational professionals	In response to European and national policy priorities, this project focused on **elevating knowledge and competence in STEAM subjects** to drive innovation and creativity. It aimed to achieve this by identifying and analysing best practices in STEAM education across diverse socio-economic, demographic, and educational settings in five countries. This project was particularly attuned to the needs of **marginalised groups, including children from migrant and itinerant communities, those with special educational needs, ethnic and linguistic minorities, and addressing the gender gap in STEAM participation.**
STEAM - Connect	Communicate to schools and teachers the values of the STEAM approach	Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, STEAM focused career training	Develop digital literacies beyond computer science	The STEAM-Connect project centres on the creation and testing of innovative STEAM resources and teaching methods in collaboration with dedicated educators. By harnessing **open-source digital tools** like GeoGebra, Sonic Pi, Raspberry Pi, and cutting-edge technologies such as 3D printing, Augmented and Virtual Realities, and robotics, the project aims to make **learning more engaging and meaningfu**l.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
STEAM learning ecologies	More research on STEAM education effectiveness, Provide easy-to-use STEAM material, Value STEAM approach	Open schools (and other real world approaches), Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes	Better connection between the needs of the labour market and lifelong learning, Focus on societal challenges and real problems to promote interest in science, Promote positive attitudes towards STEAM	This initiative embraces a holistic approach, fostering **inclusiveness** within a continuum of formal and informal learning environments. It aspires to bring together various stakeholders, including formal and informal education providers, businesses, and civil society, giving them the space and motivation to play central roles. In the context of this project, a Learning Ecology is not just a physical setting but also encompasses sociocultural dimensions. Much like natural ecosystems, robust science learning ecologies are characterised by diversity and adaptability, offering students a multitude of ways to **engage with science** in a continuous learning journey. At its core, SLEs introduces this concept as a vehicle for envisioning and implementing impactful local open schooling partnerships, transforming them into science learning continuums **accessible to all**.
TRAS network	More research on STEAM education effectiveness		Policy to affect structural changes	Integrate the need for scientific thinking also in non-scientific/arts topics	TRAS aims encompass the facilitation of collaboration between artists and scientists, the support of research, the cultivation of creative works merging arts and sciences, and the promotion of associated cultural and educational endeavours, **promoting literacy for all**. They are dedicated to advocating for the recognition of the distinctive character of this transdisciplinary, cross-cutting, and intermedial approach within the framework of public policies and across relevant organisations and federations. Their network serves as a crucible for the exchange of methodologies among our members and diverse ecosystems. They actively contribute to the aggregation and organisation of resources and data arising from activities that bridge the realms of arts and sciences.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
SEE Eco-STEAM Challenge	Expose students to science careers from the early years, Value STEAM approach: supporting young people to bring these subjects together	Open schools (and other real world approaches), Project-based collaborative learning to develop soft skills and inclusivity,		Focus on societal challenges and real problems to promote interest in science	The project **addresses the pressing climate challenges** faced by South-East Europe (SEE) over the past two decades. It involves three scientific institutions from SEE collaborating to engage primary schools, teachers, and students in the region. Each participating country selects four primary schools, each comprising a team of at least two teachers and five students. These teams focus on several key tasks, including assessing climate conditions within their school environments, analysing and comparing these findings with historical climate data, and proposing innovative, nature-based solutions to climate-related issues. Additionally, they discuss and evaluate the feasibility of their proposed solutions and **creatively present their project journey** and outcomes through **various artistic forms.** This project aims to empower students to address climate challenges creatively, fostering **problem-solving skills and artistic expression** while confronting the pressing climate issues in SEE.
SENSE 2022-2025	More research on STEAM education effectiveness, Provide easy-to-use STEAM material, Value STEAM approach	Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, Analyse the impact of national differences in school systems	Better connection between the needs of the labour market and lifelong learning, Develop digital literacies	SENSE. puts forward an art-integrative science education, grounded into a sensory and participatory approach to STEAM education, leading to the development of a New European Roadmap for STEAM Education This approach promotes **culturally relevant and meaningful real-world learning experiences** for students within their local communities. Their methodology “SENSE.STEAM” represents a core component of their resulting teaching innovation, fostering **institutional and curriculum transformations**. The SENSE project aims to create the SENSE.STEAM Educational model and pedagogy, informed by practical experience, identify the prerequisites for effectively implementing this model across European educational settings and synthesise its research findings into a comprehensive **Roadmap for Science Education designed for practitioners and beneficiaries**.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
The SEER	More research on STEAM education effectiveness	Data on industries and organisations' needs are used to support education policies	More research on moderating factors and career paths to optimise policies, Policy to affect structural changes, Analyse the impact of national differences in school systems	Better connection between the needs of the labour market and lifelong learning	SEER focuses on four key dimensions: collecting existing **STE(A)M education policies and practices**, fostering dialogue among STEAM stakeholders, conducting ongoing needs and impact analyses, and offering guidance for future actions with widespread stakeholder involvement. The project aims to deliver the SEER process, including focus groups and case studies, resulting in the identification of gaps and the STE(A)M Education European Roadmap. This roadmap will serve as a versatile tool for improving STE(A)M education across different starting points and objectives. Additionally, the project will provide a STE(A)M Education European Roadmap Impact Strategy to assess the impact of STEAM plans and initiatives. It also seeks to propose an **Integrated STE(A)M education certification framework that contributes to educational reform** and benefits students, teachers, citizens, and education authorities while enabling schools to self-evaluate. Furthermore, SEER intends to engage the community through a series of dissemination actions, promoting the advantages of STE(A)M education and its relevance to a **sustainable future**.
Arts at CERN		Multidisciplinary and interdisciplinary projects		Integrate the need for scientific thinking also in non-scientific/arts topics;	Artists from diverse creative backgrounds are welcomed to CERN, where they engage with the profound questions explored in fundamental science. They can embark in research-led artistic residencies that take place on-site or remotely and promote a **broader conversation between science and society**.

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Project	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all	Description and comments
iMuSciCA	Provide easy-to-use STEAM material, Value STEAM approach for teachers and supporting young people to bring these subjects together	Multidisciplinary and interdisciplinary projects		Provide sufficient professional development and training of educational professionals, Integrate the need for scientific thinking also in non-scientific/arts topics	The iMuSciCA project is dedicated to the integration of STEM and the arts through the development of a **digital platform and interactive music activities.** Utilising cutting-edge technologies like interactive pens, 3D printing, and wearable devices, iMuSciCA targets secondary school students. Its primary objectives are to **enhance students' grasp of core STEM subjects** while fostering creativity and **deeper learning skills** through music engagement. The project's key deliverables encompass a Music Activity Workbench with advanced enabling technologies, cross-disciplinary lesson plans intertwining physics, geometry, mathematics, and technology with creative music activities, and **professional development resources for educators** to embrace innovative STEAM teaching approaches. This initiative bridges the gap between STEM and the arts, promoting holistic education.
I am A scientist	Provide easy-to-use STEAM material, Value STEAM approach for teachers and supporting young people to bring these subjects together, Expose students to science careers from the early years		Policy to affect structural changes, Replace the leaky pipeline metaphor with epistemic justice, Role models to redefine identities and change culture		The three main objectives of this project are: - To **inspire students from all backgrounds** fighting against stereotypes that often dissuade young learners from pursuing scientific careers, by showcasing diverse scientists who took unconventional paths to success. - To **bridge the gap between theoretical science and real-world applications**. The project provides educators and parents with a resource library filled with hands-on experiments that connect science to everyday life. - To **address disparities in access and knowledge** that can hinder students' progress in STEAM fields. It offers a digitised database of resources and insights from scientists to ensure that all students, regardless of their background, have equal opportunities to succeed in STEAM education.

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Some of these projects are further detailed below. They appear to be particularly relevant for our research and might be included in the exemplary STEAM practices studied in RoadSTEAMer. Nevertheless, in-depth reflection has to be carried and outcomes of next tasks and participatory research actions will highly influence this supposition.

- ➢ SciCultureD:

At its core, SciCultureD aims to create a student-centric, intensive course with a pan-European reach, seamlessly merging science, arts, and humanities. This course will serve as a platform for real-world collaboration while fostering international online learning.

Furthermore, SciCultureD seeks to expand and deepen existing networks, such as RESEO and EUSEA, fostering stronger transdisciplinary bonds among artists, scientists, educators, and entrepreneurs. These collaborations will focus on transformative projects and research initiatives designed to benefit European society and its environment.

The project places a significant emphasis on promoting design thinking, systems approaches, co-creation, entrepreneurship, and innovation. By instilling these principles among educators, professionals, students, and academics, SciCultureD aims to instigate positive change within communities and contribute to environmental well-being.

At its heart, SciCultureD strives to nurture a culture of transdisciplinarity, where the advantages of collaboration across diverse fields are recognized and celebrated. This shift in perspective is underpinned by a commitment to inclusivity, reflecting the values of an inclusive and sustainable society.

Additionally, SciCultureD integrates mechanisms for inclusivity and diversity, active citizenship, citizen science, participatory research approaches, European Green Deal values, and Sustainable Development Goals.

- ➢ PERFORM:

The PERFORM project (2015-2018) aimed to address the European Commission's call for stimulating young people's interest in science and promoting STEM (Science, Technology, Engineering, and Mathematics) careers. It achieved this by exploring the impact of participatory science education methods infused with performing arts and Responsible Research and Innovation (RRI) values on the motivation and engagement of secondary school students with science and STEM subjects. The study involved 12 secondary schools across three case study locations: Paris (France), Barcelona (Spain), and Bristol (UK), engaging students aged 13 to 17. PERFORM's educational approach embedded key RRI values, with a focus on inclusiveness, ethics integration, and critical thinking. These values were incorporated into participatory workshops tailored to local educational contexts and participants' needs. The project conducted these workshops in two rounds in 2017 and 2018,

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demonstrating the potential for arts-based science education to enhance students' engagement with STEM disciplines while instilling RRI values. framework.

The PERFORM project uncovered essential strategies for cultivating an engaging STEM learning environment. By merging the worlds of arts and science, they tapped into the transformative potential of playfulness, opening up new avenues of exploration. Central to this approach was the active involvement of students, ensuring inclusivity and placing them at the heart of the learning journey. Moreover, fostering direct interaction with researchers allowed students to bridge the gap between theory and real-world applications, making science tangible and relevant to society. These findings collectively contribute to a dynamic and effective STEM education.

- ➢ STE(A)M Truck:

STE(A)M Truck's core mission is to address educational disparities by offering hands-on STEAM experiences to underserved students. Research underscores the significance of such experiences in fostering STEM interest, particularly among economically disadvantaged children. The organisation aims to not only enhance student achievement but also provide ongoing support and curriculum alignment for educators, ensuring that the impact of STEAM Truck's programs extends well beyond a single event.

Moreover, STEAM Truck serves as a catalyst for community engagement, forging authentic connections between educators, students, and the broader community. By creating opportunities for mentorship and teacher-artists while establishing maker hubs in schools and public spaces, it actively fosters local talent and spreads the benefits of hands-on learning. Ultimately, STE(A)M Truck's overarching goal is to broaden access to STEM careers and equip students with vital 21st-century skills—collaboration, creativity, critical thinking, and problem-solving—regardless of their socioeconomic backgrounds. Through the provision of resources, expertise, and relevant curriculum, STE(A)M Truck strives to create a more equitable and enriched educational landscape.

- ➢ WASO, Global Science opera (GSO) and GSO4SCHOOLS:

GSO is a flagship initiative under the European Commission's "Developing an Engaging Science Classroom (CREATIONS)" project and a key focus of the Norwegian Research Council's "Integrating Science of Oceans, Physics, and Education (iSCOPE)" project. Inspired by the WASO project, it facilitates interdisciplinary learning on a global scale, allowing individuals to explore and share knowledge across boundaries. Through the production of an annual “Global Science Opera”, it aims at enriching the understanding of science and art.

GSO4SCHOOL, or "The Global Science Opera for School," is an innovative initiative uniting students and teachers in a collaborative exploration of science and the arts. Rooted in the

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Global Science Opera concept, it aims to engage participants in diverse cultural, educational, and scientific disciplines.

A primary goal is to address diversity in school education, nurturing social, civic, and intercultural competencies. GSO4SCHOOL creates a concrete educational framework focused on creativity, collaboration, and inquiry-based learning, forming a European network that reaches underserved communities and isolated regions.

The project actively involves teachers and students in the development of performances, offering comprehensive training and cross-sectoral skill development. Students lead in creating their own performances, exploring science topics from their curriculum. This immersive process enhances collaboration, entrepreneurship, teamwork, and communication skills while deepening their scientific understanding.

GSO4SCHOOL encourages cross-sectoral collaboration among teachers, students, researchers, artists, and the creative industry. It provides vital teacher support through professional development courses and ongoing workshops, empowering them to drive positive change in their educational settings. Through this initiative, participants embark on a transformative educational journey, integrating science and the arts, enriching their learning experiences, and promoting lifelong learning.

- ➢ iMuSciCA

The iMuSciCa project's qualitative and quantitative data suggest a potential positive impact on learner motivation in science education. Favourable indications also emerge regarding Deeper Learning Competencies. Comparatively, the results demonstrate positive effects on both Deeper Learning Competencies and Motivation and Attitudes toward Science Learning, particularly when contrasted with prior situations (longitudinal approach within the same students group) or alternative teaching methods in different groups.

- ➢ Arts at CERN:

This initiative focuses on building cultural bridges and fostering meaningful exchanges between the arts and scientific communities. It offers research-driven artistic residencies, either on-site or remotely, along with art commissions that encourage further exploration and dialogue.

