NEXT STEP O1

Empowering schools to design a more desirable and sustainable future

NEXT STEP Conceptual Framework

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Short Description:

This document presents the main approach that the NEXT STEP project will use in order to introduce STEAM practices into the classroom. Also present the main tools that will be used in order to operate the proposed STEAM IDEAS' Square. Finally include the main steps that the school unit will need in order to implement the proposed activities as well as the NEXT STEP Self Reflection tool in order to measure the impact.

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1. Introduction

The NEXT STEP project builds on pupils' own cultural initiatives as natural gateways to knowledge creation within formal, informal and non-formal educational environments. Inspired by real-life questions the project will design and implement an EU level action to promote STEAM approach to facilitate the development of creativity, innovation and inclusion in schools all over Europe.

Enabling stakeholders to implement creative, interdisciplinary and digitally-enabled art/science (STEAM) interventions, NEXT STEP pushes the current status quo at schools from being "reactionary" to "necessary innovation". Artistic ways of working are mainly attributed to the fields of literature, architecture, visual and performing arts and there are numerous existing projects implementing arts-based educational processes to which NEXT STEP refers. Relying on a portfolio of educational interventions (e.g., Learning Science Through Theatre, Global Science Opera, iMUSICA), NEXT STEP will develop a theoretical framework, training materials, training workshops (both digital and in-person) and an evaluation approach which will constitute the state of the art regarding digital implementation of creative, interdisciplinary teaching in primary and secondary schools in the era of Covid-19. This will furthermore be extended to informal learning arenas.

2. STEAM Approach in Education

STEAM education refers to education which brings together the disciplines of Science, Technology, Engineering, Arts and Mathematics into a common framework. There have been numerous approaches to the interactions between disciplines in STEAM.

In their review of STEAM education for the British Educational Research Association (BERA), Colucci-Gray et al. (2017) described STEAM as a "hybrid concept arising at the intersection between conceptions of science and the arts…" (pg. 7). "STEAM" builds upon the more established term "STEM" (Science, Technology, Engineering & Mathematics) which is often used as an (essentially) economic term identifying educational areas that impact Gross Domestic Product to a great extent (ibid, pg. 8).

The expansion of STEM to STEAM has been referred to as (among others):

- a potential to improve PISA rankings.
- a catalyst for a society's capacity to produce world-leading scientists, engineers, technologists
- a motivating factor aimed at engaging youngsters to pursue STEM careers in order to strengthen employment levels in STEM.

Indeed, STEAM education offers a fertile space for developing STEM education beyond its current status. To achieve this, underpinning concepts must be clearly stated for the following reasons (summary of elements in Colucci-Gray et al., 2017):

- STEAM is a "portmanteau" term.
- STEAM has "varied modalities and associated purposes".
- 'Art' and 'arts' are often used interchangeably and even uncritically in STEAM.
- There is confusion with regard to whether the arts "in general", "specific art forms/practices", or "pedagogies used in teaching art subjects or arts and humanities" are being implied by the various practitioners implementing STEAM.
- The "so-called STEM to STEAM agenda" may implies a reconfiguration of disciplinary relationships, interdisciplinary, or transdisciplinary conceptions.
- There is an apparent conflation of STEAM with creative approaches to teaching STEM.

These specifications in STEAM open numerous opportunities for further philosophical, didactical, and pedagogical work. Indeed, "the arts" and "creativity" are two distinct phenomena. While they often co-exist, and one may enable the other to various degrees, taking part in arts education practices does not necessarily imply that one is being creative (Ben-Horin, 2021). Similarly, creative activity does not necessarily have to rely on the arts. For example, Craft et al. (2016) defined creativity in a STEAM project without direct reference to the arts: "Generating ideas and strategies as an individual or community, reasoning critically between these and producing plausible explanations and strategies consistent with the available evidence" (pg. 166). In NEXT STEP, though, the interaction between arts education and science education within the STEAM IDEAS' SQUARE enables a space for creative educational activity in schools.
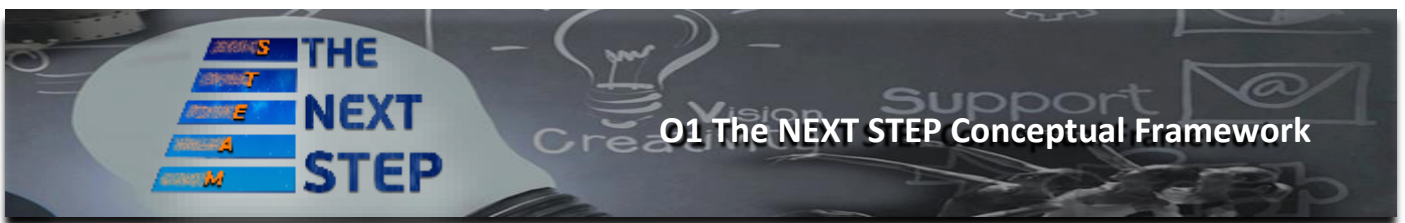
The efforts of European initiatives (e.g., CREATIONS, STORIES of TOMORROW, CREAT-IT, CASE, OSOS) make Europe's advancement to the NEXT STEP in this field a matter of "when, not if". In the interaction of science and other disciplines (e.g., the arts) science education initiatives have often viewed other disciplines as "tools" to be employed "in the service of" science education. Such views do not realize the full potential of interdisciplinary STEAM education: where Europe aims to engage *all* societal actors with science, NEXT STEP initiatives will engage on those actors' terms. It is only when all disciplines enjoy quality on their own terms that real benefits of STEAM education will emerge (Ben-Horin, et al, 2017). NEXT STEP possesses the practices, theoretical know-how and network capable of implementing that equilibrium in the innovative, creative school. That equilibrium's careful realization is what lies at the heart of quality teaching which improves the learning experience's depth and, consequently, the learning outcomes in schools. Indeed, in-depth learning relies on pupils' ability to trace common lines across disciplinary boundaries (NOU, 2015:8). Inviting young Europeans into the interdisciplinary STEAM classroom without assigning equal importance to all disciplines would thus miss the point of interdisciplinary education to begin with.

With teaching towards STEAM educators in both, formal and informal teaching environments, can provide an education to their students that fosters creative and inclusive classrooms by enabling the co-creation knowledge. Pedagogical ways towards integrating the arts in STEM are typically distinguished as art-informed and art-based approaches (Khine & Areepattamannil, 2019; Marshall, 2014): Art-informed education refers to approaches which can be characterised as using the arts and art-related creative processes and products as vehicles for conventional subject education. In contrast, art-based education in STEM, aims to teach towards whole STEAM, acknowledging the arts and artistic processes as integral component of STEM.

Educating towards STEAM is supported by a rich body of research. For example, studies have shown that art-based approaches in STEM promote the formation of integrated subject knowledge (Amabile 1983, Weisberg 1999,). This effect is observed through all age groups, from primary school (Jakobsen & Wickman 2008) to higher education (van der Veen 2015, Irving 2015). This is attributed in particular to cognitive strategies in which symbols and meanings are linked and subsequently embodied (embodiment, Polanyi 1966), as in language acquisition (Hanna 2001, Hickman & Huckstep 2003, Nahrstedt et al. 2007). In this context, literature, dance and performance art, painting and drawing and music are art forms that are used particularly frequently in combination with STEM subjects.

In the case of physical and mathematical subjects, the link with dance and performance art is particularly striking, as Stolberg (2006) summarises in her review. One of the strengths of this art form, among others, is to develop models of complex phenomena, concepts or processes in a larger group of learners, to perform them and thereby to carry out an integrated process of cognition (Burg & Lüttringhaus 2005, Maréchal et al 2009, Gollin 2016).

The use of arts-based learning processes is also at the interface with educational media, as artistic media function as educational media (Garoian 2001, Pawek 2007). Educational media are important for guiding educational processes (Bosse 2012, Oelkers 2010). Through the appropriation of media in the arts-based learning process, the

heterogeneous learning abilities of the group can be promoted and diversity can be positively connoted (Hickman & Porfilio 2012, Matthes et al. 2013).

With the support of these research findings and national **and international initiatives** that introduce young students in a STEAM-way to scientific-issues NEXT STEP takes advantage of a rich body of practice led initiatives. For example:

a. **The Global Science Opera – GSO, https://globalscienceopera.com/ (HVL, EA, SV, NUCLIO)**: GSO is the first globally produced opera initiative in history, and a global creative science education network. Using digital interaction, schools, universities and art and institutions from over 38 participating countries perform and live-stream Global Science Opera performances. The initiative is running for 6 years, attracting interest of thousands of students around the world, scientists, artists, local and national authorities. GSO involves school students and teachers from different cultural and socio-economic backgrounds.

b. **Learning Science Through Theater – LSTT, www.lstt.eu (SV, EA)**, High school students stage plays and dramatize scientific concepts and knowledge from their curricula as well as from local interest issues (e.g., environmental, energy). Writing science stories (scripts), composing music, creating settings, costumes and choreography are some of the activities that students and teachers are involved. Students and teachers collaborate with scientists to understand scientific concepts/phenomena.

   LSTT brings together students and teachers with the local communities. Parents, local authorities and local institutions (Municipalities, Hospitals, Police, local industries) are involved.

c. **Sonification of Earthquakes: The Harmony of Earth (EA) - https://portal.opendiscoveryspace.eu/en/osos-project/schools-study-earthquakes-849268**: Introduces students to the world of earthquakes and its consequences (social, economic, physical and scientific):what earthquakes are, how they can be measured, quantified and then studied, through practical experimentation and real data. In NEXT STEP, a rich database of waveforms from more than 5,000 earthquakes will be used to create musical compositions (by transforming the waveforms to sounds) forming an integrated performance to be named **"The Harmony of Earth".** The concept demonstrates how the IDEAS' Square can be used as a studio of artistic expression based on real scientific data while at the same time a scaring physical phenomenon is presented in way that soothes people.

