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PAST Framework for Teachers

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Package for Teachers

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1. Introduction

The PAST Framework for Teachers is built on a simple but important premise: History and STEAM should not be treated as separate school domains that occasionally “borrow” examples from one another. Instead, they should be understood as complementary ways of knowing the world. History helps learners examine context, chronology, continuity and change, causation, evidence, perspective, and ethical judgement. STEAM contributes modelling, experimentation, design, quantification, technological problem-solving, creativity, and applied reasoning. When these traditions are intentionally combined, students can understand not only what happened in the past, but also *how knowledge, technologies, environments, infrastructures, artistic practices, and societies developed over time*. (National Research Council 2005; NCSS 2013; Margot and Kettler 2019; Shernoff et al. 2017).

The Framework serves as a methodological and theoretical foundation for integrating history and STEAM, and is organised around six interconnected parts: **introduction, theoretical background, methodological foundations, pedagogical approaches and teacher competences, integrating history and STEAM, and practical guidelines for interdisciplinary teaching**. The same materials position the framework as the starting point for WP3 and as the reference document that will later feed into training modules, teaching scenarios, and online Learning, Teaching and Training Activities (LTTA) with teachers.

The framework has four main purposes. First, it provides a shared conceptual language for project partners and teachers working in different national systems. Second, it identifies well-founded educational reasons for integrating history and STEAM rather than treating the connection as a motivational add-on. Third, it translates theory into an implementable classroom methodology. Fourth, it creates a common reference point for teacher training, co-creation, scenario development, and evaluation in later WP3 stages. These aims are consistent with the broader project ambition to strengthen interdisciplinary education, teacher capacity, practical resources, and student competence development.

The framework should be used as a **reference and design tool**, not as a rigid script. Teachers should adapt it to age group, curriculum, timetable, partnership possibilities, available technology, school infrastructure, and local priorities. This flexibility matters because research on integrated STEM repeatedly shows that teachers value interdisciplinary approaches, but often face pedagogical, curricular, structural, and assessment barriers; they therefore benefit from quality curriculum materials, collaboration time, and professional development that is tightly linked to classroom practice (Margot and Kettler 2019; Shernoff et al. 2017).

At policy level, the framework also aligns with wider international priorities. Sustainable Development Goal 4 (**SDG 4**) calls for inclusive and equitable quality education, and **Target 4.7** explicitly asks that education for sustainable development and global citizenship be mainstreamed in policy, curricula, teacher education, and student assessment. The project’s emphasis on interdisciplinary learning, sustainability, digital competence, and historically grounded civic understanding therefore sits within a strong international policy context (United Nations 2015).

2. Conceptual and educational foundations

2.1 Interdisciplinary learning as meaningful integration

Interdisciplinary learning is not simply the inclusion of two school subjects within the same lesson. In a stronger and more purposeful form, it involves deliberately connecting concepts, methods, tools and forms of evidence so that learners can investigate a meaningful question, phenomenon or problem from more than one disciplinary perspective.

Research on integrated STEAM education describes high-quality integration as **explicit rather than implicit, authentic rather than superficial, and organised around contexts in which learners must apply knowledge across disciplinary boundaries**. The relationship between subjects should therefore be visible to students. A shared topic alone is not sufficient if the concepts and methods of the participating disciplines remain disconnected (Margot and Kettler 2019; Shernoff et al. 2017).

In the PAST approach, interdisciplinary learning should enable students to understand how historical developments, scientific knowledge, technological innovation, engineering solutions, artistic expression and mathematical reasoning interact. Each discipline contributes its own questions, evidence and methods, while the connections between them create a richer learning experience.

2.2 The contribution of history

History has a particularly important role in interdisciplinary education because it provides **contextual depth**. Scientific discoveries, engineering achievements, industrial systems, artistic movements, environmental transformations and public health measures do not emerge in isolation. They develop within particular social, political, economic and cultural conditions.