The project extends its reach beyond artists and scientists by hosting exhibitions and events that promote a broader conversation. These programs are developed in partnership with various cultural institutions, laboratories, cities, and artistic communities worldwide, all keen to connect with CERN's research and contribute to a global network at the intersection of art and science.

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We also found some practices that deserve to be presented separately because they are punctual practices, not global projects as the ones presented in table 3. We mention them here since these institutions didn't answer our survey yet.

➢ Le campement scientifique (the scientific camp):

The n+1 group collaborated with Apt's Vélo Théâtre for a unique scientific encampment in 2019. This event, spanning from October 10th to October 13th, blended science and art seamlessly in the city. Scientific expeditions explored various themes, from neuro-poetics to quantum phenomena and archaeology, engaging participants as researchers in an interactive setting. Spectacular, unconventional conferences enriched the experience, while Julien Mellano's performance "Ersatz" masterfully combined theatre and virtual reality, offering a glimpse into a futuristic world. This event celebrated the fusion of science and art, creating an engaging and innovative atmosphere in Apt.

➢ La Gaîté lyrique, le Palais de Tokyo and Society for Arts and Technology museums

The Society for Arts and Technology (SAT), in Montréal, has been a driving force in advancing digital culture in Montreal. This multifaceted institution combines an immersive theatre (Satosphere), a cutting-edge research laboratory (Metalab), a training centre, a venue, and dining options all under one roof. Metalab focuses on fostering innovative immersive experiences and making them accessible to immersion artists through open-source software. SAT offers a diverse range of programs, including evening classes, adult training, creative workshops, and day camps for kids and teens, bridging the realms of technology and art.

Le Palais de Tokyo stands as a prominent contemporary art museum, showcasing groundbreaking artists like Hicham Berrada, whose work blurs the boundaries between laboratory experiments and artistic performances. Berrada's creations invite viewers to experience the forces and energies inherent in matter, offering a unique exploration of the intersection between art and science. The museum also features artists like Takis, known for his "Magnetic Fields" exhibition, and hosts exhibitions such as the Audi Talent winners' showcase about Alternative Reality, forging meaningful connections between art and science.

La Gaîté Lyrique, a cultural centre in Paris, takes a multifaceted approach to addressing contemporary cultural, social, democratic, and environmental challenges. Through exhibitions and meetings like "What if we'd never been to the moon?", "Intensive Science" and "Artificial Intelligence: Science Fiction or Reality?", La Gaîté Lyrique embraces the fusion of art and science to confront pressing issues and promote widespread knowledge dissemination.

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During this research, we also found numerous schools or summer camps, mainly fee-based institutions that might be less accessible to students from underprivileged backgrounds, offering comprehensive STEAM programs or at least incorporating STEAM-related activities. This indicates a growing demand for and a trend towards the widespread adoption of these practices, although limited to environments with sufficient resources.

Practices such as the Science Camp in Apt or the STEAM Truck in the USA are contributing to a more inclusive dissemination of these STEAM education practices. Science Camp proposes free events that take place all around the city of Apt, on its side the STEAM truck is a mobile makerspace that can reach any audience and offers free summer camps for children. They actively engage with diverse populations, transcending geographical, financial, and socio-cultural barriers. It is noteworthy that this type of practice is not the most widespread currently, despite their high capacity to promote diversity in science.

Considering this table, several critical aspects appear to be underrepresented or receive limited attention. One notable area that appears to be insufficiently addressed is the utilisation of industry and organisations' data to inform and shape education policies. These data sources can provide valuable insights into the skills and knowledge needed in the job market, facilitating a more responsive and relevant educational system.

Another aspect that seems to be underrepresented is the promotion of entrepreneurship and self-employment within educational practices. Encouraging entrepreneurial thinking and providing support for self-employment can empower individuals to create their economic opportunities, which is especially relevant in today's evolving job landscape.

The recommendation to address gaps in abstract thinking and mathematics skills from the primary school years expressed in deliverable 2.1 is another area that merits greater emphasis. Early intervention and support in these foundational areas can lead to more proficient and confident students in later stages of their education.

The existing educational landscape tends to focus on STEAM as a tool for science education rather than as an independently nurtured “discipline”. This gap is reflected in the limited or non-existent provision of professional development programs specifically tailored to STEAM. Addressing this gap and acknowledging STEAM as a comprehensive field within education, instead of an entry point, could foster greater innovation and effectiveness in teaching practices, which would be particularly relevant in the European context. The table highlights a scarcity of practices focusing on STEAM career training. Given the increasing demand for professionals with interdisciplinary skills, incorporating STEAM-focused training into educational systems can better prepare students for a wide range of careers.

We weren’t able to find a single mention acknowledging the imbalance of financial support for the 'Arts' and its potential readdressing within the STEAM framework recommended in

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deliverable 2.1 outcomes. This highlights the need to recognise the value of arts education within a broader context that integrates science, technology, engineering, and mathematics, potentially leading to more equitable resource allocation.

Lastly, the analysis of the impact of national differences in school systems appears infrequently. Understanding and addressing these variations could offer valuable insights into how educational practices can be tailored to suit specific regional or national needs.

It is relevant to note that Road-STEAmer is exploring synergies with two other projects funded under the same funding call: SENSE. (The New European Roadmap to STEAM Education) and SEER (The STE(A)M Education European Roadmap). All three projects aim at developing roadmaps to create adequate circumstances for the mainstreaming of STE(A)M Education in Europe, and they will do so by adopting complementary approaches and perspectives. Road-STEAMer is centred on the role of the Arts and of Open Schooling, and it aims at developing a roadmap specifically intended to enable Horizon Europe to better promote STEAM education. The SENSE project (see also p. 30) focuses on sensory perceptions in STEAM, and it will also create resources and materials for educators. The SEER project (see also p. 31) evaluates educational practices and policies against assessed needs, and will produce an atlas of roadmaps, different for each type of stakeholder, as well as a proposal of an Integrated STE(A)M education certification framework. Taken together, these three projects all show the increasing attention towards STEAM practices and their development in several educational levels in Europe.

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3. Mapping of existing STEAM practices

3.1. Building a STEAM questionnaire

Based on the findings outlined in section 1.3 of this deliverable, we developed a questionnaire aiming at STEAM practitioners designed to capture on-going STEAM practices. In the initial draft, our primary goal was to keep it concise for the convenience of practitioners. To achieve this, we aligned each question with various criteria and/or socioeconomic needs, resulting in a compact 20-item survey.

However, after extensive discussions with partners from Work Packages 2 and 4, we recognized the need to eliminate any overlaps between criteria and socioeconomic needs to streamline data analysis. Feedback indicated that while this adjustment shortened the questionnaire, some questions' complexity would prolong response times. Additionally, the data processing task would become more intricate, potentially leading to misunderstandings and errors.

Given these considerations, we highlighted the crucial aspects of the criteria required to comprehensively analyse each practice. We decided to formulate at least two questions for each criteria, aiming to include a scaled response (ranging from 1 to 100) and a qualitative inquiry.

The questionnaire can be divided up and linked to the various aspects of our research project as follows:

- Ethic requirements: Q.1
- General information: Q.2 to Q.9
- Description: Q.10
- Policy and financial informations: Q.11 to Q.14
- Socioeconomic needs and challenges: Q.15 to Q.18, Q.21 and 22
- Disciplinary inter-relationship: Q.19 to 22
- Creativity: Q.24, 30, 31
- Collaboration: Q.23 to 25
- Real world connections: Q.26 to 28
- Thinking-Doing-Making: Q 28 and 29
- Inclusion, Personalisation, Empowerment: Q. 15, 22, 32, 33

The final questionnaire (See Annex 1) has been disseminated to all consortium members and their networks through the Survey Monkey website. Until now it allowed us to collect 70

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practitioners' contacts. 30 among them answered the whole survey, allowing us to give their in-depth presentations (see section 4).

3.2. Data collection and treatment

The data collection process faced significant delays due to ethical requirements. To ensure that the data collected would be usable by every consortium partner, we had to undergo an ethical review process with university committees, which, unfortunately, extended over several months.

As a result, we were able to release the questionnaire at the end of June 2023, which coincided with the summer season: not the most optimal time for gathering data from educational institutions. However, thanks to the diligent efforts of the consortium in disseminating and promoting the survey, we managed to collect information on over 52 STEAM practices before September 15, 2023. Of these, 30 practices either fully completed or almost fully completed the survey. The remaining 22 practices only provided a website or a contact email and gave their consent to be included in our current mapping efforts, allowing the consortium the flexibility to present their content through further desk research led by Work Package 4. But considering the lack of information at our disposal on these 22 practices they don't present any interest for the following analysis and therefore they won't be included in the present document. Nevertheless, when sufficient information can be found, their presentation will appear on the interactive map that will be included on the RoadSTEAMer platform, displaying practice profiles collected by the consortium.

It is important to note that our data collection efforts will continue throughout this year (i.e. 2023). We are committed to disseminating the questionnaire within our extensive networks and during various consortium-organised events, including the 'real-life use-cases workshops' scheduled as part of WP4. We anticipate that this ongoing data collection will significantly augment our dataset. The responses received after this initial report will play a crucial role in enriching our analysis and refining or corroborating our findings for the forthcoming September 2024 deliverable, D4.4, titled *"Report on lessons learnt"*.

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4. Initial results

In this section, we delve into the initial findings gathered from our survey on STEAM practices. Our exploration encompasses two key aspects: the socioeconomic needs and challenges addressed by STEAM practices outlined in Deliverable 2.1 and a detailed presentation of these practices in regard to the criteria established in Deliverable 4.1.

In the following section the diagrams and numbers presented exclusively incorporate the 30 fully completed questionnaires collected and do not include data from desk research. But in order to have a fuller picture of the STEAM practice landscape, it is important to note that we incorporated insights gained from our review to analyse and illuminate the obtained results.

Before delving into the statistical analysis of the gathered data, it's essential to acknowledge the constraints of our dataset. While these responses provide valuable insights, it is crucial to recognise that this sample size is relatively small in the context of the broader landscape of STEAM practices across Europe.

Due to the limited number of responses, the statistics presented in this report may not be fully representative of the entire spectrum of STEAM practices. As such, the findings should be interpreted with caution, and it is advisable to consider these results as preliminary rather than definitive.

It is important to note that our ongoing data collection efforts aim to expand the sample size and improve the representativeness of our analysis. As more responses are collected and incorporated into our research, the statistical insights are expected to evolve and become more robust for their final use in task 4.4.

Despite these limitations, the existing data still provides valuable glimpses into STEAM practices and can serve as a foundation for the present report.

As shown in figure 1 most of the practices collected involve collaboration with schools (90%), while 63% involve collaboration with universities. Only 2 practices (Grand Challenge in the UK and Semillero de monologos cientificos in Colombia) include students from tertiary education in their target audiences: most of the practices collaborating with universities interact with researchers (in science or education). This reflects the observation made in section 2.2 regarding a lack of STEAM practices offered for tertiary education students.

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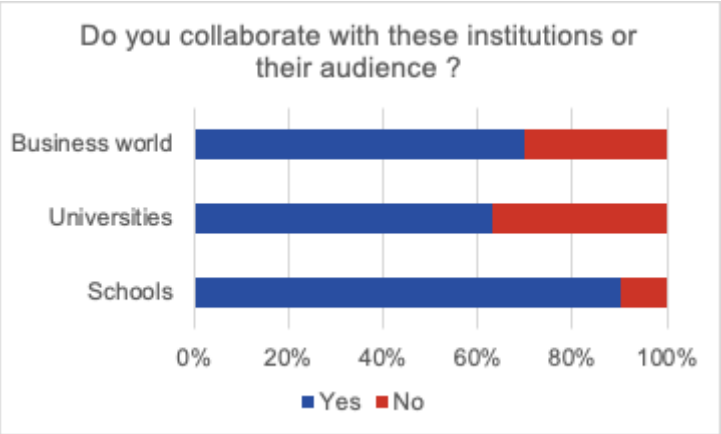

Figure 1: Percentage of collaboration with different institutions

Within the gathered sample 74% are involved in Open Schooling, 60% in Open Science and only 9% in none of these. Open schooling is a practice well developed in Europe lately, projects such as OSOS or Make it Open (see section 2) are good examples of this trend. These practices allow students to behave as change agents in their communities, collaborating together and with external partners. It is able to foster empowerment, entrepreneurship and self confidence.
The percentage of Open Science involvement is in accordance with the percentage of collaboration with universities, in fact most of these collaborations are focused on the communication between science and society, fostering the spreading of researchers' work and results to increase literacy for all.

Most of these activities are implemented at the local level (40%). National and European level implementation is smaller (21% for both). A few among them (4) are implemented at international level. It is worthy noting that 47% received European funding and only 10% received local fundings. 40% of the practitioners consider they didn't have access to adequate funding while designing and running their activity. Suggestions have been formulated by 8 practitioners to enhance the EU's funding programs for STE(A)M education:

- Prioritising the "A" for arts in STEAM as the most important factor promoting the others should be a fundamental focus.
- EU funding should be directed towards promoting arts education to instigate changes in the support for arts within the national curricula of European countries.
- Engaging companies in STEAM initiatives by advocating for funding programs directly aimed at businesses with subsequent investment analysis.
- Renegotiate Brexit to allow UK researchers to re-access Erasmus+ funding, and consider funding smaller grass roots networking initiatives too.

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- The establishment of open platforms for evaluating teachers' projects, offering monitoring capabilities, and facilitating funding opportunities through foundations
- EU funding should focus on a more comprehensive and trans-disciplinary integration of all STEAM fields, as opposed to predominantly concentrating on a few.
- The implementation of a robust system for continuous monitoring and evaluation of funded projects to ensure accountability, assess impact, and identify areas for improvement, ultimately fostering ongoing enhancement in STE(A)M education.