3. The NEXT STEP Approach

The NEXT STEP project will provide well-tested and yet tailor-made solutions in skills development and inclusion through creativity and the arts, proposing an effective operation of the "creative and innovative school". The creative and innovative school is anchored in the local community yet participates in, and is a leader of, a digital development together with other European schools which are currently dealing with the necessity of redesigning and redefining their educational practices at all levels in order to reach high quality learning despite the interference of the Corona virus.

The NEXT STEP vision for a creative and innovative school is the development of the creative and innovative classroom of tomorrow, the IDEAS' Square, in which education relies on an interdisciplinary, arts-based methodology within an entrepreneurship and design thinking framework.

NEXT STEP will provide opportunities to all involved target groups (students, teachers, school heads, researchers and artists) in acquiring and developing key competences necessary for the 21st century. More specifically, by following already tested pedagogical approaches (such as creative inquiry-based science education), NEXT STEP
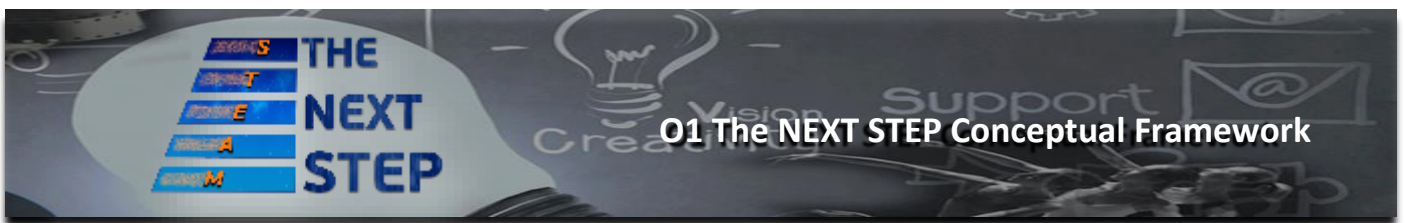
will engage participants in interdisciplinary arts-science activities, which foster critical thinking and creativity, cooperation and co-creation of knowledge in all STEAM fields, teamwork, communication skills and emotional intelligence as well as digital competences, that reinforce creativity and innovation in education. To achieve this, in NEXT STEP, the active and continuous cooperation of relevant stakeholders (schools, creative industry, local society and authorities, artists etc) plays a key role by developing active networks and encouraging continuous support and cooperation between the different actors.

NEXT STEP will involve and engage school students and teachers in the development of art-based activities on scientific notions drawn from the official school curricula. So, as the school students will be involved in activities where they will be invited to collaborate, lead and co-create their own projects (e.g., theatre performances), they will be utilising skills in storytelling, directing and acting, while investigating specific aspects of science subjects of their curricula. Based on science themes they will progress through all the needed steps of developing a project while the consortium will constantly support them with all relevant scheduled activities and tools. Through this approach the participants will learn to collaborate, lead and manage in order to develop e.g., a full-scale production. During this process they will need to be innovative, exchange new ideas and to develop cross sectoral skills such as entrepreneurship skills, teamwork, communication skills, while at the same time becoming more motivated and familiar with concepts of science.

NEXT STEP places a strong focus on teachers' support during the implementation of the project, thus enhancing their professional development. Two professional development courses (Summer Schools - one virtual and one physical) will be organised and will be the starting point for equipping the teachers with the competences they need to act successfully as NEXT STEP ambassadors in their various contexts. Also, continuous support is foreseen via national workshops (virtual and physical) and online communities by the consortium's experts, in order to support teachers in dealing with diversity in the classroom and in adopting collaborative, innovative and interdisciplinary science-arts practices. Collaborative professional development is expected to have a positive impact on teachers' skillset and confidence of teaching and learning innovative strategies, their ability to match these to their students' needs, their self-esteem and their commitment to continuous learning and development.

By utilising cutting-edge technologies (e.g., Virtual Reality), NEXT STEP will establish deep, immersive meeting points between schools in the consortium countries (and beyond) thus enabling participating pupils and their educators to creatively interact with their peers within the scope of a creative and innovative classroom, the IDEAS' Square. Such long-term innovations are required in order to a) provide pupils with the global context in which the pandemic is transforming societies and b) provide pupils with the larger social environment which they will lack in years to come as a result of the pandemic's nature. Furthermore, by relying on consortium members which are leading organizations in the creative/cultural industries, high-level artistic and cultural input will be secured in direct contact with participation educators and pupils and thus enlarging the outreach of the cultural sector.

4. Essential Features of the STEAM IDEAS' Square

STEAM IDEAS' Square is an **innovative learning environment which will be the nucleus of the school's creative and innovative activities. Must have two substances: digital and physical. In its premises and via its digital tools in-school interaction between STEM and other disciplines educators and among all the relative stakeholders (students, teachers, parents, artists, scientists, local community, industrial stakeholders, and policy makers) will be established with purpose to run complex and exciting real-life educational world projects.**

By connecting curious minds and specialists and lead them to think "out of the box" will help to speed up the flow of ideas to **transform the school and its classrooms to** a unique creative space for educational innovation and STEAM education.

Through collaboration and the appropriate pedagogies will be established prototyping, pedagogical innovation, creativity (along with distance learning opportunities) and well-being at school.

In addition, the capacity to work with external organizations so as to explore how such partnerships and networks can be built through a long-term strategy-based on trust and common objectives they contribute to key competence development.

The development of key competences is further facilitated by the provision of context from other disciplines and can:

a. offer opportunities for deeper learning of STEAM,

b. improve the innovation and creative capacities of learners,

c. support the new role of teacher as a coach of the learning process,

d. facilitate the effective cooperation with external stakeholders and

e. inspire policy makers, school heads and school staff to imagine the schools of tomorrow.

All the above in total in the context of a functional NEXT STEP STEAM IDEAS' square will drive to overcome the organizational and technical barriers and to integration of creative and innovative culture in every day school practices and to aggregate and create projects and activities customized to the specific needs of schools.

Deeper Learning Competences, as **defined in the Recommendation of the European Parliament and of the Council of 18 December 2006 on Key Competences for Lifelong Learning (2006/962/EC)** as described by the Hewlett Foundation model (Pellegrino & Hilton, 2013) can be adopted in order to define the exact indicators needed to measure the efficiency of the project's objectives. A selection of certain deeper learning competences that correspond to a range of ages wider than the high school students (which is the main target group of the deeper-learning competences model) can be classified in the following three groups (Frans & Andreotti, 2018):

Group A: Cognitive competencies
(1) Mastering rigorous academic content - A1
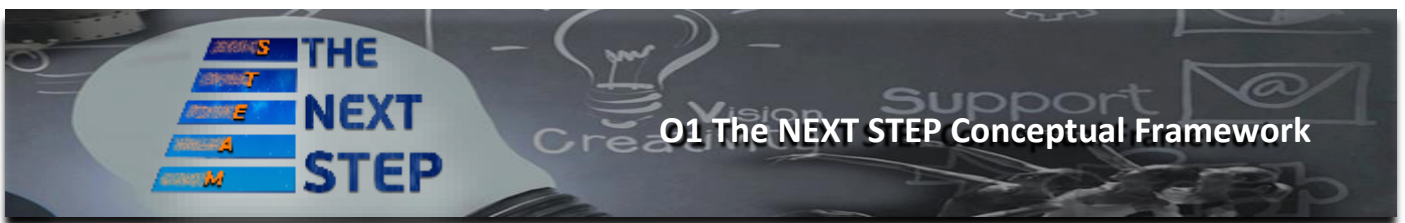(2) Thinking critically - A2
Group B: Interpersonal competencies
(3) Working collaboratively - B3
(4) Communicating effectively - B4
Group C: Intrapersonal competencies
(5) Learning to learn (C5)
(6) Developing academic mindsets - C6

As defined in the Recommendation of the European Parliament and of the Council of 18 December 2006 on Key Competences for Lifelong Learning (2006/962/EC):

F1) Literacy competence (GA1)

F2) Multilingual competence

F3) F3M.Mathematical competence and F3S. competence in science, F3T. technology and F3E.engineering, F3MS, F3ST, (STEM=F3)

F4) Digital competence - F4

F5) F5P.Personal, F5S.social and F5L.learning to learn competence (C5)

F6) Civic competence

F7) Entrepreneurship competence

F8) F8C. Cultural awareness and F8E.expression competence

We use the Competences as Features taxonomy from the European Parliament and the Council's recommendation in our project approach.

5. NEXT STEP Competence-based Framework

5.1 The school's journey to STEAM

STEAM teaching requires extensive skills in interdisciplinarity. In that perspective, collaborative teaching between teachers should be the common ground that they share with their students. Our project takes the "next-step" towards collaborative teaching enabling teachers to give guidance to their students who can follow the same example by forming inter-disciplinary teams.

Teaching strategies that deliver 21st century skills in school education should encourage students:

> • to discover things that are relevant between different disciplines,
>
> • to develop thinking skills and encourage learning transfer,
>
> • on how to learn and address misunderstandings directly,
>
> • to use technology to support learning,
>
> • to foster creativity and treat teamwork as an outcome.

The NEXT STEP project, in order to achieve the above, is following the STEAM IDEAS' Square approach as described in Section 4.