Historical learning enables students to:

- place innovations and discoveries within their chronological context;
- analyse causes and consequences;
- identify continuity and change;
- compare different accounts and interpretations;
- examine how people responded to challenges in different periods;
- assess how knowledge and technology affected societies and environments.

Strong history teaching should balance factual knowledge with conceptual understanding, especially in relation to change, causation and the evaluation of historical accounts (National Research Council 2005).

2.3 The contribution of STEAM to historical learning

STEAM approaches deepen historical learning by making the past more materially, visually and analytically accessible.

Science and mathematics allow students to investigate demographic change, environmental processes, disease transmission, energy use, materials, transport systems and technological development. Engineering and design help students examine how people addressed practical problems under the constraints of their historical period. Arts-based approaches support visualisation, reconstruction, representation, storytelling and communication.

Examples of STEAM contributions to historical enquiry include:

STEAM area	Contribution to historical learning	Possible classroom application
Science	Explains natural processes, health, materials, energy and environmental change	Investigating epidemics, pollution, agriculture or energy transitions
Technology	Shows how tools and systems transformed communication, transport and daily life	Examining printing, navigation, electrification or digital technologies
Engineering	Reveals how people designed structures and solved practical problems	Reconstructing bridges, buildings, machines or transport systems
Arts	Supports interpretation, representation and communication of historical experience	Analysing architecture, visual culture, design or creating exhibitions
Mathematics	Enables measurement, comparison, modelling and analysis of change	Working with population data, timelines, maps, geometry or statistics

STEAM should not reduce historical learning to a sequence of stories about famous inventors or technological “heroes”. Its purpose is to expand the questions that students can ask about the past and increase the range of evidence and analytical tools available to them. This approach is consistent with historical enquiry, integrated STEAM education and evidence-based social studies learning (National Research Council 2005; NCSS 2013; Shernoff et al. 2017).

2.4 National and international PAST contents

The PAST Recommendations Framework (R2.3) provides a practical bridge between interdisciplinary theory and the selection of classroom topics. As defined in that framework, PAST content is divided into two complementary categories: **national PAST contents** and **international PAST contents**.

National PAST contents reflect the distinctive cultural, scientific, technological, industrial or environmental heritage of each participating country. They allow teachers to connect

interdisciplinary learning with local history, national curricula and regional heritage.

International PAST contents are themes shared across the curricula and educational traditions of the participating countries. They support cross-national learning and enable students to examine historical, scientific, technological, environmental and social developments from a broader European or global perspective.

The framework emphasises the importance of balancing these two categories. National topics strengthen local relevance and cultural understanding, while international topics highlight shared European and global processes.

2.5 Criteria for selecting suitable History–STEAM topics

The selection criteria developed within the PAST Recommendations Framework should also guide teachers when choosing or adapting topics for lessons and teaching scenarios.

Selection criterion	Guiding question for teachers
Relevance for History–STEAM integration	Does the topic contain a genuine connection between historical development and one or more STEAM areas?
Educational relevance	Is the topic appropriate for the curriculum, age group and expected learning outcomes?
International significance	Can the local or national example be related to wider European or global developments?
Historical reliability	Is the topic based on credible evidence and interpretations accepted in educational and academic practice?
Uniqueness and complementarity	Does the topic contribute a new perspective rather than repeat another theme?
Pedagogical applicability	Can the topic support enquiry, discussion, problem-solving, practical work or creative production?
Balance of perspectives	Does the topic help connect national experience with international processes?

These criteria help teachers avoid superficial integration. A suitable PAST topic should not merely mention a scientific discovery or technological object. It should enable students to explore how knowledge, society, environment, culture and innovation influenced one another.

2.6 Educational value of the integrative approach

The rationale for integrating History and STEAM is both disciplinary and educational.

From a disciplinary perspective, the approach helps students understand how knowledge is created, applied, challenged and transformed over time. It shows that scientific and technological progress is shaped by human decisions, available resources, cultural values and political or economic conditions.