The first part of this section is dedicated to assessing how these STEAM practices directly relate to the socio-economic challenges articulated in Deliverable 2.1. The second part is related to the analysis of each practice regarding D4.1 criteria, presented as tables. This analysis will be included in the profiles of the future map that will be incorporated on the community platforme.
Through these different points of view, we aim to provide valuable insights and a deeper understanding of the evolving landscape of STEAM education and its potential effects on socio-economic needs and challenges.

4.1 Socioeconomic recommendations

As in Table 3 of this deliverable, we provide in this section a table summarising each practice collected through the survey and the recommendations they fulfil regarding socioeconomic needs and challenges defined in D2.1. Using the data collected, we also obtained informative charts on some specific aspects. While the charts are rooted in the responses provided by our participants, their analysis has been further enriched by insights gleaned from our extensive literature research presented in section 2 of this report. As a result, we present a comprehensive overview of the socio-economic needs and challenges addressed by all the STEAM practices collected in the last two months of this project’s first year.

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Table 4: Practices collected through the survey, description and the corresponding recommendation they address.

Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
Educational Robotics	Optional extracurricular activities, such as robotics, provide a unique opportunity for students aged 12 to 15 to develop various skills and interests. With its focus on the STEAM approach, robotics offers an engaging and interdisciplinary experience. In a team of 12 participants, students learn to work together, communicate effectively, and delegate tasks. They experience the dynamics of teamwork firsthand, discovering the significance of cooperation and shared responsibility.The benefits include cultivating critical thinking, problem-solving abilities, creativity, teamwork, and the practical application of knowledge. The fascinating aspect of robotics is its ability to merge different disciplines and bridge theory and practice, empowering students to become confident, well-rounded learners in the exciting world of STEM.	Value STEAM approach: supporting young people to bring these subjects together	Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects		Develop digital literacies
Transdisciplinary Higher Education Pedagogy Network	This network runs workshops, seminars and professional development as well as sharing transdisciplinary/STEAM information to members. The audience is dominantly University colleagues, as well as partner organisations interested in STEAM. The network has a core membership of around 50 participants and is always growing/seeking new members. The benefits of the approach are that it focuses on transdisciplinary/STEAM	More research on STEAM education effectiveness, Communicate to schools and teachers the values of the STEAM approach	Data on industries and organisations' needs are used to support education policies, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, Replace the leaky pipeline metaphor with epistemic justice, STEAM focused career training, More research on moderating factors and	Better connection between the needs of the labour market and lifelong learning, Provide sufficient professional development and training

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
	teaching and learning in Higher Education so it supports those teaching in HE to develop cross faculty and department teaching, modules and programmes.			career paths to optimise policies	of educational professionals
Learning Science Through Theater	In LSTT students innovate, create and learn by performing scientific notions. LSTT is promoting Science Communication & Education in a way that connects the school with the local community as well as the research community through an innovative and creative approach. In LSTT students from all grades (primary & secondary schools) are expected to dramatise scientific notions and knowledge drawn from their school curriculum having also as a scope to provide solutions or motivate the community around the school. LSTT initiative is based on the development and operation of the STEAM IDEAS' Square (SIS) that is based on the Design Thinking Approach.a place, a facility, a meeting place between science, art and the society to connect all the stakeholders and draw ideas that will be realised with a common purpose, the well-being of the community. It will FEEL societal needs, will explore and IMAGINE novel solutions for the future so to CREATE these within the school and SHARE them with the community. As an interdisciplinary approach LSTT aims to add its contribution to the current efforts of a creative and innovative school by focusing on two key areas that could	Value STEAM approach for teachers and supporting young people to bring these subjects together	Open schools, Project-based collaborative learning to develop soft skills and inclusivity, Support entrepreneurship and self-employment	Policy to affect structural changes , Replace the leaky pipeline metaphor with epistemic justice, Role models to redefine identities and change culture	Provide sufficient professional development and training of educational professionals, Focus on societal challenges and real problems to promote interest in science, Integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
	support the realisation of suitable initiatives in every single school. Is building on a whole school approach to learning and setting up a roadmap for the transformation of the school classrooms to creative and innovative learning spaces.				
Critical Making	This project adds scientific insights into the potential of the maker movement. Focusing on critical and socially responsible making in fablabs, maker spaces, etc., to promote responsible research & innovation within them. It shows how global maker communities can offer new opportunities for young talents of all genders to contribute to an open society via open source innovation. It provides hands-on inputs for practitioners, enriching scientific knowledge in the RRI community focused on innovation practices.	More research on STEAM education effectiveness, Make science learning inclusive and appealing, Expose students to science careers from the early years, Value STEAM approach	Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects, Support entrepreneurship and self-employment	Policy to affect structural changes, Replace the leaky pipeline metaphor with epistemic justice, STEAM focused career training, More research on moderating factors and career paths to optimise policies	Better connection between the needs of the labour market and lifelong learning, Develop digital literacies, Provide professional development and training of educational professionals,
MAKE	This hardware-focused Digital Innovation Hubs (DIHs), including makerspaces, as key drivers for local digital innovation in Africa and Europe. mAkE seeks to grow the sustainability of, and collaborations between, African and European DIHs/makerspaces and the start-ups they host. Its Goals are to Improve links between DIHs/makerspaces and public-sector actors and policymakers, help its start-up members to increase their revenue and develop their management skills. It also fosters sustainable capacity development through peer-to-peer learning and		Support entrepreneurship and self-employment, Real world approaches	Policy to affect structural changes, More research on moderating factors and career paths to optimise policies, STEAM focused career training	Better connection between the needs of the labour market and lifelong learning, Develop digital literacies

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
	mentoring and shares online open standards and systems for mutual skills recognition, mapping of machinery, and contracts for distributed manufacturing. It is aimed at building sustainable networks to ensure a durable and tangible real-world impact.				
DoIT	The project's primary goal was to create and evaluate an innovative Social Innovation and Entrepreneurship Education Programme tailored for children and educators. This program hinged on integrating digital making education, open innovation methods, and leveraging technology to instil sustainable innovation practices in social and traditional businesses. Targeting various age groups, from young learners (6 to 10 years) to older pupils (11 to 16 years), along with educators, trainers, and mentors, the DOIT toolboxes facilitated experiential learning in child-friendly maker spaces. These resources, available on the DOIT Web platform, covered aspects of inspirational experimentation, design, prototyping, and basic business modelling for sustainable product and service innovation. Through an integrated platform and learning pathway, DOIT fostered entrepreneurial thinking, social innovation, and collaborative, interdisciplinary work. The project conducted extensive testing and validation across ten European countries, collaborating with regional innovation labs, schools, and business networks on	Expose students to science careers from the early years, Expose students to science role models from primary years	Support entrepreneurship and self-employment, Project-based collaborative learning to develop soft skills and inclusivity, real world approaches	STEAM focused career training, Role models to redefine identities and change culture	Better connection between the needs of the labour market and lifelong learning, Develop digital literacies, Provide sufficient professional development and training of educational professionals

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
	various topics.				
InChildHealth	The InChildHealth project investigates Indoor Air Quality (IAQ) in spaces used by school children, integrating research across health, environmental, technical, and social sciences. It conducts epidemiological studies and interventions in schools across three European cities to evaluate the health effects of multi-pollutant airborne exposures. It also explores dose-response relationships through innovative in vitro cytotoxicity testing. InChildHealth covers diverse geographical and cultural contexts, involving exposure measurements and citizen participation in multiple countries. The project will implement a citizen science methodology engaging schools, educational experts and policymakers.	Provide easy-to-use STEAM material, Expose students to science careers from the early years,	Real world approaches	Policy to affect structural changes	Provide sufficient professional development and training of educational professionals, Focus on societal challenges and real problems to promote interest in science
HandmadeWithSTEAM Competition	The competition aims to engage young people aged 11-16 in a STEAM project competition that encourages creativity and hands-on problem-solving. Participants have the choice to work individually or in teams, allowing flexibility in their approach. They can select from two project options, for example: constructing a sensory musical instrument or designing an automatic pond surface rubbish collector. Throughout the competition, students conduct research, apply STEAM skills, and build a functional product based	Value STEAM approach: supporting young people to bring these subjects together	Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, Replace the leaky pipeline metaphor with epistemic justice, Role models to redefine identities and change culture	Integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
	on their chosen project. The goal is to foster creativity, experimentation, and skill development while providing an inclusive environment where fear of failure is minimised. All participants receive a participation certificate, and three outstanding entries are awarded gold, silver, and bronze awards. The competition aims to inspire young minds and encourage them to consider STEAM-related university studies or apprenticeships.				
ReelLIFE SCIENCE Video Competition	ReelLIFE SCIENCE is a nationwide public engagement programme, which encourages young people and the public to discover more about STEM and its impact on individuals, society and the environment, while at the same time developing participants' creativity, communication and digital skills. Young people from primary schools, special schools, secondary schools and youth organisations are challenged to research a STEM topic and communicate it for the public via an engaging and educational three minute video in English or Irish. By combining elements of Art (animation, prop/set/costume design, music) with STEM, ReelLIFE SCIENCE increases participants' science capital, encourages their creativity and develops their digital skills, making it more likely they will choose STEM subjects and pursue future STEM careers.	Value STEAM approach: supporting young people to bring these subjects together	Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, Replace the leaky pipeline metaphor with epistemic justice	Develop digital literacies, Integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
YOUTH | Young Unesco Tourism and Heritage	The "Creative Workshop of Knowledge and Heritage Enhancement in Pinerolo" project was a collaborative effort involving the Marie Curie High School of Pinerolo, the City of Pinerolo, the Urban Sustainability & Security Laboratory for Social Challenges of the Polytechnic of Turin, and the Italian Youth Association for UNESCO. Its primary aim was to create a cultural design pathway that leverages the STEAM education approach to enhance the cultural heritage of Pinerolo. Methodologically, the project aimed to experiment with STEAM education and promote awareness of active citizenship. From a content perspective, it sought to identify Pinerolo's cultural heritage, understand key points of interest, and create a digital platform for knowledge sharing. The project tested a bottom-up cultural design process and a replicable format, showcasing innovative approaches to cultural heritage enhancement through education.	Expose students to science careers from the early years, Value STEAM approach: supporting young people to bring these subjects together	Open schools, Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Role models to redefine identities and change culture	Focus on societal challenges and real problems to promote interest in science, integrate the need for scientific thinking also in non-scientific/arts topics
Florina smart city	During a one year project, students from 10 to 14 years old try to solve an issue in their local community, working with external partners.	Expose students to science careers from the early years	Open schools, Project-based collaborative learning to develop soft skills and inclusivity, Support entrepreneurship and self-employment		Focus on societal challenges and real problems to promote interest in science, integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
Proper application for people with special needs	In the 1st gymnasium Helliniko, students implemented through a Living Lab methodology an open schooling project aiming at developing an application for people with special needs in order to make their everyday life easier.	Expose students to science careers from the early years,Value STEAM approach: supporting young people to bring these subjects together	Open schools, Project-based collaborative learning to develop soft skills and inclusivity, Support entrepreneurship and self-employment	Policy to affect structural changes, Role models to redefine identities and change culture	Focus on societal challenges and real problems to promote interest in science, Integrate the need for scientific thinking also in non-scientific/arts topics
Smart Composting System	In an open schooling project, a team of 8 students developed a Smart Composting System equipped with internal sensors. This system measures compost mix moisture, air humidity, air temperature, and methane levels. Depending on these recorded values, the system can activate a ventilation mechanism, adjust humidity levels, and activate a motor to agitate the contents of the compost bin. The real-time data collected by these sensors is displayed on a screen integrated into our construction.	Expose students to science careers from the early years	Open schools, Multidisciplinary and interdisciplinary projects		Focus on societal challenges and real problems to promote interest in science
From food waste to fashion	Among other workshops : Kids from prevocational schools chose an issue (for example waste) and produced biofabrics out of the waste. The activity was addressed to a class and the team worked with them over 5 afternoons at the makerspace.	Expose students to science careers from the early years, Value STEAM approach	Project-based collaborative learning to develop soft skills and inclusivity, Project-based collaborative	Policy to affect structural changes	Develop digital literacies, Focus on societal challenges and real problems to promote interest in science,