NEXT STEP methodological approach exceeds the state of the art regarding existing creative approaches and STEAM initiatives. The core lies in the STEAM IDEAS' Square, where pupils co-create with pupils in other schools, in other countries, as well as with other stakeholders (artists, industry, local community) at the interaction point of the following two axes (that were also explained in Section 2):

1. *Science and Art (STEAM).*
2. *The innovative and creative school's interaction with its community through real-life projects in the classroom.*

To reap the full potential of the 2 above-mentioned axes, **NEXT STEP** will rely on **Design Thinking methodology** to bring innovative and entrepreneurial aspects to science and art. Will combine the design thinking methods in order to integrate into the formal, informal and non-formal settings the aspects of "ideas become reality". **Design Thinking is a methodology that provides a solution-based approach to solving problems.** It is useful in tackling complex problems by understanding the human needs involved, by re-framing the problem in human-centric ways, by generating ideas in brainstorming sessions, and by adopting a hands-on approach to prototyping and testing. **NEXT STEP** activities will thus aim to conclude with specific results which will be introduced to local communities and provide solutions or overcome barriers. For the purposed of the NEXT STEP Project, we are going to use the specific Design Thinking Methodology adapted for educational purposes in the Open Schooling Model (Sotiriou, S. et. al. 2017) by following the 4 phases of Feel, Imagine, Create and Share. The main aim at this level will be for students to understand and create a new way of thinking in order to take advantage of science notions and develop future solutions. To this end, **NEXT STEP** is introducing the **STEAM IDEAS' Square**: a hub in each participating school which becomes the **heart** of the school as it invites interaction between STEM and other

disciplines: students, teachers, artists, scientists, industrial stake-holders and policy-makers meet here to negotiate the complex and exciting real-life educational world which the **NEXT STEP** project navigates.
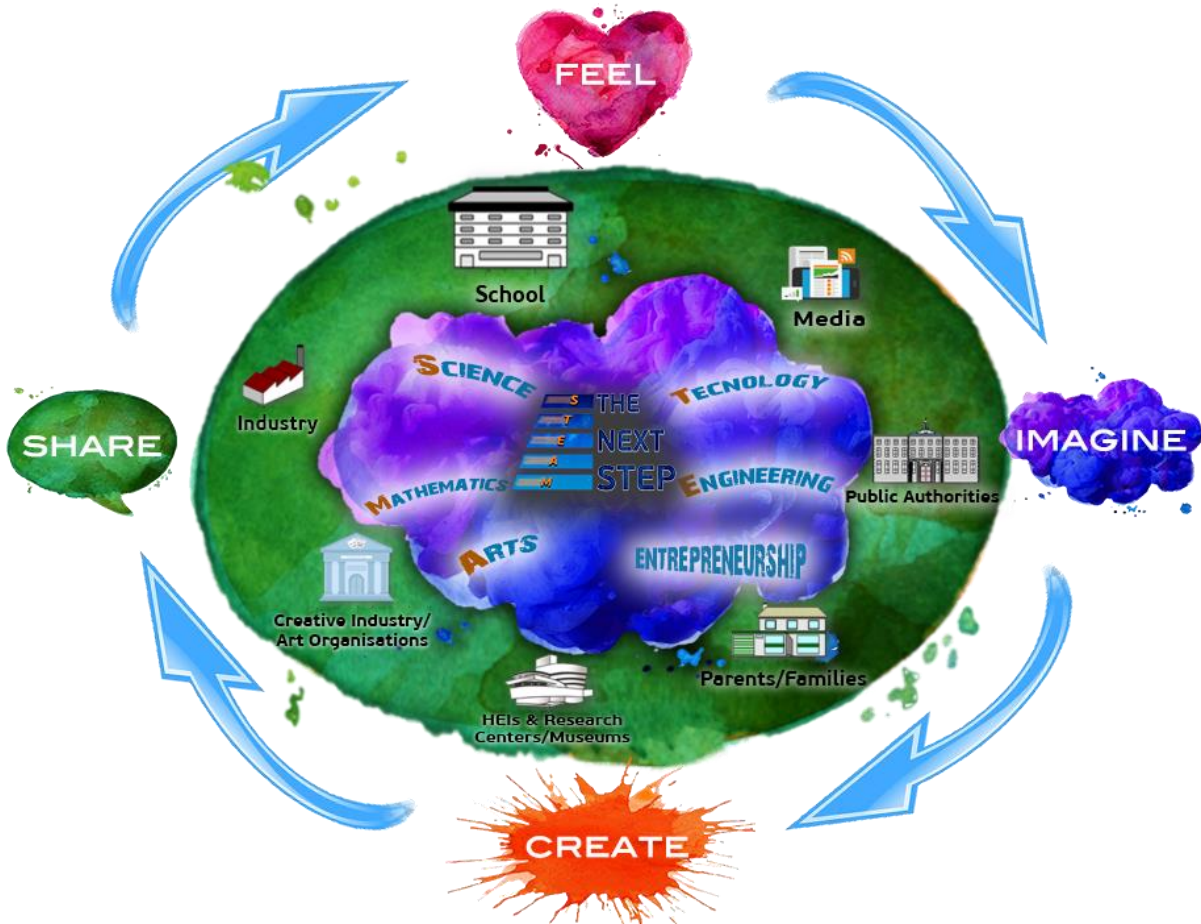
Figure 1: *NEXT STEP's STEAM IDEAS' Square will be a place, a facility, a meeting place. It's a place between science, art and the society to connect all the stakeholders and draw ideas that will be realised with a common purpose, the well-being of the local/national/international community. It will FEEL societal needs, will explore and IMAGINE novel solutions for the future so to CREATE these within the school and SHARE it with the community. It's a facility designed to generate new ideas in an open and collaborative environment, to promote experimental innovation and rapid prototyping for art/science-related projects*

The main steps that the school will need to take following the proposed NEXT STEP's Journey to STEAM education will be the following:

1. The school unit will need to identify the STEAM Status at the specific period (Using the NEXT STEP Self-Reflection Tool)
2. According to the status will have to follow the proposed strategies (see section 6)
3. The School Unit should develop a plan in order to achieve the strategy that needs to be followed

4. The School Until should develop or follow scenarios / activities in order to achieve and improve its status and follow the specific strategy
5. After a period of at least 6 months (recommended to be a full school year) the school until will have to measure its status again in order to identify the improvement (Using the NEXT STEP Self-Reflection Tool)

The steps above are illustrated in Figure 2
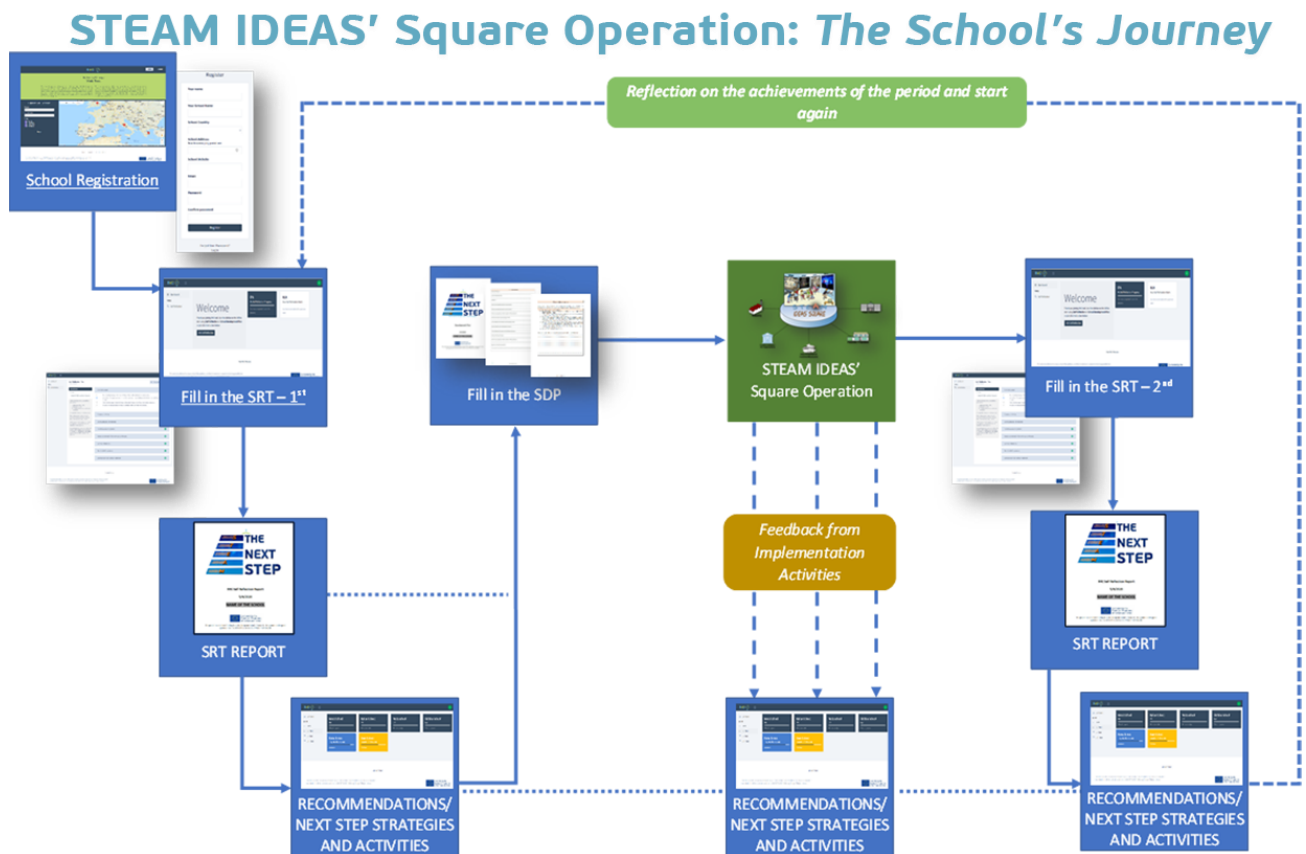
Figure 2: *The STEAM IDEAS' Square Operation*

5.2 The NEXT STEP Scenarios of Use (STEAM Activities)

NEXT STEP will develop several scenarios of use (see Output 2 and also on the NEXT STEP's website: https://www.the-next-step.eu/next-step-scenarios-of-use/. These will include proposed activities for schools in both primary and secondary education. These scenarios will be ready for use in the classroom. Though, teachers can adapt them into their settings or even could use part of the activities described. Also, it is a suggestion from the NEXT STEP Team to use the provided template and develop their own scenarios.

These scenarios are according to the STATUS of the school (School Typology). In order to identify the STATUS, the project created a self-reflection tool, the NEXT STEP Self-Reflection Tool (SRT) here: https://srt.the-next-step.eu/. Using this tool, the school management will be able to measure the status of the school according to the STEAM activities that are followed at the specific time.