From an educational perspective, interdisciplinary work can support the development of competences that are increasingly important across school curricula:

- critical thinking;
- evidence-based reasoning;
- problem-solving;
- creativity;
- collaboration;
- communication;
- ethical reflection;
- digital literacy;
- the ability to transfer knowledge between contexts.

Together, these disciplinary and educational benefits make History-STEAM integration a valuable approach for deepening subject knowledge while enabling students to apply what they learn critically, creatively and responsibly to complex real-world questions.

2.7 History and STEAM as co-equal domains

A central principle of the PAST Framework is that History and STEAM should be treated as **co-equal knowledge domains**.

History should not function merely as background information presented before the “real” scientific or technological activity. Historical questions, sources, interpretations and concepts should remain essential throughout the learning process.

Equally, STEAM should not be reduced to a decorative practical activity added to a conventional history lesson. A model, experiment, calculation, digital tool or creative task should contribute directly to the investigation and help students answer the central enquiry question.

Superficial integration	Meaningful PAST integration
Students read about an invention and then make a poster	Students investigate why the invention emerged, how it worked, who benefited and what consequences it produced
A historical theme is used only as a setting for a science activity	Historical evidence and scientific analysis are both needed to answer the enquiry question
A digital tool is included for motivation	The tool supports source analysis, modelling, data interpretation or communication
Subjects are present but remain separate	Concepts and methods from different disciplines interact throughout the lesson
One subject dominates and the other is decorative	History and STEAM each make a necessary contribution to the final conclusion

The distinctive contribution of PAST lies in avoiding both forms of simplification. The framework promotes teaching in which **historical enquiry and STEAM enquiry inform, challenge and strengthen one another**. Students should finish a PAST learning activity with a deeper understanding of the past and a clearer awareness of how scientific, technological, artistic and mathematical knowledge develops within society.

3. Methodological foundations

The methodological core of the PAST Framework is based on seven principles that guide the planning, implementation and assessment of interdisciplinary History–STEAM teaching.

3.1 Explicit integration

Interdisciplinary teaching is most effective when the connections between subjects are deliberately planned and clearly communicated to learners. Students should understand why a historical case is also relevant to science, technology, engineering, the arts, mathematics or environmental studies.

Teachers should identify:

- the concepts contributed by each discipline;
- the methods and forms of evidence that students will use;
- how the different perspectives contribute to answering the central question.

For example, a lesson on industrialisation should not simply combine a historical text with an unrelated experiment. Students might instead examine how steam power, engineering, natural resources, transport networks and economic decisions jointly transformed society. Research on integrated STEM

education emphasises that disciplinary connections must be explicit, as students may not recognise them automatically (Margot and Kettler 2019; Shernoff et al. 2017).

Not every PAST lesson needs to include all STEAM subjects. Integration may involve History and one or several STEAM areas, provided that each discipline makes a meaningful contribution.

3.2 Authentic enquiry

A PAST lesson should be organised around a meaningful question, problem, challenge or historical case rather than the transmission of fragmented information. Suitable enquiry questions might include:

- How did railway technology transform nineteenth-century communities?
- Why did an epidemic affect some groups more severely than others?
- How did available materials influence historical architecture?
- Who benefited from electrification, and who initially remained excluded?

The College, Career, and Civic Life (C3) Framework for Social Studies State Standards presents enquiry as a process that begins with questions, continues through the application of disciplinary concepts and the evaluation of sources, and ends with the communication of conclusions and, where appropriate, informed action (NCSS 2013). This enquiry structure is well suited to PAST because both historical and STEAM investigations depend on worthwhile questions and the critical examination of evidence.

A PAST enquiry may therefore follow a simple sequence:

1. introduce the central question;
2. identify what students need to investigate;
3. examine historical and STEAM evidence;
4. apply relevant concepts and methods;
5. formulate and communicate conclusions;
6. reflect on consequences and alternative interpretations.