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
			learning to develop soft skills and inclusivity		integrate the need for scientific thinking also in non-scientific/arts topics
Rayon Science - the sciences at your doorstep	With “Rayon science”, we invest empty stores located in the priority districts of the Paris City Policy and transform them into “pop-up” (ephemeral) science centres where curious people of all ages, and especially young people, playfully engage with science and technology. This open and co-constructed space, with no entrance fees, allows everyone to exchange, explore, create and engage in scientific activities. We navigate between crafts, use of a microscope, challenges and puzzles, making manipulations, scientific experiments, discussion, etc. All this based on the ideas of the mediators, but also those of the participants who are invited to invest in the program by proposing workshops and leading them. For example: making slime and magic sand!	Expose students to science careers from the early years, Value STEAM approach: supporting young people to bring these subjects together	Multidisciplinary and interdisciplinary projects, Project-based collaborative learning to develop soft skills and inclusivity	Policy to affect structural changes, Replace the leaky pipeline metaphor with epistemic justice	Develop digital literacies, Integrate the need for scientific thinking also in non-scientific/arts topics
Particle Physics and the visual arts	The community arts group In-Public (co-founded by Ian Andrews and Sarah Fortes Mayer) have been collaborating with the University of Birmingham particle physics group to develop a series of practical workshops for Primary and secondary schools. The workshops developed with Prof Kostas Nikolopoulos are designed to operate at different levels for different participants and explore the relationship between fine art	Communicate to schools and teachers the values of the STEAM approach, Expose students to science careers from the early years	Multidisciplinary and interdisciplinary projects	Include families to change science stereotypes	Develop digital literacies, Integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
	and particle physics. The exercises explored in the workshops use artistic visualisation techniques to give visual form to particle characteristics and interactions to aid understanding and stimulate further interest. They utilise the interrelationship between drawing, photography, sculpture and performance and offer an “art school ” experience for students, pupils and adults in addition to providing an introduction to particle physics. Additional workshops "particle cartoon characters" have been designed for primary school pupils 8 to 11 years old. And variations have been trialled with family sessions with children as young as 4 years old. Other workshops have been designed to explain the approach to educators and demonstrate the techniques to them as professional practice development.				
Défis E-FABRIK'	In this program, young people come together with individuals with disabilities to form a creative community. Their collective objective is to brainstorm and create tangible solutions related to disabilities. This initiative serves to connect innovative digital and technical creative spaces with youth and disability organisations, fostering collaboration among diverse groups. Participants not only engage in active solidarity but also acquire essential skills for mastering new digital tools. Ultimately, the program empowers individuals to reappropriate technology through these collaborative efforts.	Value STEAM approach: supporting young people to bring these subjects together	Real world approach, Project-based collaborative learning to develop soft skills and inclusivity, Support entrepreneurship and self-employment	Policy to affect structural changes, Replace the leaky pipeline metaphor with epistemic justice, Role models to redefine identities and change culture	Develop digital literacies, Focus on societal challenges and real problems to promote interest in science, Integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
Camden STEAM	The STEAM Hub Leadership Programme, an integral part of Camden's broader STEAM Program, aims to empower teachers in both primary and secondary education to design STEAM curricula and foster employer partnerships. Simultaneously, it strives to raise awareness among young individuals about STEAM industries, equipping them with the skills and attributes desired by STEAM employers. Additionally, the program creates pathways for young people to enter and succeed in STEAM careers while actively engaging those from underrepresented backgrounds to promote diversity within the field. Moreover, it endeavours to establish an innovative and inclusive STEAM community in Camden that influences policy and contributes to regional growth.	Communicate to schools and teachers the values of the STEAM approach		Policy to affect structural changes, STEAM focused career training	Better connection between the needs of the labour market and lifelong learning, Provide sufficient professional development and training of educational professionals
Recycle Camp	The Recycle Camp is a recreational space for semi-structured and free play activities related to the creative recycling of plastic. It is set up outdoors, in the school courtyard, and it is equipped with tools for creative recycling. It is open to all the 5-14 years old children in the local community, that are about 650, and to their families as well. The STEAM approach will encourage children to develop critical thinking about their relationship with the environment that surrounds them and the construction of a more sustainable world, where the concept of 'waste', in its negative sense of a problem, is replaced by the positive concept of 'resource,' understood as something		Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Include families to change science stereotypes	Focus on societal challenges and real problems to promote interest in science, integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
	valuable. Additionally, the younger ones will develop an awareness that many small impacts, seemingly insignificant when taken individually, can lead to a significant collective impact when combined.				
SISCODE activities pool for co-creation labs	A set of activities that labs can use or take inspiration from to create an interactive and engaging programme for their local audiences. The activities selected are 12 ice-breakers, 14 dialogue activities and 9 engagement activities. Their origins are varied, some were designed for European projects, some were recommended by the consortium partners and some are widely used activities.	Provide easy-to-use STEAM material,			Provide sufficient professional development and training of educational professionals, Develop digital literacies
Digital storytelling in formal education: Climate change	This activity supports teachers and students in working with digital storytelling tools to share climate change stories.	Provide easy-to-use STEAM material, Communicate to schools and teachers the values of the STEAM approach			Provide sufficient professional development and training of educational professionals, Develop digital literacies, Focus on societal challenges and real problems to promote interest in science
PlayDecide	PlayDecide enables people to explore a topic in-depth in an informal and informative way. The game element really helps explore thoughts and opinions that would be difficult to get to and express in other ways.	Provide easy-to-use STEAM material	Multidisciplinary and interdisciplinary projects	Replace the leaky pipeline metaphor with epistemic justice	Integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
Universe in a box	Universe in a Box is an educational kit to assist teachers and educators in bringing astronomy and space sciences to 4–10 year old children around the world. Universe in a Box was developed to meet a demand for practical, interactive, and fun resources to bring astronomy to the classroom. It provides teachers and educators with over 40 practical activities as well as the materials and models required to do them. Universe in a Box is based on a first prototype developed and tested by Cecilia Scorza of Haus der Astronomie in Heidelberg, Germany which was further developed and adapted under the framework of EU-UNAWE.	Provide easy-to-use STEAM material, Communicate to schools and teachers the values of the STEAM approach			Integrate the need for scientific thinking also in non-scientific/arts topics;
Grand Challenges	Grand Challenges is a project week, in which undergraduate students work in interdisciplinary groups with other like-minded students to design innovative solutions to real world challenges. Top academics and invited speakers will share their views and help students apply their skills and knowledge to a real-life problem. Group work is facilitated by postgraduate students. Participants further develop their transferable skills including team work, presentation skills and project planning. Each year about 400 undergraduate students complete the programme.	Expose students to science careers from the early years, Value STEAM approach	Real world approach, Project-based collaborative learning to develop soft skills and inclusivity, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, Role models to redefine identities and change culture,	Focus on societal challenges and real problems to promote interest in science, Integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
Synergy of museums and schools	A cooperation between the school and the museum through the expert guidance of the curator is suitable for students with developmental disabilities as well as for the regular population. Using different web tools, realising interdisciplinary, correlational workshops.	Expose students to science careers from the early years, Expose students to science role models from primary years	Open schools, Multidisciplinary and interdisciplinary projects	Policy to affect structural changes, Role models to redefine identities and change culture	Integrate the need for scientific thinking also in non-scientific/arts topics
Semillero de monólogos científicos	El semillero de monólogos is actively seeking professors, researchers, and university students to share their work with diverse and non-expert audiences. This endeavour involves stage training, enabling participants to narrate their research or their interests in science in five minutes.		Multidisciplinary and interdisciplinary projects, Role models to redefine identities and change culture	STEAM focused career training	Provide sufficient professional development and training of educational professionals
Scientific Stand-up	The "Scientific Monologues" begin with a comic introduction about the scientists and the frikismo, follow a series of monologues of about 10 minutes each, on particular themes or phenomena of science specific to the training of their interpreter, and end with a Question time where the audience asks questions about the topics exposed or about any science topic, and the scientists respond by interacting with him and improvising. The public has the option to ask a show of hands, or to do so through the social network Twitter. They are designed for adult public and students from 3rd of ESO. Its maximum duration is one and a half hours, but can be adapted to	Expose students to science careers from the early years	Multidisciplinary and interdisciplinary projects,	Include families to change science stereotypes	

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
	shorter passes; the minimum would be a monologue of fifteen minutes.				
Professional and Technology hands on	An initiative aimed at integrating, dignifying, and advancing technological knowledge in rural regions of the country. It offers specialised training programs, including computer literacy and certification in information technology specialisation, ensuring high employability through partnerships with public and private entities. The facility includes a FabLab equipped for rapid prototyping and digital tools accessible to students, researchers, entrepreneurs, and inventors. Moreover, it operates as a competence centre for the development of innovative technological solutions and offers regional development support. The project encourages the sharing of technological knowledge and its benefits within the local community, promoting technology-related fairs and events.	Value STEAM approach	Support entrepreneurship and self-employment	STEAM focused career training	Better connection between the needs of the labour market and lifelong learning, Provide sufficient professional development and training of educational professionals, Develop digital literacies
Tinkering Challenges	The Tinkering methodology is a STEAM education approach based on both individual and collective creativity as a driver of curiosity and a vehicle for learning and understanding. It has proven to be a powerful tool that contributes to the improvement of key competences and skills, and connects science knowledge and skills to storytelling. Participants are often given a challenge. For instance : build something so that a balloon pops when	Value STEAM approach: supporting young people to bring these subjects together	Project-based collaborative learning to develop soft skills and inclusivity	Role models to redefine identities and change culture	Integrate the need for scientific thinking also in non-scientific/arts topics

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Practice	Description	More scientists	Alignment of industry and societal needs with education	More diversity (gender, ethnic, socio-economic, etc.)	Increase science literacy for all
	you draw on a thread. This single challenge is the opening to an hour of exploring, testing, failing, improving,... With groups we can see several times, the challenges can become trickier and trickier. The participants also, little by little, express themselves more through the artistic side of the "objects" they build. Participants also interact with each other.				
Toy take apart	6 workshops with the same group of young adults. Based on the hands-on Tinkering methodology. Introduces several complexification levels through the several workshops, to end with creations that are shown, or valued. Starts with one or two tinkering workshops : a challenge is given and participants try to answer it through building, tinkering with everyday life material. Electrical components are introduced : batteries, small electrical motors, LEDs and light bulbs, buzzers,... During the last 4 workshops, participants are given a whole lot of broken toys (that used to do something : movement, sound, light,...). They can choose whatever they want. The goal is first to take them apart to see what is inside. Then, they can try to reuse parts of the toys, to recombine them,... When all the "creatures/objects" are done, we try to set up an exhibition to value their work.	Value STEAM approach: supporting young people to bring these subjects together	Project-based collaborative learning to develop soft skills and inclusivity	Role models to redefine identities and change culture	Integrate the need for scientific thinking also in non-scientific/arts topics, Develop digital literacies

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As it has been highlighted in deliverable 2.1 recommendations are often related to several challenges reflecting the complex and multifaceted reality. Moreover, we are presenting preliminary results. They will be nuanced and complemented with the following year's lessons learnt from co-creation workshops and insights offered by the consortium partners and external stakeholders engaged in the project.

This being said, we can already observe that most of the European projects aimed at educational professionals tend to provide easy-to-use material, even if sometimes after the project ends, this material sadly becomes unavailable. During the project time, most of them also propose training, workshops and conferences communicating widely the values of STEAM approach for students and society.

Another aspect which is highly recurrent is the real world approach. It is presented as an empowering tool, allowing participants to place themselves as change agents. Similarly the project based approach is often used to promote collaboration and inclusivity, it also allows multidisciplinary practices. This should also be kept in mind when considering the STEAM criteria: several among them present some of the above-mentioned aspects.

4.2 Statistical analysis

The statistics presented below are drawn from the responses received from the sample of 30 practices that have completed the whole survey. It is important to note that this sample size is relatively small, and as such, these findings should be considered as preliminary. It is our intention to refine and amend these results as we gather additional responses from a broader spectrum of stakeholders. We will also gather valuable contributions from practitioners actively engaged in STEAM, who will provide their perspectives to further inform our research through several workshops.

A largely widespread characteristic within our sample is the fact that participants don't need specific cultural or scientific background to take part in the activity (87%). Considering this we will specify cases that do have specific cultural or scientific requirements from the participants.

The gender gap in access to scientific disciplines appears to be an issue strongly considered by institutions, 75% of them claim to implement policies to reach equality at this level. LGBTQ+ persons and migrants, refugees or asylum seekers are less included in the sense of a lack of inclusion policy: less than 20% of the institutions seems to have a specific policy to reach them.

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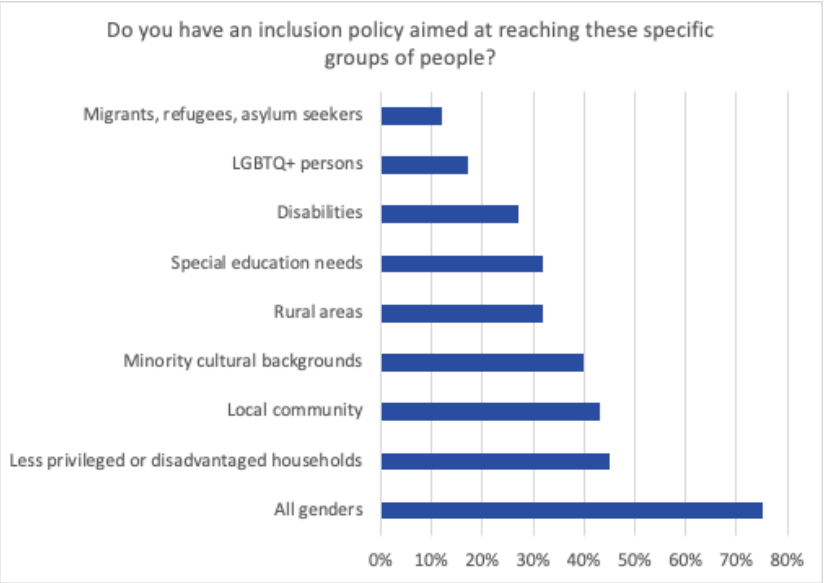

Figure 2: Chart displaying the percentage of activities having inclusion policies for reaching specific groups of peoples

Figure 3 illustrates the key barriers that individuals may encounter when attempting to engage in STEAM activities. Notably, the scheduled timing of these activities emerges as a prominent obstacle, warranting further deliberation and dialogue with practitioners for potential solutions. Additionally, the cost barrier aligns with expectations: the funding constraints mentioned in the introduction of section 4 can contribute to this challenge. We can also remark that in instances where STEAM practices necessitate specialised materials, as is common in makerspaces activities, costs can highly increase, however several STEAM practices are designed to avoid this constraint (few materials needed, at low costs…). Nevertheless, this diagram shows the inclusive trend of STEAM practices: in 90% of the cases specific levels of knowledge are not required and access for people with disabilities is guaranteed.