5.3 Identifying the STEAM related Status of the school

The School Typologies are identified by filling in the NEXT STEP SRT according to approaches that the school is following at the specific moment in 3 levels:

Management: The aim of the instrument is to assess the vision, the leadership of the school community key stakeholders towards the adoption of a changing culture towards STEAM approaches, and the overall innovation potential of the school community (George and Desmidt, 2018) and to highlight the appearance (or not) of the key factors that can catalyse the cultural changes (e.g., coherence of local or national policies, development of a shared vision and understanding, development of motivation mechanisms and specific plans for staff competencies, school autonomy). This section of the instrument includes a step-by-step approach for the school heads to define a root of development and to locate the current position of their school in the STEAM approach journey towards the overall operation of the STEAM IDEAS Square.

Process: The aim of this section is to identify which process is already in place in the school community and which must be further developed. The instrument is sensitive in highlighting the processes and the mechanisms such as a) the operation of collaborative environments and tools (for content co-creation and sharing), b) how many members of the school community are using them regularly, c) adjustments with the curriculum that allow for the implementation of STEAM activities, d) parents and external stakeholders' involvement in the STEAM activities, and e) procedures in place that are offering opportunities to reflect and debate, communication and feedback mechanisms.

Professional Development: The aim of this section of the instrument is to assess to what extent teachers and school staff engaged in the STEAM approach (the STEAM IDEAS Square) have a holistic view of science, scientific research, and major scientific developments (Harris and Tassell, 2005; Sotiriou et al., 2016) as well as arts involvement and elaboration in the whole process. This section includes reflections on the integration of RRI principles into school curricula and teaching practices (van Atteveldt et al., 2019). These reflections and evaluation of curricula and practices are supposed to reveal changes in awareness/knowledge aspects/behaviour in relation to the RRI principles—such as gender, ethics, open access, open science, public engagement, governance, socio-economic development and sustainability, social issues related to scientific developments. Supporting teacher leadership may play an essential role to empower reaching this target (Muijs and Harris, 2003).

For each one of the above-mentioned levels, the tool reflects upon 8 task-specific statements (24 statements in total, see Table 1).

In our methodology and while we were developing the Self-Reflection Tool, we choose to use a form of a task-specific rubric (the full rubric is in the ANNEX). Task-specific statements function as "scoring directions" for the person who is grading the work. Because they detail the elements to look for in a participant's answer to a particular task, scoring participants' responses (in our case schools) with task-specific statements is lower-inference work than scoring participants' responses with general rubrics. For this reason, it is faster to train ratters to reach acceptable levels of scoring reliability using task-specific rubrics for large-scale assessment. Similarly, it is easier for school heads to apply task-specific rubrics consistently with a minimum of practice (Brookhart 2013). Rubrics has been tested for their validity as an assessment tool (self-assessment as well) for peer groups of participants (Hafner & Hafner, 2003).

Table 1: The 8 items in each one of the 3 levels of change, 24 task-specific statements in total.

	Management Level	Process Level	Teacher's Professional Development Level
1	Vision and Strategy	School Leaders and Teachers Shaping Learning Systems	Teacher Awareness and Participation
2	Coherence of Policies	Creating an inclusive environment	Setting Expectations
3	Shared Vision and Understanding	Collaborative environments and tools (co-creation, sharing)	Professional Culture
4	Education as a Learning System	Implementing STEAM Projects	Professional Competences, Capacity Building and Autonomy
5	Responsible Research, Reflective Practice and Inquiry	Parents and external stakeholders' involvement in school's STEAM activities/projects	Leadership related Competence
6	Motivation Mechanisms	Reflect, Monitor, Debate	Collaborative learning (mobility actions)
7	Plans for Staff Competences	Learning Processes adaptation	Collaborative learning (ICT Competences-STEAM related)
8	Communication and Feedback Mechanism	Established collaboration with local, national institutions, STEM or STEAM centers	Use and reuse of resources

For each statement in each level the school head or the school representative can choose one statement that corresponds to the actual situation of the school at the specific time. Each statement corresponds to a school typology, according to the school's readiness to adapt an innovation culture. The four school typologies that are presented in Table 2. Schools, according to their statements, will be characterized according to their STEAM status to four categories: Starter, Enabled, Advanced or Master.

**Table 2:** The four school typologies according to the STEAM characteristics

STARTER	ENABLED	ADVANCED	MASTER
Schools that are planning to incorporate STEAM educational in their classrooms.	Schools that have implemented at least one STEAM education activity by means of collaboration between teachers of various STEAM disciplines.	Schools that have achieved a high degree of STEAM education, by actively promoting collaboration between teachers of various STEAM disciplines in e.g., a project-based learning approach. ICT tools are integrated in their practices.	Schools that have STEAM learning as a common practice among their teachers and can provide best practice examples as well as recommendations on how to implement relevant activities. These schools can act as agents of STEAM Education. The school

		Cooperation with community stakeholders and other external partners on specific STEAM activities/projects has been established	has established systematic collaboration with community stakeholders and other external partners on specific STEAM activities/projects.

After the completion of each one of the required sections of the self-reflection tool, the school representative gets a report that includes the answers in each one of the sections as well as the results of the reflection process. The status of the school could be Starter (25% as the minimum of the selected scales – starting point for a school unit), Enabled (scores between 26-50%), Advanced (scores 51-75%) or Master (scores 76-100%).

Below there are some figures of the NEXT STEP Self-Reflection Tool. The NEXT STEP SRT is available through the project's website here: https://www.the-next-step.eu/self-reflection/. For the school units there was also a short guide developed in order to support them filling in the tool (https://srt.the-next-step.eu/files/NEXT_STEP_Short_Webtool_Instructions_v1_4_10_2022_EN.pdf).
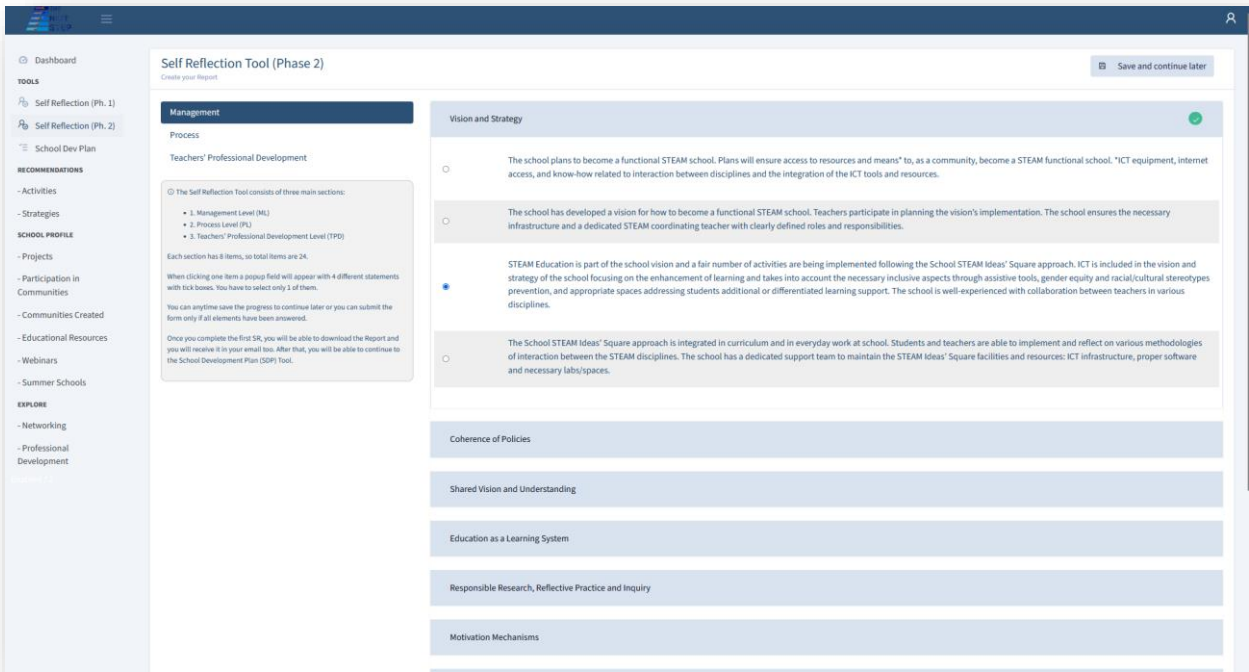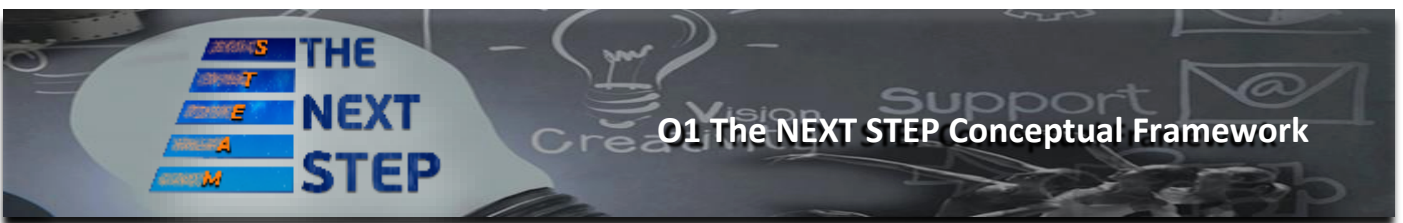
6. NEXT STEP Strategies

According to status the school unit will be able to identify through the NEXT STEP Self Reflection tool, will need to follow a specific strategy to be able to improve and or keep the same status in case will achieve the Master.

NEXT STEP has identify the strategies according to each one of the Statuses (typologies) that were presented in section 5.3.