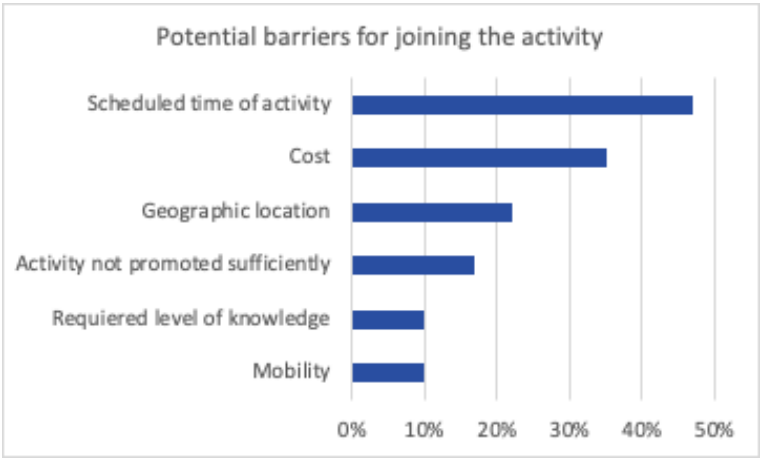

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Figure 3: Percentage of the potential barriers for joining the activities

In terms of addressing social challenges, our analysis reveals that certain issues are more prominently tackled within our sample of STEAM practices. Notably, a significant focus is directed toward concerns such as future employment (52%), gender equity (47%), enhancing self-empowerment and confidence among individuals with limited educational backgrounds (38%), and promoting climate neutrality and sustainability (63%). Conversely, there is relatively less emphasis on addressing racism (10%) and sexism (7%) in the context of these activities. Intermediate attention is given to social injustices (22%) and overall well-being (25%). These findings provide insights into the prevailing priorities and areas of emphasis within the STEAM practices under consideration.

4.3 STEAM criteria analysis

The following table provides a summary of responses from each practice concerning STEAM criteria, as outlined in Deliverable 4.1.

As explained in section 3.1 the criteria are linked to the questions of the survey in the following way:

- Disciplinary inter-relationship: Q.19 to 22
- Creativity: Q.24, 30, 31
- Collaboration: Q.23 to 25
- Real world connections: Q.26 to 28
- Thinking-Doing-Making: Q 28 and 29
- Inclusion, Personalisation, Empowerment: Q. 15, 22, 32, 33

The descriptions have already been included in Table 4. Regarding each criteria the scale answers and directly related information are the first presented, more indirect or transversal (linked to several criteria) information are written in *italic.*

The present study aims to assess projects and practices regarding STEAM criteria through 2 perspectives:

- Gathering the practitioners assessment on their own practice (mainly through scale questions), recognising they know their specificity better than anyone else.
- Combining their assessment to considerations (competencies, collaboration tools, facilitator role, developed skills…) identified in D 4.1 as characteristics of STEAM criteria.

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Table 5: Practices collected through the survey and STEAM criteria.

Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
Educational Robotics	93/100 Facilitator: Advisors, counsellors *Tools: Communication*	83/100 Interdisciplinary between STEM, Creative design, teamwork and collaboration	Prioritising thinking aspects over making and doing in the initial stages, gradually integrating hands-on activities and practical application. *Observational skills, critical learning, problem solving*	88/100 Creative practice, Innovation, playfulness,	Some robotics activities address concrete problems, others focus on developing fundamental robotics skills and creativity without concrete aspects. *Personal development, career aspirations,problem solving*	87/100 Emotional development, Personal development, Self-empowerment, Self-confidence, *Career aspirations*
Transdisciplinary Higher Education Pedagogy Network	100/100 Facilitator: Equal with participants *Tools: Technology, communication, Artistic and creative practice, environment*	100/100 Transdisciplinarity Any disciplines STEM, Arts, creativity and design thinking	Giving equal emphasis to TDM aspects throughout the entire STEAM practice. *Critical learning, Problem solving, Active behaviour, Observational skills, Object-based learning, Environment*	75/100 Playfulness, TDM *Artistic and creative practice serving collaboration and interdisciplinary connections*	Encourage colleagues in the network to focus transdisciplinarity and STEAM practice around a particular problem but it is up to them to identify this. *Technological/Entrepreneurship/ Interdisciplinary skills, Personal development, career aspiration*	50/100 Self-empowerment and confidence, Personal meaning expression, *Personal development* *Interest for socio-scientific knowledge* *Broadening the skills and mindset of participants, career aspirations*
Learning Science Through Theater	100/100 Facilitator: Advisors or counsellors *Tools: Technology, games, communication,*	90/100 Transdisciplinarity STEAM Creativity, design thinking, aesthetics	Allowing flexibility in the balance between thinking, making, and doing aspects. *Critical learning, Problem solving, Active behaviour, Observational skills, Object-based learning,*	100/100 Innovation, TDM, Playfulness *Artistic and creative practice serving collaboration and interdisciplinary*	As the School teams are following the Open Schooling Model (based on OSOS project), they are focusing on tackling local and/or national issues as well. *Personal development, Uncertainty management,*	100/100 Increasing self expression /esteem/empowerment/confidence and wellbeing of participants, Personal development / meaning expression

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
	Artistic and creative practice		*Uncertainty management, Environment*	*connections*	*Technological/Entrepreneurship/ Interdisciplinary skills*	*Interest for socio-scientific knowledge, Broadening the mindset of participants*
Critical Making	46/100 Facilitator: Mentors *Tools: Technology, DIY learning, Communication, Creative practice*	49/100 Transdisciplinarity Arts, technology, science, manufacturing, Creativity, design thinking, aesthetics	Allowing flexibility in the balance between thinking, making, and doing aspects *Critical learning, Problem solving, Object-based learning*	97/100 Innovation, Playfulness, TDM *Artistic and creative practice serving collaboration and interdisciplinarity*	The aim is to find solutions for a specific problem. *Technological and Interdisciplinary skills, career aspirations*	44/100 Increasing self expression /esteem/empowerment/confidence and wellbeing of participants, Personal development *Broadening the mindset of participants, career aspirations*
MAKE	88/100 Facilitator: Mentors *Tools: Technology, DIY learning, Communication, Creative practice*	48/100 Transdisciplinarity Economic, manufacturing, design thinking, science Creativity, design thinking, aesthetics	Allowing flexibility in the balance between thinking, making, and doing aspects *Critical learning, Problem solving, Object-based learning*	69/100 Innovation, TDM *Collaborating support*	The aim is to establish one's' own business, get a training; solve problems in a makerspace *Technological/Entrepreneurship/ Interdisciplinary skills, Personal development, career aspirations*	50/100 Increasing self expression /esteem/empowerment/confidence and wellbeing of participants, Personal development *career aspirations*

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
DoIT	100/100 Facilitators: Advisors or counsellors *Tools: Technology, DIY learning, Creative practice, Environment*	85/100 Transdisciplinarity creativity & arts, entrepreneurship, manufacturing Creativity, design thinking, aesthetics	Allowing flexibility in the balance between thinking, making, and doing aspects *Critical learning, problem solving, Active behaviour, Observational skills, Object-based learning, Environment*	100/100 Innovation, TDM *Interdisciplinary and Collaborating support*	Children were familiarised with SDGs and found related specific problem in their environment *Technological/Entrepreneurship/ Interdisciplinary skills, Personal development, Uncertainty management, career aspirations*	100/100 Increasing self expression /esteem/empowerment/confidence and wellbeing of participants, Personal development, *Broadening the mindset of participants, career aspirations*
InChildHealth	100/100 Facilitators: Top-down educators *Tools: Technology, communication, environment*	100/100 Interdisciplinary Science education, creativity in showing findings *Integration of arts to solve a STEM problem*	Prioritising thinking aspects over making and doing in the initial stages, gradually integrating these aspects *Problem solving, Observational skills, Connection with their environment*	25/100 presenting research findings to policy makers in a creative way *Innovation, interdisciplinary connections,*	Related to indoor air quality in schools, homes and public transportation *Interdisciplinary skills, problem solving*	19/100 **Need of a specific cultural/scientific background** Personal development, Self-empowerment, *Interest for socio-scientific knowledge*
HandmadeWithSTEAM Competition	90/100 Facilitators: Advisors or counsellors *Tools: Technology, DIY learning, Communication, Artistic or Creative practice, Their environment*	75/100 Interdisciplinary Design & technology, science and maths, design thinking, aesthetics *Integration of arts to solve a STEM problem*	Giving equal emphasis to thinking, making, and doing aspects *Critical learning, Problem solving, Active behaviour, Observational skills, Object-based learning, Connection with their environment*	100/100 Innovation, TDM *Interdisciplinary and Collaborating support*	Participants choose one of the two options below: -to construct a musical instrument that provides a sensory environment other than only sound -to construct an automatic device that can collect rubbish from the surface of a pond. *Technological/Entrepreneurship/ Interdisciplinary skills*	100/100 Increasing personal meaning expression, self expression /esteem/ empowerment/confidence and wellbeing Emotional and social development in relation to activities *Interest for socio-scientific knowledge*

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
ReelLIFE SCIENCE Video Competition	100/100 Facilitators: Guides *Tools: Technology, Communication, Creative practice*	90/100 Transdisciplinarity STEAM Creativity, design thinking, use of STEM to solve an issue	Giving equal emphasis to thinking, making, and doing aspects *Critical learning, Problem solving*	100/100 Playfulness, TDM *Collaborative support*	No relation with concrete problem *Technological skills, Problem solving*	100/100 Personal development, Self-empowerment, Self-confidence, Personal meaning expression, *Interest for socio-scientific knowledge,* *Career aspirations*
YOUTH | Young Unesco Tourism and Heritage	100/100 Facilitators: Guides *Tools: Technology, Creative practice*	98/100 Multidisciplinary History of Art, Italian, Computer science, Creativity, design thinking	Allowing flexibility in the balance between thinking, making, and doing aspects *Active behaviour, Observational skills, Object-based learning*	85/100 TDM *Interdisciplinary support*	Make young people aware of cultural heritage *Technological skills, Interdisciplinary skills*	59/100 Increasing self expression /esteem/empowerment/confidence and wellbeing Emotional and social development in relation to activities
Florina smart city	89/100 Facilitators: Equals *Tools: Technology, DIY learning*	43/100 Multidisciplinary **No discipline involved in this activity ?** Understanding arts, science, design thinking, STEM to respond to an issue	Emphasising making and doing aspects to a greater extent, while minimising the importance of thinking *Critical learning, Problem solving, Active behaviour*	83/100 Innovation, Playfulness, *Collaborative support*	Sustainable cities *Technological skills*	78/100 **?** **Need of a specific cultural/scientific background** Personal development, Self-empowerment, Self-confidence

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
Proper application for people with special needs	100/100 Facilitators: Equals *Tools: Technology, Communication, Artistic or creative practice, The environment*	84/100 Transdisciplinary **Respect** creativity and design thinking, STEM to respond to an issue	Giving equal emphasis to thinking, making, and doing aspects *Problem solving, Active behaviour, Observational skills, connect to their environment*	100/100 Innovation, TDM *Collaborative support*	Accessibility for people with special needs *Technological skills, Personal development*	100/100 Increasing personal meaning expression, self expression /esteem/empowerment/confidence and wellbeing Emotional, cultural and social development in relation to activities
Smart Composting System	100/100 Facilitators: Advisors or counsellors *Tools: Technology, Game learning, DIY learning, Communication, Creative practice*	96/100 Multidisciplinary Co-creation Creativity Prototype creativity and design thinking, STEM to respond to an issue	Giving equal emphasis to thinking, making, and doing aspects *Critical learning, Problem solving, Active behaviour, Observational skills, Object-based learning*	100/100 Innovation, Playfulness, TDM *Interdisciplinary and collaborative support*	Climate change *Technological/Entrepreneurship/ Interdisciplinary skills, personal development*	100/100 Personal development, Self-empowerment
From food waste to fashion	61/100 Facilitators: Guides *Tools: DIY learning*	88/100 Transdisciplinary chemistry, digital fabrication, nutrition, sustainability, fashion, *Creativity, design thinking, aesthetics*	Emphasising making and doing aspects to a greater extent, while minimising the importance of thinking *Problem solving, Object-based learning*	64/100 Innovation, TDM	Food waste *Technological skills, Career aspirations*	100/100 *Interest for socio-scientific knowledge,* *Career aspirations*

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
Rayon Science - the sciences at your doorstep	100/100 Facilitators: Equals *Tools:Technology, Game-based learning, DIY learning, Artistic practice, Creative practice*	51/100 Multidisciplinary technology, biology, physics...but mainly about social skills obtained through the sciences	Giving equal emphasis to thinking, making, and doing aspects *Problem solving, Active behaviour, Observational skills, Object-based learning, Connection with their environment*	94/100 Playfulness, TDM *Collaborative support*	We encourage participants to solve small problems/concerns of their everyday life *Technological skills, Interdisciplinary skills, Personal development*	100/100 Increasing personal meaning expression and development, self expression/esteem/ empowerment/confidence and wellbeing, Social development in relation to activities *Interest for socio-scientific knowledge*
Particle Physics and the visual arts	100/100 Facilitators: Equals *Tools: DIY learning, Communication, Artistic practice, Creative practice, The environment*	100/100 Transdisciplinary Fine art and the particle physics *Creativity, design thinking, aesthetics, STEM to respond to an issue*	Giving equal emphasis to thinking, making, and doing aspects *Critical learning, Problem solving, Active behaviour, Observational skills, Object-based learning, Uncertainty management*	100/100 Innovation, Playfulness, TDM *Interdisciplinary connections, Collaborative support*	**No relation to concrete problem** *Technological skills, Interdisciplinary skills, Personal development, Career aspirations*	100/100 Personal development, Self-empowerment, Self-confidence, Personal meaning expression, *Interest for socio-scientific knowledge,* *Career aspirations*
Défis E-FABRIK'	100/100 Facilitators: Advisors or counsellors *Tools: Technology, DIY learning, Creative practice, The environment*	63/100 Transdisciplinarity Using Fablab tools, Design concrete solutions. Social abilities. *Creativity, design thinking, STEM to respond to an issue*	Emphasising making and doing aspects to a greater extent, while minimising the importance of thinking *Problem solving, Active behaviour*	81/100 TDM *Collaboration support*	Issues from peoples with disabilities *Technological skills, Interdisciplinary skills*	89/100 Self-empowerment, Self-confidence, Social development in relation to activities *Career aspirations*

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
Camden STEAM	80/100 Facilitators: Equals *Tools:* Technology, Communication, Creative practice	100/100 Interdisciplinarity All STEAM *Creativity, design thinking, STEM to respond to an issue*	Allowing flexibility in the balance between thinking, making, and doing aspects *Critical learning, Problem solving, Connection with their environment*	80/100 Innovation, *Interdisciplinary connections, Collaborative support*	Teacher training within the STEAM Hub Leadership Programme includes curriculum development that aligns with UN SDG's or UCL's Grand Challenges for example. *Technological and Interdisciplinary skills, Career aspirations*	75/100 Self-confidence, Personal meaning expression, *Career aspirations*
Recycle Camp	100/100 Facilitators: Guides *Tools: Technology, Game-based learning, DIY learning, Creative practice*	100/100 Transdisciplinary Science, Technology, Engineering and Arts. *Creativity, design thinking*	Allowing flexibility in the balance between thinking, making, and doing aspects *Problem solving, Active behaviour, Observational skills*	50/100 Playfulness, TDM *Interdisciplinary connections*	Plastic and organic waste management. *Technological skills, Interdisciplinary skills, Personal development*	100/100 Personal development, Social development in relation to activities *Interest for socio-scientific knowledge*
SISCODE activities pool for co-creation labs	100/100 Facilitators: Equals *Tools:* Game-based learning, Communication, The environment	50/100 Interdisciplinarity STEM, Art, Civics, Language *STEM to respond to an issue*	Prioritising thinking aspects over making and doing in the initial stages, gradually integrating them *Critical learning, Problem solving, Uncertainty management, Connection with their environment*	80/100 Playfulness, *Collaborative support*	Science in society *Interdisciplinary skills, Personal development, Uncertainty management*	100/100 Increasing personal meaning expression, self expression /esteem/empowerment/confidence and wellbeing, Social development in relation to activities *Interest for socio-scientific knowledge*

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
Digital storytelling in formal education: Climate change	100/100 Facilitators: Guides *Tools: Technology, DIY learning, Creative practice, The environment*	70/100 Transdisciplinarity - STEM - STEAM - ICT *Creativity, design thinking, STEM to respond to an issue*	Emphasising making and doing aspects to a greater extent, while minimising the importance of thinking aspects *Critical learning, Problem solving, Active behaviour, Connection with their environment*	90/100 Innovation *Interdisciplinary connections*	Climate change *Technological skills, Interdisciplinary skills*	60/100 Self-confidence, Personal development, Social development in relation to activities *Interest for socio-scientific knowledge*
PlayDecide	100/100 Facilitators: Guides *Tools: Game-based learning, Communication*	100/100 Interdisciplinary Language, STEAM, Civics *Creativity, design thinking*	Prioritising thinking aspects over making and doing in the initial stages, gradually integrating them *Critical learning, Problem solving, Active behaviour, Uncertainty management*	100/100 Playfulness *Interdisciplinary and collaborative support*	The game can be designed and/or adapted to address major societal issues that make good candidates for a public debate *Interdisciplinary skills, Personal development*	90/100 Increasing personal meaning expression, self expression /esteem/empowerment/confidence and wellbeing, Social and emotional development in relation to activities *Interest for socio-scientific knowledge,*
Universe in a box	80/100 Facilitators: Guides *Tools: Game-based learning, DIY learning, Communication, Creative practice*	70/100 Interdisciplinary Astronomy, physics, Arts *STEM to respond to an issue*	Allowing flexibility in the balance between thinking, making, and doing aspects *Critical learning, Problem solving, Observational skills, Object-based learning*	90/100 Playfulness *Interdisciplinary and collaborative support*	Access to scientific knowledge (Astronomy) *Interdisciplinary skills, Personal development, career aspiration*	90/100 Increasing empowerment/confidence Personal development, cultural development in relation to activities *Interest for socio-scientific knowledge,*

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
Grand Challenges	99/100 Facilitators: Guides *Tools:* Technology, Game-based learning, DIY learning, Communication	97/100 Transdisciplinary All disciplines across degree programmes at the University of Exeter *Creativity, design thinking, STEM to respond to an issue*	Giving equal emphasis to thinking, making, and doing aspects *Critical learning, Problem solving, Active behaviour, Uncertainty management, Connection with their environment*	70/100 Innovation, Playfulness, TDM *Interdisciplinary connections, Collaborative support*	Each group selects their own challenge, a real-life problem they want to focus on that relates to one of the wide themes, such as, for example, social inequalities and gender inequality within that theme. *Technological/Entrepreneurship / Interdisciplinary skills, Personal development*	99/100 Increasing personal meaning expression, self expression /esteem/empowerment/confidence and wellbeing Personal meaning expression Social development in relation to activities *Interest for socio-scientific knowledge,*
Synergy of museums and schools	90/100 Facilitators: Equals *Tools: Technology, Communication, Artistic practice, Creative practice, The environment*	96/100 Transdisciplinary (disciplines: No Answer) *Creativity, design thinking, aesthetics, STEM to respond to an issue*	Allowing flexibility in the balance between thinking, making, and doing aspects *Critical learning, Problem solving, Active behaviour, Observational skills, Object-based learning, Uncertainty management, Connection with their environment*	95/100 Innovation, Playfulness, TDM *Interdisciplinary connections, Collaborative support*	Limited movement, mobility of persons with developmental disabilities *Technological skills, Entrepreneurship skills, Interdisciplinary skills, Personal development*	100/100 Increasing personal meaning expression, self expression /esteem/empowerment/confidence and wellbeing, Emotional, cultural and social development in relation to activities *Interest for socio-scientific knowledge, career aspiration*
Semillero de monólogos científicos	83/100 Facilitators: Advisor or counsellor *Tools: Creative practice, The environment*	79/100 Multidisciplinary Sciences, maths, art, engineering, humanities and social sciences.	Allowing flexibility in the balance between thinking, making, and doing aspects *Critical learning, Uncertainty management*	72/100 Interdisciplinary connections	Not related to a concrete issue *Interdisciplinary skills, Personal development*	57/100 Increasing self expression /esteem/confidence and wellbeing *Interest for socio-scientific knowledge*

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
Scientific Stand-up	80/100 Facilitators: Performers and guides *Tools:* *Communication,* *Artistic practice,* *Creative practice,* *The environment*	100/100 Transdisciplinary Biology, biomedicine, physics, chemistry, genetics, nutrition, environmental sciences, maths… *STEM to respond to an issue*	Emphasising making and doing aspects to a greater extent, while minimising the importance of thinking *Critical learning,* *Problem solving*	80/100 TDM	Not related to a concrete issue *Interdisciplinary skills,* *Personal development*	85/100 Increasing self expression /esteem/confidence and wellbeing, Emotional development in relation to activities, Personal development *Career aspirations*
Professional and Technology hands on	/100 Facilitators: *Tools:*					
Tinkering Challenges	69/100 Facilitators: Helpers when needed *Tools:* Creative practice, The environment	79/100 Interdisciplinary maths, engineering, art, mechanics, electronics *Creativity, design thinking, STEM to respond to an issue*	Allowing flexibility in the balance between thinking,making, and doing aspects *Problem solving,* *Active behaviour,* *Observational skills,* *Object-based learning*	95/100 TDM	No concrete issue *Technological skills,* *Interdisciplinary skills,* *Personal development*	100/100 Increasing self expression /esteem/confidence/empowerment and wellbeing, Emotional development in relation to activities *Interest for socio-scientific knowledge*

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Practice	Collaboration	Disciplinary Inter Relationships	Thinking-Making-Doing (TDM)	Creativity	Real-world Connection	Inclusion / Personalisation / Empowerment
Toy take apart	73/100 Facilitators: Advisors or counsellors *Tools:* *Artistic practice,* *Creative practice,* *The environment*	92/100 Transdisciplinarity Art, electricity, technology, mechanics, maths *STEM to respond to an issue*, *design thinking*	Allowing flexibility in the balance between thinking, making, and doing aspects *Problem solving,* *Active behaviour,* *Observational skills,* *Object-based learning*	99/100 Playfulness, TDM	No concrete issue *Technological skills,* *Interdisciplinary skills*	89/100 Increasing self expression /esteem/confidence/empowerment and wellbeing, Emotional development in relation to activities *Interest for socio-scientific knowledge*

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The survey results highlight the predominant roles of the arts in STEAM activities. Among the identified roles, transdisciplinarity emerges as the most prominent, with 48% of respondents recognizing its centrality. This is followed by interdisciplinary approaches, acknowledged by 30% of participants, and multidisciplinarity, recognized by 22%.

Arts are frequently leveraged to foster creativity and design thinking, with a substantial 72% of respondents emphasising this role. Moreover, they are integrated with STEM components in 65% of cases, underscoring their value in addressing complex problems. The arts also play pivotal roles in promoting social and emotional development, with 46% and 32% of respondents highlighting their significance, respectively. Conversely, aesthetics (24%) and cultural development (22%) are less frequently associated with the arts in these activities. This suggests a stronger emphasis on functional and problem-solving aspects rather than aesthetics or cultural exploration.

Furthermore, the arts play a crucial role in enhancing participants' self-expression, self-esteem, and overall well-being, as recognized by 65% of respondents. They also contribute significantly to broadening participants' skills and mindsets, a sentiment shared by 62% of participants. These findings underscore the arts' capacity to empower individuals personally, personalise their learning experiences, and expand their horizons.

The survey reveals an interesting perspective on the roles of facilitators or teachers in STEAM activities. Respondents recognise these educators as equals to participants in 22% of cases, highlighting a collaborative and inclusive approach. Additionally, they are seen as advisors or counsellors in 32% of instances, emphasising their role in providing guidance and support. A significant portion, 30%, perceive facilitators or teachers as guides, indicating their role in facilitating exploration and learning journeys. In the context of makerspaces, the term 'mentors' is preferred, receiving 2 mentions.
Notably, a mere 5% view facilitators or teachers as top-down educators, suggesting as expected, a departure from traditional hierarchical teaching methods.

The surveyed STEAM activities primarily focus on employing interdisciplinary skills, with a substantial 89% of respondents highlighting their integration. Additionally, technological skills are significantly utilised in these activities, with 73% acknowledging their importance.

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Moreover, personal development is a prominent aspect of these activities, with 65% of respondents emphasising its inclusion. However, entrepreneurship skills appear to be employed to a lesser extent, with only 30% of respondents indicating their incorporation.

In summary, these results underscore the multifaceted role of the arts in STEAM activities, with a strong focus on transdisciplinarity, creativity, problem-solving, and personal development. Technological skills and personal development are also fostered. While personal growth is a key component, there is potential for greater emphasis on fostering entrepreneurship skills within these activities. Aesthetics and cultural aspects are less frequently addressed, the arts prove instrumental in fostering holistic growth and empowerment among participants.

These findings also underscore the evolving nature of education in STEAM activities, with facilitators and teachers assuming roles as collaborators, advisors, and guides rather than traditional educators. This shift reflects a more learner-centred and experiential approach to education, fostering active engagement and exploration.

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5. Conclusion

In conclusion, this report represents the culmination of extensive desk research and the initial launch of our survey, along with the presentation of preliminary results obtained thus far. It materialises our collective efforts to gain a deeper understanding of STEAM practices across the European landscape (mainly from the United Kingdom, France, Spain, Greece, Malta and Austria but also some from Israel or Colombia for example).

The preliminary results of our mapping of STEAM education practices offer valuable insights into the evolving landscape of STEAM education and its potential impacts on socioeconomic needs and challenges. Our analysis has revealed several noteworthy trends and areas that warrant further attention.

Firstly regarding the **European landscape of science education in general**, the report highlights the significant efforts being made in the domain of open schooling, with numerous projects focusing on personalised science learning and community engagement. These initiatives contribute to the co-creation of educational content and tools, enriching STEM education within schools. However, there remains room for greater articulation of Arts within these projects. Several initiatives, such as REUNICE, LEVERS, C4S, and IANUS, emphasise socio-economic needs, fostering lifelong learning, science awareness, and inclusive approaches. These projects prioritise transparency, trust-building, and cooperation between science and society, promoting literacy for all. Additionally, gamification-based projects like GAPARS and GREAT offer innovative approaches to engage citizens in scientific tasks, infusing elements of fun and engagement into STEM fields. Furthermore, a focus on inclusivity in STEAM education is evident, underlining the importance of fostering diversity.

Despite these promising developments, some critical aspects appear to be underrepresented or receive limited attention. These include the utilisation of industry and organisations' data to shape education policies, promoting entrepreneurship and self-employment within educational practices, addressing gaps in abstract thinking and mathematics skills from primary school years, recognising the value of arts education within STEAM practices not only as a tool or a support for STEM education but as an entire part of the process and

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learnings STEAM has to offer, and analysing the impact of national differences in school systems.