6.1 STEAM for beginners: from initial procedures to holistic action plans

Schools that are at an initial stage in relation to STEAM activities, are offered needs-analysis tools that aim to identify areas that are in need for immediate action and modernisation, such as CPD, use of ICT, creation of educational content, participation in communities of peers and others. Schools should be supported by National Coordinators to develop an initial School Development Plan. The next step is the organisation of a core group of teachers who will act as Change Agents: These are innovative teachers who will share the vision of the school community to take the school to the next level.
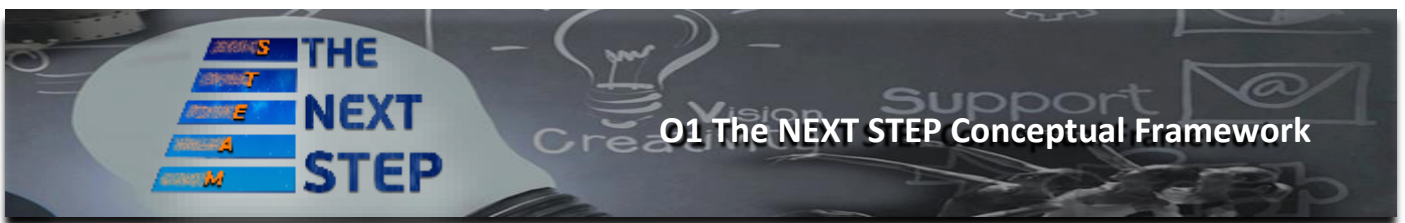
> **What is the mission of a change agent?**
> - **A pioneering teacher who leads the team of the participating teachers from each school, and:**
> - Takes initiative in order to implement innovative STEAM practices that aim to have **long-term effect** on the development of the **school as a whole**.
> - Develops a **strategy** for involving and disseminating the results of innovative STEAM practices to the **whole school community**
> - Develops a strategy for **dealing with resistance to change**
> - **Reflects** on the progress of organizational changes
> - **Explains why STEAM is important to ensure long-term success**

Also, at this level, initial STEAM scenarios are being implemented to pioneer future-oriented practices and to experiment with scientific data and resources, as well as with innovative STEAM and practices. At this phase, the NEXT STEP project offers a database of creative initiatives with access to numerous resources, guidelines and support (also online through webinars and hangouts) as well as examples for the coordination of action plans offering funding opportunities for the realization of the school action plans focusing on teachers' professional development and the adoption of a School Development Plan for the participating schools. Tools that will be offered to schools at the stimulation phase will include Teachers' Guidelines, a School Leaders Tool Kit and Community Building Tools. The NEXT STEP strategy at this phase is to stimulate the teaching and learning processes with basic innovative STEAM initiatives, and the different trials to explore methods, such as Project Based Learning (PBL) through the STEAM IDEAS' Square Approach (using the Feel, Imagine, Create and Share steps). Teachers need time to re-visit their own perspectives and experiment in their own classrooms. At this level, it is expected that STEAM IDEAS' Square Approach is becoming a powerful and versatile pedagogical approach that will eventually lead to the birth of student-led innovative STEAM projects. Community building tools are key elements at this stage. They support relationships and alliances within schools and between schools and local players, help localization of the success experiences (best practices turned into local projects), and understanding of how structures, hierarchies and learning cultures will adopt the change. Here, teachers and students adopt well-designed educational practices and foster their use and spread (over to other colleagues initially), in order to facilitate the incubation of educational innovations and communities of practice. The teacher has to reflect on the organizational change and learning cycles for implementation. Finally, the teacher should contribute back to his/her community, resulting in new collaboration and networking. Novel learning practices and educational experiences must foster to search, reflect upon, and create things that can be eventually delivered out of the educational environment, exchanged and assessed with and by others in the school. The outcome of previous educational experiences (projects, ideas, etc.) can incubate future ones that are derived from the originals.

A school's current needs in relation to STEAM will be assessed by looking into certain relevant strengths and weaknesses. The proliferation of online communication and, therefore, of online communities has offered a number of further advantages to peer learning and teacher professional development. These include the tackling of time limitations in traditional training, the offering of both synchronous and asynchronous engagement and the equal participation of all community members (again, as opposed to traditional instructive training) that increases the democratic character of this particular context. Above all, online communities offer access to both the latest educational technology (such as web 2.0 tools), as well as to useful insights on how to best implement them through best practices that peers are willing to share with their colleagues. NEXT STEP and specifically the STEAM IDEAS' Square Approach facilitates the building of various forms online communities (school, thematic, international, etc.) to support teachers to create, use and share digital resources relating to STEAM student

projects with an emphasis on social responsibility Communities that focus on particular RRI principles and how to incorporate them into the school culture both at the initial phases of Stimulation and Incubation, as well as at more advanced levels are of great importance and will serve the NEXT STEP STEAM strategy of the school.

6.2 Introducing STEAM to competent schools: from essential change to acceleration

These schools have strong capacity to innovate, they are implementing local STEAM projects and activities but they are operating in isolation and usually they are missing numerous opportunities to integrate external resources to their plans and programmes. Communities of teachers are operating at local level while the content and the material produced are not shared with external communities.

The implementation of a School Development Plan is valid here. It could be a helpful tool for the school management who has to be committed to change to initiate a series of activities that will help the educational staff to realize the added value of the process towards STEAM Education. The introduction of the NEXT STEP Activities and proposed tools (authoring environments, training academies, tool-kits for leaders, teachers and parents, collaborative environments) could help schools to develop to incubators of STEAM.

Attention should be given to exploiting knowledge management techniques (sharing what is known within the participating school communities) and synthesizing evaluation and accelerating diffusion within national agencies (to reach more users). Insights from the use of data from the school communities, the development of the teachers' competence profiles, the content that was created and delivered locally, the interaction of the communities and their members will create a unique data base for future recommendations and for the identification of best practices.

NEXT STEP proposes initial scenarios for the introduction of the STEAM IDEAS' Square approach in the participating schools while schools should be encouraged to create networks. Training on the preparation of etwinning projects or KA1, KA2 Erasmus+ mobility and school-based projects applications could be a nice process to introduce schools in the international cooperation field while at the same time significant resources could be allocated to the PD programme of the school.

The STEAM IDEAS' Square environment and the proposed activities to introduce this approach will help schools to develop their ideas to new localised projects that could provide new solutions for the school and its community, for bringing the gap between formal and informal learning settings and creating new opportunities for personalisation at different levels (student, teacher, school). The National Coordinators will support the design and development of the new localised scenarios and will provide a framework for the implementation of large-scale projects (beyond the school) and activities in the participating schools.

6.3 Reinventing schools: forward looking scenarios and future classrooms

The aim of NEXT STEP for proposing strategies for schools that have already achieved a high level of STEAM in their operation is twofold. The first one is that we are considering sustainability as a route to the future. The NEXT STEP's STEAM IDEAS' Square Approach put emphasis on creating viable change to school settings that lasts and expands. The approach aims to create strong school networks which are ready to share their experiences with others. The second reason is that education systems simply must evolve. Three words sum up the change that has to happen: experimentation, independence, and sharing. Schools must then be given the freedom to test, assess the experiments, abandon those which fail or are too costly, learn lessons, and disseminate and reproduce the

successful ones on a larger scale. The schools that have manage to achieve the high levels of STEAM integration have to act as drivers of this change. And they will need significant support to play this crucial role.
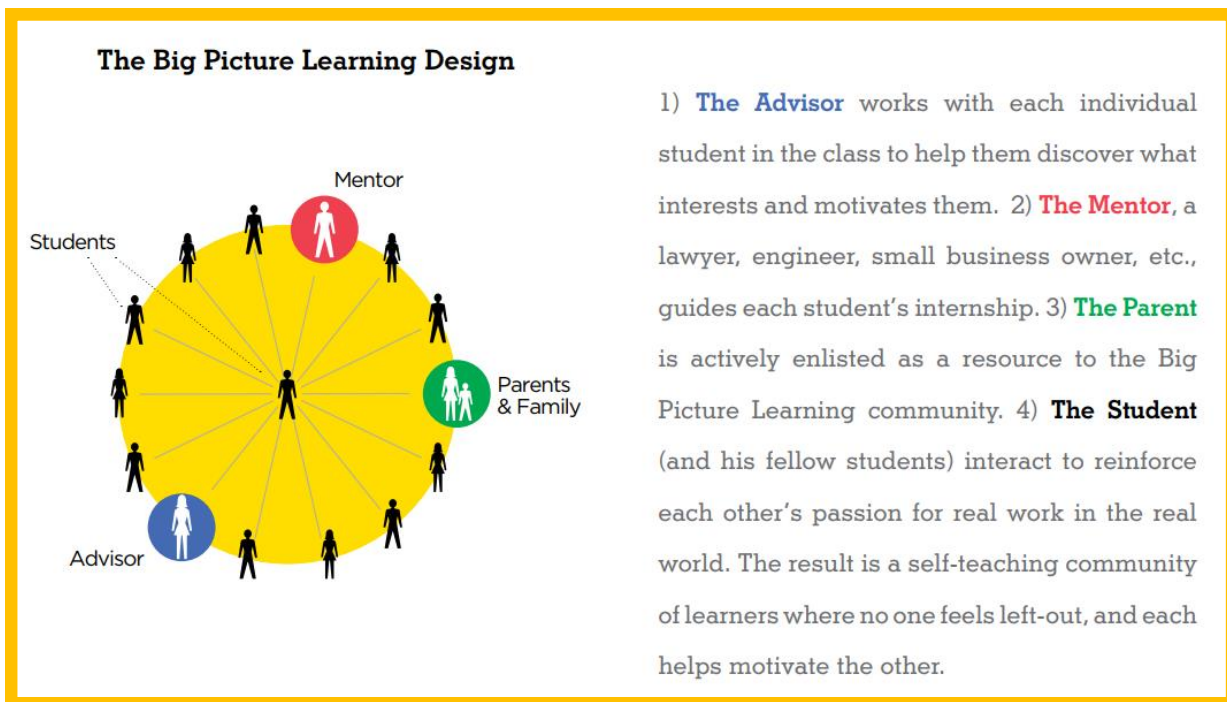
The NEXT STEP approach (along with the support mechanism which will be in place) will facilitate the development of school networks with these schools as core nodes and reference points. Sustainability in this context does not simply mean whether the proposed approaches will last. It addresses how particular initiatives can be developed without compromising the development of others in the surrounding environment now and in the future. Sustainability is about changing and developing the social environment. The NEXT STEP approach is not about the proliferation and the development of single schools; it is about creating new environments across the system through tri-level development, at school level, at the community level and at national level. Learning from each other concept is a very crucial point in moving this ambitious agenda forward. We know this but need to address it explicitly with respect to tri-level reform. School cultures improve when teachers within the school learn from each other on an ongoing basis.

Table 3: *The guiding principles of a conventional school versus a school innovation environment.*

Standardisation Strict standards for schools, teachers and students to guarantee the quality of outcomes.	**Flexibility and diversity** School-based curriculum development, steering by information and support.
Emphasis on literacy and numeracy Basic skills in reading, writing, mathematics and science as prime targets of education reform.	**Emphasis on broad knowledge** Equal value to all aspects of individual growth and learning: personality, morality, creativity, knowledge and skills.
Consequential accountability Evaluation by inspection.	**Trust through professionalism** A culture of trust on teachers' and headmasters' professionalism in judging what is best for students and in reporting of progress

STEAM oriented schools are moving towards outcome-based education. Flexibility and diversity are the main guiding principles here. The school curricula are adopted to the local needs while the student-led projects are the norm. While the common feature in global education policy has been emphasis on scientific literacy and numeracy with strong emphasis on structural knowledge of systems, technical skills, and cognition in the open school environment all school subjects are emphasized, giving equal value to all aspects of an individual's personal development, whether they be moral, creativity, knowledge or skills based. The current trend in the educational systems in Europe has been consequential accountability systems for schools. Success or failure of schools and their teachers is often determined by standardized tests and external evaluations that only devote attention to limited aspects of schooling, such as student achievement in science, mathematical and reading literacy. In a STEAM school a different direction is chosen: trust through professionalism. A culture of trust within the education system values teachers' and headmasters' professionalism in judging what is best for students and in reporting on progress of their learning.

The Big Picture Learning Design

1) **The Advisor** works with each individual student in the class to help them discover what interests and motivates them. 2) **The Mentor**, a lawyer, engineer, small business owner, etc., guides each student's internship. 3) **The Parent** is actively enlisted as a resource to the Big Picture Learning community. 4) **The Student** (and his fellow students) interact to reinforce each other's passion for real work in the real world. The result is a self-teaching community of learners where no one feels left-out, and each helps motivate the other.

Figure 3: *The three basic principles of the Big Picture Learning Design: 1) Learning must be based on each student's interests and needs. 2) Curriculum must be relevant to the student and allow them to do real work in the real world. 3) Students' growth and abilities must be measured by the quality of their work and how it changes them.*

A very interesting initiative that is being implemented the last two decades in US is the Big Picture Learning initiative (http://www.bigpicture.org/). Big Picture Learning has worked to put students at the center of their own learning. Today, hundreds of Big Picture Learning network schools in the US and around the world work together and in their communities to reinvent and reshape education. Each student at a Big Picture Learning school is part of a small learning community of 15 students called an advisory. Each advisory is supported and led by an advisor, a teacher that works closely with the group of students and forms personalized relationships with each advisee. Each student works closely with his or her advisor to identify interests and personalize learning. The student as the center of learning truly engages and challenges the student and makes learning authentic and relevant. Each student has an internship where he or she works closely with a mentor, learning in a real-world setting. Parents and families are actively involved in the learning process, helping to shape the student's learning plan and are enrolled as resources to the school community. The result is a student-centered learning design, where students are actively invested in their learning and are challenged to pursue their interests by a supportive community of educators, professionals, and family members.

NEXT STEP has also a plan to support further such schools' environment in this re-schooling process. Our strategy offers a support mechanism with two main axes, a) to define and deliver a holistic framework to support schools' STEAM profiling and development towards the re-schooling process and b) to involve schools' communities in a pedagogical Plug and Play approach by introducing innovative approaches in the STEAM curricula organization, by focusing on Big Ideas.

6.4 From innovative schools to STEAM-enriched learning ecosystems

In this category schools have well established innovation and STEAM plans; they have already introduced a culture of sharing while they have well established cooperation with other schools and with external stakeholders. The NEXT STEP strategy for these schools is to emphasise on the integration of the STEAM and School Innovation culture in the school setting. The role of research and innovation (R&I) involves every key stakeholder (including policy-makers, researchers, industry and commerce, science educators, and civil society organizations as well as the public at large). NEXT STEP strategy development here foresees a series of tools that guide the introduction of STEAM in different educational organizations both in formal and informal learning sector. It will offer a handbook for school teachers (along with a series or self-reflection tools) with the main aim of accommodating STEAM practices in schools. The way from innovative school to STEAM learning common can be done through a number of pedagogical methods such as inquiry-based learning, structured research school projects or through reflections on ethical, legal and social aspects (ELSA) and basic socio-scientific issues (SSI) based on a range of inspiring resources for designing and implementing class activities.

The NEXT STEP provides recommendations to school leaders for strategic holistic school improvement. More specifically, the recommendations are:

- Specific STEAM principles to be incorporated into the School Development Plan and recommendations regarding particular accelerators that are relevant to local social issues. In this context, the accelerators will align local challenges facing the community that hosts the school with particular science education scenarios and the ability of the school and its community (teachers, students, etc.) to take up such tasks. Recommendations on the development of effective cooperation with organizations like universities and research centres, informal learning centres (e.g., museums and science centres), enterprises, industries and the local communities.
- Potential partner schools with similar (or complementary) profiles so as to support collaborations and mutual improvement. Such activities are heavily supported in the European context within a range of initiatives, including ERASMUS+ staff mobility (e.g., teaching staff shadow teaching), eTwinning (e.g., joint teaching projects) and ERASMUS+ strategic partnerships (e.g., teaching staff formal training activities).
- Professional development courses to meet the specific competence needs of the teaching staff. This recommendation type will match the competence profiles of teaching staff and the descriptions of professional development courses in terms of competences they cultivate so as to identify targeted training opportunities.
- Improvement of the use of ICT in the teaching practice (i.e., educational designs) employed in the school. This recommendation type could analyze the educational designs used in the school in terms of the level/type of ICT exploited and generate potential recommendations for enhancing this level in case of low ICT use. Additionally, these recommendations should also take into account the teaching staff ICT competence profiles, so as to provide personalized suggestions that the teaching staff will be competent to employ Recommendations of educational designs. This recommendation type could suggest educational designs employed in one school to the teaching staff of another school, based on the similarity of school innovation profile. In that way, teaching staff will be able to select educational designs which have been successfully employed in schools with similar innovation profile to their own (Sergis & Sampson, 2016). Furthermore, these recommendations should also take into account the teaching staff ICT competence profiles, so as to provide personalized suggestions that the teaching staff will be competent to employ.

The school leaders should be able to explicitly define which recommendations they actually implemented, so as to (a) provide a means to validate the recommender system's impact on school improvement and (b) provide a
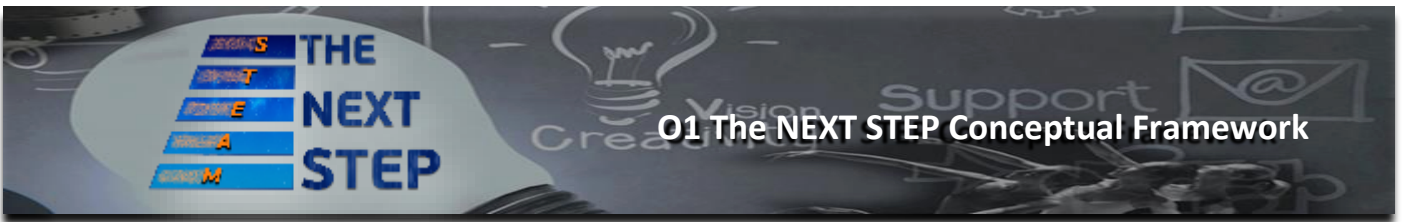
means to build open school pathway templates. These templates will be formulated based on the specific actions that schools implemented (supported by the provided recommendations) towards improvement and could be shared for streamlining the adoption from other schools with similar initial profiles. This kind of open innovation streamlining is highly required to replicate successful innovation development in a wider scale.

The activities to be adopted at this level will have all the qualities of complete scenarios guiding student-led projects. However, and since in these cases we are dealing with school that are innovative and generally open, the basic ingredient is a set of the most up-to-date STEAM guidelines supporting schools not only to study and incorporate local issues into their science teaching to attempt a long-lasting impact in their communities. In this context, Gender equality is not only a principle that must govern the schools' profile and/or science teaching for example (female role models in science), but must a fundamental element of increase collaborations with parents, local groups, business, etc. in which (the collaborations) the school plays a pivotal role in the offering solutions and tools to stakeholders to improve their own uptake of such a principle. In other words, these schools with these types of accelerators will be in a position to enlighten, train, support through their own projects, local stakeholders in need of such change.

6.5 Supporting School to follow the NEXT STEP Strategies

In order to support the schools in this STEAM Oriented journey and follow the proposed strategies, within the NEXT STEP Self-Reflection tool, Science View has developed an automatic system according to which each school that fill in and submit its self-reflection and after getting its status, automatically is recommended with the appropriate strategy. So, the recommended strategies and activities are available to the school unit and what they have to follow is to fill in how they can achieve each recommendation and what activities they will follow during the next period in order to improve their status. A screenshot of the specific feature within the web tool is illustrated in Figure 4.