Our review of **past and existing STEAM projects** highlighted significant insights into their alignment with socioeconomic needs and challenges and the recommendations formulated in D 2.1. Our analysis underscores several key findings:

- ➔ **Utilisation of Industry and Organisational Data**: Insufficient attention has been given to the utilisation of industry and organisational data to inform and shape education policies. This untapped resource has the potential to provide valuable insights into the skills and knowledge required in the job market, enabling a more responsive and relevant educational system.
- ➔ **Promotion of Entrepreneurship and Self-Employment**: There is a notable lack of emphasis on promoting entrepreneurship and self-employment within educational practices. Encouraging entrepreneurial thinking and providing support for self-employment can empower individuals to create economic opportunities, especially pertinent in today's evolving job landscape.
- ➔ **Addressing Gaps in Abstract Thinking and Mathematics Skills**: While crucial, addressing gaps in abstract thinking and mathematics skills from the primary school years is an area that merits greater emphasis. Early intervention and support in these foundational areas can lead to more proficient and confident students in later stages of their education.
- ➔ **STEAM as an Independent Discipline**: STEAM is often viewed as a tool for science education rather than as an independently nurtured discipline. This gap is evident in the limited provision of professional development programs tailored specifically to STEAM. Recognizing STEAM as a comprehensive field within education could foster greater innovation and effectiveness in teaching practices, particularly within the European context.
- ➔ **School Systems and curriculums**: The analysis highlights a scarcity of practices centred on STEAM focus career training. Given the growing demand for professionals with interdisciplinary skills, incorporating STEAM-focused training into educational systems can better prepare students for a wide range of careers. Additionally the impact of national differences in school systems is infrequently addressed.

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Understanding and addressing these variations could provide valuable insights into tailoring educational practices to suit specific regional or national needs.

- ➔ **Acknowledge the imbalance in Financial Support for the Arts**: Notably, we did not identify any mention of the imbalance of financial support for the arts within the STEAM framework. Recognising the value of arts education within a broader context that integrates science, technology, engineering, and mathematics is essential for more equitable resource allocation.

Moreover, our research has brought attention to the fact that the STEAM oriented curricula are often found in fee-based institutions, which may limit access for students from underprivileged backgrounds. However, initiatives like the Science Camp in Apt and the STEAM Truck in the USA are actively working to bridge these accessibility gaps and promote diversity in STEAM.

As we delve into the **analysis of the survey data**, several intriguing insights emerge regarding the landscape of STEAM practices and their alignment with socioeconomic needs and challenges

- ➔ **Inclusive and Accessible STEAM**: One remarkable aspect of our findings is the inclusivity of STEAM practices. Approximately 87% of the surveyed practices extend an open invitation, not requiring specific cultural or scientific backgrounds for participation. This inclusivity serves as a testament to the accessibility and openness of STEAM initiatives.
- ➔ **Addressing Disparities**: Our analysis underscores the pronounced concern over gender disparities in STEM fields. A significant 75% of institutions actively implement policies to bridge these disparities. Nonetheless, we found that there remains an important gap in addressing LGBTQ+ individuals and migrants, refugees, or asylum seekers, indicating a critical area for future inclusion efforts.
- ➔ **Overcoming Engagement Barriers**: Figure 3 visually captures the significant barriers individuals may encounter when engaging with STEAM activities. Notably, the timing of these activities emerges as a prominent challenge. Cost-related hurdles align with expectations and are often linked to funding constraints. Moreover, STEAM

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practices that necessitate specialised materials can pose financial challenges, although many STEAM initiatives manage this constraint.

- ➔ **Prioritising Socioeconomic Challenges**: Our analysis reveals a keen focus on specific socioeconomic challenges within STEAM practices. Issues related to future employment, gender equity, self-empowerment for those with limited educational backgrounds, and sustainability prominently feature, reflecting the dynamic landscape of STEAM initiatives. However, we note that other important concerns, such as racism and sexism, receive comparatively less attention, though not entirely overlooked. The intermediate emphasis on social injustices and overall well-being completes this picture.
- ➔ **Lack of funding:** Half of the practices gathered received European funding, while only 10% received local funding. Furthermore, 40% of practitioners expressed concerns about inadequate funding. Eight practitioners offered suggestions for improving EU funding programs for STE(A)M education, including prioritising the arts in STEAM, engaging businesses, addressing Brexit-related challenges, and establishing open evaluation platforms and continuous monitoring systems to enhance STE(A)M education initiatives.

While we have made notable progress in collecting data and insights, it is important to acknowledge that our work is still in progress, looking for more practices that will nourish our research. The consortium remains committed to further disseminating the survey within its extensive network and leveraging various upcoming events to expand our dataset.

In addition to the progress detailed in this report, the engineering team within our consortium is currently working on the development of an interactive mapping feature to be integrated into the project' platform. This feature will serve as a dynamic resource, showcasing the diverse range of practices that have contributed to our research through survey responses. This ongoing endeavour reflects our dedication to comprehensively assess and promote STEAM practices, addressing not only their current state but also their potential for growth and impact. As we continue to gather valuable responses and refine our analysis, we look forward to contributing to the advancement of STEAM education and its positive influence on society.

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Moreover, we recognise the immense value in engaging directly with practitioners who have generously shared their experiences and perspectives with us. To facilitate this ongoing exchange, we will invite them to participate in various phases of the project when it can be relevant. Specifically, they will be encouraged to contribute their insights during "real-life use-cases" events organised by Work Package 4 later this year. These collaborative efforts will not only enrich our understanding of STEAM practices but also foster a sense of community and knowledge-sharing among practitioners, researchers, and stakeholders.

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ANNEX 1. STEAM questionnaire

STEAM Practices

Thank you for your interest in participating in our research study. This questionnaire is designed to gather valuable information on STEAM (Science, Technology, Engineering, Arts and Mathematics) practices.
Please note that your participation in this questionnaire is completely voluntary, but if you choose to do so, you may answer some mandatory questions. You may also withdraw participation by not completing the survey.

We want to assure you that all information collected through this questionnaire will be treated respecting GDPR (General Data Protection Regulation) rules. The data collected will only be used for the purposes of this research study and any associated reporting or publications. If you agree your organisation will be added on a map listing STEAM practices.

Thank you for taking the time to fill this questionnaire and to contribute to the RoadSTEAMer project. By doing so you will be integrating with a network dedicated to studying the STEAM field, its strengths and needs, and your experience and opinion will contribute to EU policy making on these matters.
If you want to be more involved in this research project please contact us at roadsteamer@groupe-traces.fr

In every case, we will be pleased to share the outcomes of this research with you.

This form contains 2 types of information: General information about your organisation and STEAM practices that you propose to your audiences.
If you want to register several activities please fill in the questionnaire again skipping questions 3 and 4.

* 1. After reading the information provided, Please answer the following questions to the best of your knowledge. If the questions are true to you, please select each sentence.

Do you confirm that you...

- ☐ Accept to continue filling this form
- ☐ Accept to appear on our map of STEAM practices
- ☐ Are over the age of 18

* 2. Please fill in your organisation's name

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3. Please fill in some general informations about your organisation

Website	
Email (will not be published)	
Adress	
City/Town	
Country	

4. Add a logo or a picture of your organisation

This will be used if you agree to appear on the mapping of STEAM practices (Max 16 MB).

Choose File Choose File No file chosen

Your STEAM activities

Now that we know more about your organisation, please share with us some details about your STEAM activities!

* 5. Please fill in the title of the STEAM activity you want to describe

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6. Which is the format of your STEAM activity?

- ◯ Conferences
- ◯ Contests
- ◯ Fairs
- ◯ Guided visits
- ◯ Holiday camps
- ◯ Lectures
- ◯ Maker space
- ◯ Multiple workshops
- ◯ Panel discussions
- ◯ Performances
- ◯ Professional development
- ◯ Science cafés
- ◯ Science camps
- ◯ Science shows/demos
- ◯ Single workshops
- ◯ Vocational trainings
- ◯ Volunteer programmes
- ◯ Other (please specify)

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* 7. Do you collaborate with these institutions or their audience? (Yes/No)

	Yes	No
Schools (Yes/No)	◯	◯
Universities (Yes/No)	◯	◯
Business world (Yes/No)	◯	◯

Other (please specify)

* 8. Do you think you are involved in Open schooling or Open science?

- ☐ **Open Schooling** (Educational institutions that promote partnerships with families and the local community with a view of engaging them in the teaching and learning processes but also to promote education as part of local community development.)
- ☐ **Open Science** (Open cooperative work involving all relevant knowledge actors and systematic sharing of produced knowledge and tools in science?)
- ☐ **None**

* 9. What is the scale of this project/activity?

- ◯ Local level
- ◯ National level
- ◯ European level
- ◯ Other (please explain)

* 10. Description: Please describe this activity, the targeted audience, the number of participants, the benefits of a STEAM approach in this activity...Explain what is particulary interesting from your point of view!
You can also provide us a Website link.

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* 11. Which of these 8 key competencies for life-long learning do you think are most addressed in your activity? Select up to 3 options.
The European Commission uses these 8 key competences to encourage peer learning and exchange of good practices; and promotes wider use of the 8 key competences in related EU policies.

- [ ] Communicating in a foreign language
- [ ] Communication in the mother tongue
- [ ] Cultural awareness and expression
- [ ] Digital competence
- [ ] Learning to learn
- [ ] Mathematical, scientific and technological competence
- [ ] Sense of initiative and entrepreneurship
- [ ] Social and civic competencies
- [ ] None of the above

* 12. Have you received EU, national or international funding for your activity? And if yes, under which programme?

- ◯ No
- ◯ Yes (please specify under which programme)

* 13. Did you have access to adequate funding opportunities when designing and running your programme?

- ◯ Yes
- ◯ No

14. Do you have any suggestions to improve the EU's funding programmes for STE(A)M education?

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Socio economic dimension

* 15. Do the participants need to have a specific cultural/scientific background to take part in this activity?

- ◯ Yes
- ◯ No

* 16. Do you have an inclusion policy aimed at reaching these specific groups of people?

- ☐ All genders
- ☐ Teenagers/young adults from less privileged or disadvantaged households
- ☐ Teenagers/young adults from minority cultural backgrounds
- ☐ Teenagers/young adults from rural areas
- ☐ Teenagers/young adults in your neighbourhood or community
- ☐ Teenagers/young adults with special education needs
- ☐ Teenagers/young adults with disabilities
- ☐ LGBTQ+ persons
- ☐ Migrants from outside the EU, refugees, asylum seekers
- ☐ Other (please specify)

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* 17. What may be the potential barriers for joining this activity? Multiple answers possible

- [ ] Accessibility of the venue (Geographic Location)
- [ ] Accessibility of the venue (Mobility)
- [ ] Accessibility of the venue (Reputation i.e. being part of a university may be intimidating)
- [ ] Activity not promoted sufficiently
- [ ] Cost (including participation fee, materials, etc)
- [ ] Not receiving accreditation (e.g. credits or certificate)
- [ ] Number of places available
- [ ] Required level of skills / knowledge for participants
- [ ] Scheduled time of activity
- [ ] Untrained staff / protocols for those with special educational needs and/or disabilities
- [ ] Other (please specify)

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* 18. Does your activity address any of these social challenges?

- [ ] Future employment (skills in high demand in the current job market)
- [ ] Social justice (transforming unfair and violent social orders through minority's awareness and mobilisation)
- [ ] Gender's equity improvement
- [ ] Knowledge hierarchy (Increasing self-empowerment/confidence for people with low educational background)
- [ ] Racism
- [ ] Sexism
- [ ] Mental health and wellbeing
- [ ] Climate neutrality/sustainability
- [ ] Other (please specify)

STEAM criteria

* 19. Are the disciplines involved in your activity of equal importance? (Please note this is a continuum, there are more than only 3 possibilities)

Only one discipline is at the core of the activity, the other ones are "complementary".

Several disciplines are at the core of the activity but some are not really important

The activity implies each discipline with equal importance, the result depends on every aspect equally.

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* 22. Which of these roles for the arts do you think are most addressed in your activity? Select up to 5 options

- [ ] Developing understanding/learning in STEM
- [ ] Developing understanding/learning in the arts
- [ ] Contributing understanding/learning of creativity and design thinking
- [ ] Contributing understanding/learning of aesthetics
- [ ] Integrating with STEM disciplines to respond to a problem
- [ ] Encouraging social development in relation to activities
- [ ] Encouraging cultural development in relation to activities
- [ ] Encouraging emotional development in relation to activities
- [ ] Increasing self-expression, self-esteem and wellbeing of participants
- [ ] Broadening the skills and mindset of participants
- [ ] Other (please explain)

* 23. How important is the collaboration between the participants in this activity? (From 0 to 5)

0 (No collaboration at all, each participant is doing it on their own without interaction)

5 (Participants are working together, all the activity is built around their interaction)

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* 24. What are the tools that enable/facilitate this collaboration?

- [ ] Technology
- [ ] Game-based learning
- [ ] DIY learning
- [ ] Communication
- [ ] Artistic practice
- [ ] Creative practice
- [ ] The environment
- [ ] Other (please specify)

* 25. Are the facilitators/teachers considered as

- ◯ Equal with the other participants
- ◯ Advisors/counsellors
- ◯ Guides
- ◯ Top-down educators
- ◯ Other (please explain)

* 26. Is this activity related to a concrete problem (local or global)?