Figure 4: *The recommendation system of NEXT STEP and the fields where each school can include the specific plan for each recommended strategy.*

7. Conclusions

Europe stands before a unique potential to reinvent science learning by opening its schools to creative and innovative approaches which locate education at the heart of a learning continuum occurring in interaction with a wide spectrum of societal actors. We thus need to ensure relevant and meaningful engagement of all societal actors with science and increase the uptake of science studies and science-based careers, employability and competitiveness in light of a new world in which we learn to deal with the realities of a global pandemic. The Creative and Innovative school seems to be an effective vehicle for such a new participatory reengineering of schooling. Yet current actions towards the Creative and Innovative school still struggle with traditional organisational structures, out-of-date curricula and lack of a long-term vision. The NEXT STEP project is proposing a whole school approach to science learning. Building on previous successful European open schooling and STE(Arts)M initiatives, the project will bring about the NEXT STEP in education by providing a roadmap for the transformation of school classrooms into open and creative learning spaces. NEXT STEP will look at different examples and research findings which show the need to rethink classrooms organisation in order to facilitate the Creative and Innovative school and wellbeing at school. In this framework the NEXT STEP project will design and set in operation the STEAM IDEAS' Square, an innovative learning environment which will be the nucleus of the school's activities. NEXT STEP will demonstrate how these environments a) can offer opportunities for deeper learning of STEAM, b) can improve the innovation and creative capacities of learners, c) can support the new role of teacher as a coach of the learning process, d) can facilitate effective cooperation with external stakeholders and e) can inspire policy-makers, school heads and school staff to imagine the schools of tomorrow.

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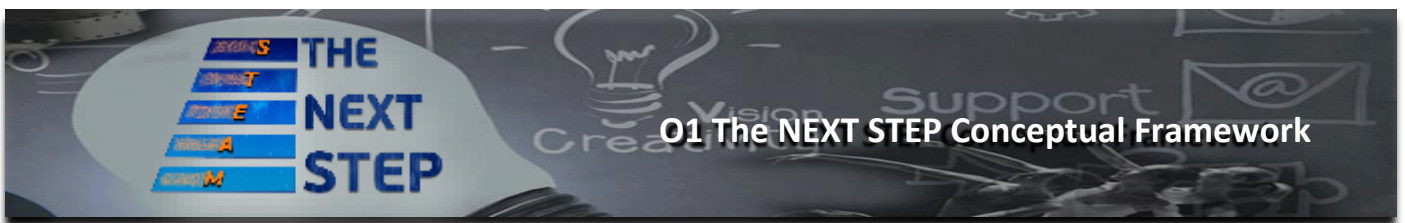
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9. ANNEXS

9.1 ANNEX I: The NEXT STEP Self-Reflection Tool Statements

		STARTER	ENABLED	ADVANCED	MASTER
MANAGEMENT LEVEL	**Vision and Strategy**	The school plans to become a functional STEAM school. Plans will ensure access to resources and means* to, as a community, become a STEAM functional school. *ICT equipment, internet access, and know-how related to interaction between disciplines and the integration of the ICT tools and resources.	The school has developed a vision for how to become a functional STEAM school. Teachers participate in planning the vision's implementation. The school ensures the necessary infrastructure and a dedicated STEAM coordinating teacher with clearly defined roles and responsibilities.	STEAM Education is part of the school vision and a fair number of activities are being implemented following the School STEAM Ideas' Square approach. ICT is included in the vision and strategy of the school focusing on the enhancement of learning and takes into account the necessary inclusive aspects through assistive tools, gender equity and racial/cultural stereotypes prevention, and appropriate spaces addressing students additional or differentiated learning support. The school is well-experienced with collaboration between teachers in various disciplines.	The School STEAM Ideas' Square approach is integrated in curriculum and in everyday work at school. Students and teachers are able to implement and reflect on various methodologies of interaction between the STEAM disciplines. The school has a dedicated support team to maintain the STEAM Ideas' Square facilities and resources: ICT infrastructure, proper software and necessary labs/spaces.
	Coherence of Policies	The school management plans to ensure that school policies are coherent with latest developments in STEAM education and national policies, as well as needs of students, teachers and the general community around the school. The school's policies address or will address integration of STEAM activities in their curricula.	The school considers comprehensive strategies to raise teaching quality inside the organisation, including school leadership, the attractiveness of careers at school and professional development. The school considers the integration of STEAM Education in a wide range of curricular areas.	The school critically reviews and aligns its policies with major changes to curricula, assessment, school organisation and funding, quality assurance etc., to ensure coherence in line with central policy objectives in school education. STEAM Education is integrated in the school policy and foresees the existence of assistive technology and appropriate resources to promote cross curricular learning opportunities across disciplinary boundaries.	The school involves policy makers and education organisations in an open and regular dialogue with the goal of increasing policy coherence and to benefit from stakeholders' experience and networks. There is a well-established policy for safety and acceptable use of the internet. Technology Enhanced Learning (TEL) opportunities are integrated in teachers' daily practices, to ensure equity and equal opportunities to all students. The school integrates recent practice-based research on the topic of STEAM in its curriculum and teaching approaches. .

		STARTER	ENABLED	ADVANCED	MASTER
	Shared Vision and Understanding	The school is planning to design, a common vision for STEAM schooling that is or will be shared among teachers.	The school uses a STEAM approach to gather and organize information from within and outside the school, that is shared by all relevant stakeholders (parents, authorities, etc).	Teachers and school leaders shape their school as a learning organisation. ICT is used to assess the impact of the school's development plan on students' learning. All students and teachers are aware of the benefits, challenges of collaboration across disciplinary boundaries.	When defining policies and priorities for Continuing Professional Development, the school considers balancing needs at system and school levels while also considering the needs of individual teachers and school leaders. ICT is used to enable a continuous self-evaluation of teachers' needs and to facilitate the design of the school priorities with the support and participation of all members of the school community at large, including the needs of the local community. All students and teachers are able to participate in the implementation of educational practices across disciplinary boundaries.
	Education as a Learning System	The school plans to support members of the community to increase interaction with the school. Head teachers support professional development aimed at STEAM implementation.	The school builds capacity for change management. Professional development is provided to support change management in the context of STEAM activities.	The school implements broad and inclusive consultation processes aimed at building trust and enhancing support for reforms among stakeholders, and to inform the policy-making level about implementation of STEAM activities.	The school has regional or local partnerships. These stimulate school development and support implementation of changes and reforms which enhance of STEAM activities.
	Responsible Research, Reflective Practice, Inquiry	The school plans to introduce principles of responsible research, reflective practice and inquiry.	The school supports teachers' acquiring research qualifications by encouraging research as part of professional development, through grants for research project grants or PhD qualifications.	The school supports reflective practice to develop learner-centred teaching and assessment strategies. It rewards and stimulates innovation , for instance through grants, awards and feedback to teachers.	The school creates partnerships with higher education institutions. These focus on research, and feedback loops between theory and practice (involving both teacher education providers and faculties of educational science). It implements training for peer-mentoring.
	Motivation Mechanisms	The school plans to set up a mechanism aimed at motivating teachers and students to undertake innovative STEAM projects.	The school has a mechanism to motivate teachers and students to undertake innovative STEAM projects.	The majority of teachers and students demonstrate motivation to undertake innovative STEAM projects.	The school's motivation mechanism is evaluated and updated regularly. STEAM projects are implemented regularly as a motivation mechanism.
	Plans for Staff Competences	The school plans to identify teachers' professional development needs, in particular in the adoption of innovative methodologies for STEAM learning.	The school has appointed a teacher or a team of teachers as responsible to identify and plan the whole school staff Professional Development needs. Technology Enhanced Learning is suggested as a means for developing knowledge on STEAM curriculum activities in theirs and other schools.	The school is realising or participating in Teachers' Professional Development programmes (related to ICT and STEAM activities).	The school regularly updates the plan for the Staff Professional Development programme according to a needs analysis mechanism. Teachers are invited to reflect on their professional development and actively participate in the materialization and review of the school's CPD plan.

		STARTER	ENABLED	ADVANCED	MASTER
PROCESS LEVEL	**Communication and Feedback Mechanism**	The school is working on a communication plan, including a mechanism for communicating its STEAM Ideas' Square approach and strategy to relevant stakeholders. The school is planning an online presence (Website, social media channels, etc) as a means to communicate with the local community.	The school communication plan takes various target audiences into consideration (staff, teachers, students, local communities) and has a team responsible for its design and follow-up. School Management communicates the vision and its STEAM Ideas' Square approach to the community.	The school communication plan specifies channels aimed at ensuring involvement of the whole school and local community, including other stakeholders (education authorities, local businesses, etc.). The STEAM Ideas' Square approach is shared with the community. There is an area of the school's website dedicated to these activities.	The school's communication plan defines all actions, channels and target audiences and is co-created with the local community. Continuous evaluation of the plans' impact is conducted, and the necessary adaptations integrated in the plan. A group of teachers is in charge of website updates and social media sharing of major developments and milestones achieved. Students are involved in the dissemination and communication plan of the school and run regular dissemination campaigns in support of the school's plan.
	School Leaders and Teachers Shaping Learning Systems	School leaders and teachers have their expertise recognized and are planning to contribute to the development of STEAM activities.	The school creates opportunities for school staff to diversify careers by taking on additional roles at school (coordinating or leadership roles; support to colleagues, including mentoring, professional development, involvement in school development, (international) project work, extracurricular activities, cooperation with external partners).	The school creates opportunities for school staff to become involved in developing the School Innovation approach (school evaluation; policy dialogue; policy development, etc.)	The school encourages and supports staff to engage in school-to-school networks to share expertise and teaching resources, spread innovation and support school development. Students are invited to collaborate with students from different schools (on a national and international level) and the school as whole is invited to participate in a series of activities and challenges. Micro accreditation mechanisms such as digital badges are a common practice in the school.
	Creating an inclusive environment	The school has identified, or will identify, the national or European guidelines concerning inclusiveness. The school's strategic plan takes those guidelines into consideration.	Teachers aim to implement inclusive activities that take into consideration aspects of communication, awareness, equal opportunities, and gender balance, awareness related to cultural and racial stereotypes..	All teachers are implementing inclusive activities that take into consideration communication, awareness, equal opportunities, awareness related to cultural and racial stereotypes and gender balance. As part of these actions several community problems have been targeted and identified (social, gender, cultural, religious, etc.).	The majority of teachers is implementing inclusive activities that take into consideration: communication, awareness, equal opportunities, awareness related to cultural and racial stereotypes and gender balance, and collaborate with schools at local or national level in the targeting of related community problems. Students help identify and propose solutions to such problems (social, gender, cultural, religious, etc.).
	Collaborative environments and tools (co-creation, sharing)	The school plans to set up the needed infrastructure to enable teachers and students to create a collaborative working environment in the terms of STEAM Ideas' Square aapproach.	Teachers and students are using collaborative environments for some classroom activities. Teachers co-create materials with their colleagues and with	Teachers and students regularly use collaborative environments in their classroom activities and are developing and sharing content. Teachers collaborate and work in an interdisciplinary way.	Teachers and students regularly use collaborative environments in their classroom activities and co-create content with other schools. Teachers promote

		STARTER	ENABLED	ADVANCED	MASTER
			the participation of students in a STEAM Ideas' Square environment.	Students use ICT within school hours to collaborate and acquire knowledge within their school environment, as well as with other schools. A cooperative approach for producing and sharing activities is in place using a STEAM Ideas' Square e-environment.	interdisciplinary activities, and inquiry-based learning opportunities. The community at large is welcome to participate in the collaborative projects and help in their creation and sharing process by using the STEAM Ideas' Square resources and environment.
	Implementing STEAM Projects	The school implements part of a STEAM activity or will implement one or more STEAM projects, in at least one classroom, targeting the involvement of the community.	The school implements more than one STEAM project in several classrooms, targeting the involvement of the community. The school disseminates information about their projects.	The majority of teachers participate and disseminate their participation in national and international STEAM projects, in particular those addressing the involvement of the community. There is collaboration among teachers of different disciplines, and they actively disseminate their projects as part of the school's communication plan. All projects are following the school inclusion strategy and make good use of Technology Enhanced Learning opportunities.	Teachers create new STEAM projects and coordinate the participation of several classrooms in them, including cross-grades participation. The projects are interdisciplinary and open to members of the school and local community. Teachers support dissemination of their projects as part of the co-created school's communication plan. All projects follow the school inclusion strategy and make good use of Technology Enhanced Learning opportunities.
	Parents and external stakeholders' involvement in school's STEAM activities/projects	Parents (guardians, family) and external stakeholders' engagement is, or will be, evidenced through STEAM projects that the school has initiated.	Parents (guardians, family) and external stakeholders' engagement is embedded in most of the school's activities and STEAM projects that the school has begun.	Parents (guardians, family) and external stakeholders' engagement is embedded in most of the school's activities and STEAM projects the school has begun and there is ongoing monitoring and evaluation of these projects.	The community (families, etc.) and external stakeholders actively participate in the school's STEAM activities. There is ongoing monitoring and evaluation of these projects. The school identifies infrastructures existing in the locality (maker spaces/places, science centres, industry, service providers, etc) and how they can support and collaborate in materialization of the school's vision and mission through STEAM Ideas' square model/approach.
	Reflect, Monitor, Debate	The school plans to conduct reflection, monitoring and debates as part of the school's activities (involving teachers and students) identified as critical to the implementation of the STEAM Ideas' Square approach.	The school performs regular analysis and evaluation of the data collected from the reflection, monitoring, and debates with teachers and students.. These actions reinforce and influence the STEAM ideas' Square approach.	The school produces regular reports on the findings of the reflection, monitoring and debates with teachers and students, including the assessment of students' progression and self-assessment. The reports are distributed to teachers, students, parents, school management and relevant improvements are made accordingly.	The school produces regular reports on the findings of the reflection, monitoring and debates with the whole school community as well as with external stakeholders. The reports are distributed to all stakeholders and relevant improvements are integrated in the school's development plan.

		STARTER	ENABLED	ADVANCED	MASTER
TEACHERS' PROFESSIONAL DEVELOPMENT	**Learning Processes adaptation**	0 to 25% of teachers show evidence of adapting the STEAM learning processes according to their previous experience.	26 to 50% of teachers adapt their learning processes according to established feedback mechanisms involving all stakeholders. Teachers use STEAM activities as a means to increase pupils' motivation and improve their competence profile.	51 to 75% of teachers adapt their learning processes according to established feedback mechanisms involving all stakeholders. Students can work online and their progress can be monitored. STEAM activities and relative tools are used and adapted depending on the needs of the students.	All teachers and students improve and adapt learning processes according to feedback from all stakeholders, regularly. Teachers use ICT to assess the evolution of the students using Learning Analytics, ePortfolio or other similar technologies. ICT solutions are available to all students with special needs and are used in a cross disciplinary format.
	Established collaboration with local, national institutions, STEM or STEAM centers	0 to 25% of teachers collaborate or will collaborate with local and/or national research/science institutions and STEAM centres makerspaces.	26 to 50% of teachers implement projects with the collaboration of local and/or national research/science institutions and STEAM centres and/or makerspaces and other businesses and industries in their region.	51 to 75% of teachers are implementing projects with the collaboration of local and/or national research/science institutions and STEAM centres and/or makerspaces and other businesses and industries in their region.	Collaboration with local and/or national research/science institutions and STEAM centres and/or makerspaces and other businesses and industries in their region, is embedded in all the school's activities. An ongoing monitoring and evaluation of interventions is established.
	Teacher Awareness and Participation	Teachers are or will be introduced and offered to engage in Professional Development opportunities related to STEAM education and the user of ICT to facilitate learning.	Several teachers have participated in Professional Development programmes (e.g., Summer Schools, Mobility actions) related to STEAM education and the use of ICT to facilitate learning.	All teachers are aware, and the majority of the teachers have participated (individually or as whole school) in Professional Development programmes related to STEAM education and the use of ICT to facilitate learning.	All teachers meet their professional needs through active participation in communities of practice, peer to peer networks and accredited practice-based research.
	Setting Expectations	The school sets, or will start setting, a framework of clear and tangible expectations for each member of the school community concerning STEAM activities and projects.	The school creates transparency on the competences required from teachers and other staff at different stages of their involvement through frameworks or standards concerning STEAM activities and projects.	The school involves teachers and other relevant stakeholders in its development and regularly reviews its strategy to ensure ample acceptance, relevance and usefulness concerning STEAM activities and projects.	The school ensures that expectations are set out in the school framework and that clear and tangible expectations for each member of the school community are aligned with national policy and curricula as well as with the schools' own curricula and goals concerning STEAM activities and projects.
	Professional Culture	The school will encourage and support collaboration among staff for STEAM teaching (e.g., team teaching, sharing of teaching resources) and staff learning. The school will work on a team building strategy to make use of STEAM teaching resources.	The school encourages cross-school networks and digital platforms to support a culture of collaboration between teachers. The school invests in a series of team building activities as part of their strategic plan. The activities are implemented in collaboration with other school's networks. The school already plans to establish a dedicated time schedule to promote interdisciplinary collaboration among the members of the teaching staff.	The school supports a culture of collaboration. The school strengthens recruitment and retention of qualified staff by focusing on school ethos or professional culture. Team building activities are integrated in the whole school vision and involves teachers, students and other staff members.	The school encourages links between schools and providers of teacher education. School supports systematic induction of new teachers,. Besides the integrated vision for team building activities, members of the school and local community and beyond, participate in the co-creation of the strategy.

		STARTER	ENABLED	ADVANCED	MASTER
	Professional Competences, Capacity Building and Autonomy	The school clarifies, or will create, the definition of CPD (Continuous Professional Development) for school staff, with a preference for a broad, open and inclusive concept that is operational at the same time (including formal, informal and non-formal forms of professional learning). Teachers are encouraged to include the use of STEAM based learning and ICT in their training.	The school considers making CPD an obligation/explicit duty, and allocating working time to it. Teachers are encouraged to integrate TEL in their training, including the curriculum opportunities for its use in classroom. Teachers are encouraged to plan the delivery of curriculum content by using the STEAM approach.	The school aligns priorities with real needs at different levels (teachers' individual learning needs, school level needs,) and review systems of priority setting if needed (at which level, by whom) It encourages professional development cultures at school: this may include reviewing decision-making on priorities and funding allocation; the use of CPD plans by schools/individual teachers; links to teacher appraisal. The use of digital tools and resources to facilitate the whole process is included across the training opportunities.	The school supports self-regulation of the profession (e.g., through a teaching council or consultation processes). School staff is invited to share their training and implementation experience in a collaborative way. The use of a variety of different software and Open Education Resources is incentivized.
	Leadership related Competence	The school creates, or will create transparency on the competences required from school leaders, for instance through competence frameworks or standards	The school ensures transparency and common understanding on the leadership competences of teachers (at different stages of their career)	The school reviews teacher education, including CPD available to ensure it addresses leadership competences	The school promotes forms of distributive leadership with broad involvement of staff at school
	Collaborative learning (mobility actions)	There is no, or limited, sharing of STEAM based innovative and collaborative learning among the teachers of the school.	Teachers in the school are sharing and collaborating in STEAM based innovative and collaborative learning among the teachers of the school.	Teachers regularly share their STEAM based innovative and collaborative learning among the teachers of the school as well as with other schools.	School supports and facilitates peer to peer learning in STEAM based innovative and collaborative learning among the teachers of the school through mobility actions and other formal approaches.
	Collaborative learning (ICT Competences-STEAM related)	Professional Development is, or will be, focused at least on basic collaborative ICT skills and the promotion of STEAM learning.	Some teachers participate in Professional Development Programmes aimed at introducing collaborative learning through digital platforms and STEAM ideas square practices.	The majority of teachers participate in Professional Development Programmes introducing collaborative learning through digital platforms and STEAM ideas square practices.	School identifies and designs its whole school Professional Development programme collaborative learning through digital platforms and STEAM ideas square practices.
	Use and reuse of resources	Teachers are, or will be offered the opportunity to engage in web communities and avail of online resources to support STEAM teaching practices.	Teachers in the school use online resources and share self-developed resources in order to enrich their STEAM practices.	Teachers regularly use online resources from web communities and portals in their classroom. These resources are strongly related to STEAM practices enriched by ICT tools.	Teachers confidently share their online STEAM based resources within their own school and with other schools.

NEXT STEP Partnership

Western Norway University of Applied Sciences

SCIENCE VIEW

ELLINOGERMANIKI AGOGI

NUCLIO
Núcleo Interactivo de Astronomia

DUNDALK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA DHÚN DEALGAN