- ◯ No
- ◯ Yes (explain briefly)

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* 27. Does this activity employ:

- [ ] Technological skills
- [ ] Entrepreneurship skills
- [ ] Interdisciplinary skills
- [ ] Personal development
- [ ] Other (please specify)

* 28. Which competencies do participants need to use during this activity? (Select several options if needed)

- [ ] Critical learning
- [ ] Problem solving
- [ ] Active behaviour
- [ ] Observational skills
- [ ] Object-based learning
- [ ] Uncertainty management
- [ ] Connection with their environment

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* 29. Which of the following options best represents the balance between the thinking (cognitive), making (hands-on), and doing (practical application) aspects in this STEAM practice?

- ◯ Giving equal emphasis to thinking, making, and doing aspects throughout the entire STEAM practice.
- ◯ Prioritizing thinking aspects over making and doing in the initial stages, gradually integrating hands-on activities and practical application.
- ◯ Emphasizing making and doing aspects to a greater extent, while minimizing the importance of thinking aspects in STEAM practices.
- ◯ Allowing flexibility in the balance between thinking, making, and doing aspects based on the specific goals and nature of the STEAM practice.
- ◯ Completely separating thinking, making, and doing aspects, focusing on each separately in dedicated phases or activities.

* 30. Does this activity employ participants' creativity/creative thinking? (From 0 to 5)

0 (There is not any creative aspect in this activity) — 5 (The main skill to participate in this activity is creativity)

* 31. In this activity would you say that creativity is linked to

- ☐ Innovation
- ☐ Playfulness
- ☐ Thinking-making-doing
- ☐ Interdisciplinary connections
- ☐ Collaborative support
- ☐ Other (please specify)

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* 32. What is the level of accessibility of this activity? (From 0 to 5)
(Accessibility: participants feel able to take part in all aspects of the process regardless of their level of knowledge/confidence in any aspect.)

0 (To take part in the activity participants need a strong background knowledge in the implied disciplines)

5 (There is absolutely no background knowledge needed, participants can learn every competency necessary during the activity itself and be active in it)

* 33. Does this activity allow participants to develop their:

- [ ] Personal development
- [ ] Self-empowerment
- [ ] Self-confidence
- [ ] Personal meaning expression
- [ ] Interest for socio-scientific knowledge
- [ ] Career aspirations
- [ ] Other (please explain)

Thanks for filling this questionnaire !

34. Do you want to add something else that might be relevant for this study?

35. Thank you for filling-in this questionnaire and contributing to the development of RoadSTEAMer's mapping of STEAM practices.
Would you like to be kept informed of the progress of this project?

- ◯ Yes
- ◯ No

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ANNEX 2. Table of practices and projects mentioned in this project

Acronym used in the report	Full name	Website address
Playing with protons	Playing with protons	https://playprotons.web.cern.ch/about
CASE	Creativity Art and Science in Primary Education	https://www.project-case.eu/
Putting the “A” into STEM	Putting the “A” to STEM	https://erasmus-plus.ec.europa.eu/projects/search/details/2019-1-UK01-KA101-061158
ER4STEM	Educational Robotics for STEM	http://er4stem.acin.tuwien.ac.at/
TransEET	Transforming Education with Emerging Technologies	https://transeet.eu/
OSOS	Open Schools For Open Societies	https://www.openschools.eu/
PULCHRA	School students working with communities and experts to explore cities as urban ecosystems	https://pulchra-schools.eu/
COSMOS	Connecting Science Education to Communities	https://www.cosmosproject.eu/
MULTIPLIERS	MULTIPLIERS promotes Open Schooling across Europe, a new way to learn that makes science more meaningful and directly relevant to everyday life & real-world challenges	https://multipliers-project.org/
OSHub	The Open Science Hub Network: School-led community development through research and	https://oshub.network/

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	innovation	
Phereclos	Partnerships For Pathways To Higher Education And Science Engagement In Regional Clusters Of Open Schooling	https://www.phereclos.eu/
Make it Open	Make it Open is a project which prioritises widening participation through bringing maker culture, citizen science and open schooling cultures to science education. I	https://makeitopen.eu/
Surrounded by science	Science is all around us. Science-related activities outside the classroom can spur interest in science.	https://surroundedby.science/
FEDORA	Regenerating the ecosystem of science learning by developing a future-oriented model to enable creative thinking, foresight and active hope as skills needed in formal and informal science education.	https://www.fedora-project.eu/
REUNICE	REUNICE, a boost for research within EUNICE, the European UNIversity for Customised Education,	https://eunice-university.eu/research/
IANUS	Trust in Science? Inspiring and Anchoring Trust in Science, Research and Innovation	https://trustinscience.eu/
NEWSERA	#CitSci is the new #SciComm	https://newsera2020.eu/
GAPARS	Gamification of participatory science for training and education purposes	https://cordis.europa.eu/article/id/413456-online-gamers-help-analyse-big-data-science
GREAT	Games Realising Effective and Affective Transformation (societal and cultural domains)	https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/org-details/997686323/project/101094766/program/43108390/details

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C4S	COMMUNITIES FOR SCIENCES: Towards promoting an inclusive approach in Science Education	http://www.communities-for-sciences.eu/
Hypatia	Promote gender equality in particular by supporting structural change in the organisation of research institutions and in the content and design of research activities.	https://cordis.europa.eu/project/id/665566/fr
LEVERS	LEarning VEntuReS for Climate Justice	https://cordis.europa.eu/project/id/101094825
CREATIONS	Developing an engaging science classroom	http://creations-project.eu/
CSRC	Center for STEAM Education Research, Science Communication and Innovation	https://cordis.europa.eu/project/id/763594
SALL	Schools As Living Labs	https://www.schoolsaslivinglabs.eu/
CONNECT	Inclusive open schooling through engaging and future-oriented science	https://www.connect-science.net/
PERFORM	Participatory Engagement with Scientific and Technological Research through Performance	https://www.perform-research.eu/
FemSTEAM Mysteries	Counteract the tendency for gender inequality in the STEAM by bringing out the significant role of women in STEAM to students' and teachers' community,	https://femsteam-project.eu/
InSTEAM	Inclusive environmental STEAM education with Online labs	https://insteam.deusto.es/
E-STEAM	Equality in Science, Technology, Engineering, Art and Mathematics	http://e-steamerasmusproject.com/index.html

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CoM'n'Play - Science	Learning Science The Fun & Creative Way!	https://comnplayscience.eu/
ArtBot	Results of the project "Learn to Machine Learn"	https://learnml.eu/ https://art-bot.net/
WASO	Write a science opera	https://www.reseo.org/project/write-a-science-opera/
GSO	Global science opera	https://globalscienceopera.com/about/
GSO4 SCHOOL	Leverage students' participation and engagement in science through art practices	https://gso4school.eu/gso4school-project/
SciculturED	Bringing together social enterprise, scientific research, and the arts.	https://scicultured.eu/about/
STE(A)M Truck	STE(A)M Truck is the award-winning program from Community Guilds designed to help eliminate inequities in the local systems and catalyze transformation across all areas of education.	https://www.steamtruck.org/
STEAMing	STEAM: International Guidance to best practice.	https://steamingproject.eu/
STEAM - Connect	Co-creating Transdisciplinary STEM-to-STEAM Pedagogical Innovations through Connecting International Learning Communities	https://steamconnect.education/
STEAM learning ecologies	STE(A)M Learning Ecologies (SLEs) is an EU-funded project developing engaging open schooling-enabled science learning paths for all in learning continuums of formal and informal learning environments that are also focusing on inclusiveness.	https://www.steamecologies.eu/
TRAS network	Transversale des Réseaux Arts	https://www.reseau-tras.eu/presentation

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	Sciences (Transversal Arts Sciences Networks)	-du-reseau/
SEE Eco-STEAM Challenge	Challenge proposed by Scientix project (The community for science education in Europe)	https://www.scientix.eu/projects/steam-partnerships/eco-steam
SENSE	The New European Roadmap to STEAM Education puts forward an art-integrative science education, grounded into a sensory and participatory approach to STEAM education.	https://sense-steam.eu/
The SEER	The STE(A)M Education European Roadmap	https://cordis.europa.eu/project/id/101058569
Arts at CERN	Since its founding in 2011, Arts at CERN has been fostering the dialogue between artists and physicists in the world's largest particle physics laboratory.	https://arts.cern/
iMuSciCA	Problem-solving is one of the key skills for the 21st-century job market. STEM (Science, Technology, Engineering and Mathematics) teaching rely on the left half of the brain and thus is logic driven. Artistic activities, which uses the right side of the brain fosters creative problem-solving.	http://www.imuscica.eu/
I am A scientist	The stories & science of real world scientists. An Initiative For Inclusive Stem Education.	https://www.iamascientist.info/
Educational Robotics	Educational Robotics	https://www.ea.gr/en/index.asp
Transdisciplinary Higher Education Pedagogy Network	Transdisciplinary Higher Education Pedagogy Network	https://www.exeter.ac.uk/

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Learning Science Through Theater	Community of Learning Science through Theater, where teachers and students can connect, create, upload and share material and communicate with the educational community both in Greece and internationally.	http://lstt.eu/?lang=en
Critical Making	Powering Inclusion and Openness: Together, we add scientific insights into the potential of the maker movement.	https://criticalmaking.eu/
MAKE Africa Europe	An innovative maker ecosystem across Africa, Europe and the world	https://makeafricaeu.org/
DoIT	Digital Fabrication And Making For Social Innovators	https://www.zsi.at/de/object/project/4545
InChildHealth	Improving indoor air quality to bring about a healthier future for our children	https://inchildhealth.eu/
HandmadeWithSTEAM Competition	We aim to engage young people in a Science Technology Engineering Arts Mathematics project competition that will require them to use their creative skills.	https://www.handmadewithsteam.net/competition
ReelLIFE SCIENCE Video Competition	In these challenging times, we're challenging young people to share their passion for Science and all things STEM, by making a short video about their favourite science topic.	https://reellifescience.com/
YOUTH | Young Unesco Tourism and Heritage	Pinerolo Routes Discovering the city	https://percorsipinerolo.it/
Florina smart city	Innovation from the classroom to practice. Teaching upgrade using technological means in education	https://pektpedm.sch.gr/pektpeflo/

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Smart Composting System		https://www.youtube.com/watch?app=desktop&v=cvGBoXvN4oI
From food waste to fashion	Onl'fait est un espace ouvert à toutes et tous autour de l'artisanat numérique, qui met à la disposition de sa communauté des ressources techniques, technologiques et humaines.	https://www.onlfait.ch/
Rayon Science - the sciences at your doorstep	With "Rayon Science", we take over empty stores located in the priority neighborhoods of the Paris City Policy and transform them into "pop-up" (ephemeral) science centers where curious people of all ages, and especially young people, playfully engage with science and technology.	https://www.groupe-traces.fr/rayon-science-1
Particle Physics and the visual arts	Drawing Links Between Fine Art And Particle Physics	https://www.thesketchbookandthecollider.com/
Défis E-FABRIK'	E-FABRIK' brings together young people and people with disabilities. Together, they imagine and produce a concrete solution, to respond to the discomfort that the disabled person experiences on a daily basis, by learning to use digital manufacturing tools and locations.	https://www.efabrik.fr/
Camden STEAM	The A stands for Creativity. It captures the belief that addressing STEM and Creativity together delivers greater value to individuals, employers, the local community and economy.	https://www.camden.gov.uk/camden-steam
Recycle Camp	In the Recycle Camp, specific workshops are organized	https://www.cooperativasocialesose.it/educare-io-faccio-la-differenza/

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	during which children can learn and experience all the recycling phases in detail and collaborate in the creation of an object! The workshops will also be free, but with a limited number of places and by reservation!	
SISCODE activities pool for co-creation labs	Co-design for society in innovation and science	https://siscodeproject.eu/
Digital storytelling in formal education: Climate change	Digital storytelling in formal education	https://view.genial.ly/6013d489c9a2770da3ff8f05/horizontal-infographic-timeline-digital-storytelling-in-formal-education
PlayDecide	PlayDecide is a card game for simple, respectful & fact-based group discussion.	https://playdecide.eu/
Universe in a box	An educational kit to assist teachers and educators in bringing astronomy and space sciences to 4–10 year old children around the world.	https://www.unawe.org/resources/universebox/
Grand Challenges		https://www.exeter.ac.uk/
Synergy of museums and schools	Participation of school students in eTwining activities entitled "The power of art in a special school"	https://vuk-centar.edu.rs/vesti/ucesce-ucenika-skole-u-etwining-aktivnostima-pod-nazivom-snaga-umetnosti-u-specijalnoj-skoli/
Semillero de monólogos científicos	The Homo nologus collective of Parque Explora invites students, teachers, researchers, mediators and professionals to be trained to participate in the Scientific Monologues contest.	https://www.parqueexplora.org/9-concurso-de-monologos-cientificos
Big- Van Ciencia: Scientific Stand-up	The "Scientific Monologues" begin with a comic introduction about the scientists and the frikismo, follow a series of monologues of about 10 minutes each, on particular themes or phenomena of	https://www.bigvanciencia.com/espectaculo/scientific-stand-up-performances

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	science specific to the training of their interpreter, and end with a Question time where the audience asks questions about the topics exposed or about any science topic, and the scientists respond by interacting with him and improvising.	
Professional and Technology hands on	Prototyping Laboratory FabLab that provides rapid and/or digital prototyping equipment to students, researchers, entrepreneurs and inventors.	https://www.makersunit.com/
Tinkering Challenges	The project “Tinkering EU: Addressing the Adults” uses the tinkering methodology, developed and put into practice at the Tinkering Studio at the San Francisco Exploratorium. TRACES has transformed and appropriated this methodology through its Technical Creativity workshops.	https://www.groupe-traces.fr/projet/tinkering-eu-/fr

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