3.3 Evidence-based reasoning

Students should learn that claims and proposed solutions must be supported by evidence. History and STEAM use different but complementary forms of evidence.

Historical evidence	STEAM evidence
Primary documents and testimonies	Measurements and experimental results
Maps, photographs and artefacts	Statistical and demographic data
Buildings and material remains	Models, simulations and prototypes
Historical accounts and interpretations	Field observations and digital datasets

Historical reasoning requires students to consider the origin, purpose, context and reliability of a source. STEAM reasoning may involve measurement, calculation, modelling, comparison or testing. Combining these approaches shows students that knowledge is constructed through disciplined investigation rather than simply received from a textbook.

For example, an enquiry into an epidemic could combine written accounts, mortality records, population maps, information about living conditions and biological knowledge about disease transmission. The historical evidence reveals how people experienced and interpreted the event, while scientific and numerical evidence helps explain its patterns and impact.

Research on history learning and the C3 Framework both emphasise the importance of evaluating evidence, developing claims and constructing reasoned explanations (National Research Council 2005; NCSS 2013).

3.4 Design and iteration

PAST activities do not always need to end with a conventional written assignment. Depending on the enquiry, students may produce:

- a model or reconstruction;
- a map or data visualisation;
- a simulation or prototype;
- an exhibition;
- a podcast or short documentary;
- a public information or heritage product.

The product should be based on the evidence examined during the lesson. Students should be able to explain how their design reflects the historical context and why they made particular decisions.

They should also have opportunities to test, review and improve their work. Iteration may involve correcting a calculation, modifying a model, reconsidering an interpretation or improving the communication of conclusions. Integrated STEAM research identifies design, redesign, learning from mistakes and practical problem-solving as important elements of interdisciplinary learning (Margot and Kettler 2019; Shernoff et al. 2017).

3.5 Contextual and ethical reflection

History–STEAM topics frequently raise questions about responsibility, equality, sustainability and the consequences of human decisions. These issues should form part of the enquiry rather than appearing only as an optional discussion at the end.

Relevant questions include:

- Who benefited from a development, and who experienced harm?
- What social or environmental consequences followed?
- What knowledge and alternatives were available at the time?
- How should scientific and technological knowledge be used responsibly?
- How do past decisions continue to affect the present?

This principle is particularly relevant to themes such as epidemics and public health, mining and environmental degradation, industrialisation and labour, electrification and inequality, nuclear science, climate change and cultural heritage.

Ethical reflection prevents scientific and technological change from being presented as a simple history of progress. It also supports the **C3 Framework's** emphasis on informed civic participation and the objectives of **Sustainable Development Goal 4.7**, which connects education with sustainable development, global citizenship, human rights and cultural diversity (NCSS 2013; United Nations 2015).

3.6 Progression from guidance to independence

Not all learners are ready to conduct an open interdisciplinary enquiry independently. PAST teaching should therefore move gradually from teacher-supported activities towards greater student responsibility.

At the beginning, teachers may provide:

- a defined enquiry question;
- a selected set of sources and datasets;
- guiding questions and vocabulary;
- templates for source or data analysis;
- clearly assigned group roles;
- a specified form of final product.

As students gain experience, they can begin to refine questions, locate and evaluate evidence, select appropriate methods and decide how to present their conclusions.

Guided enquiry	More independent enquiry
The teacher provides the question	Students refine or formulate questions
Sources are selected in advance	Students locate and evaluate sources
Methods are modelled	Students select suitable methods
The final product is prescribed	Students choose how to communicate findings

This progression is consistent with the enquiry process described in the C3 Framework and with research showing that deep disciplinary understanding develops through structured support, conceptual organisation and opportunities for active reasoning (NCSS 2013; National Research Council 2005).

3.7 Transfer to classroom practice

The PAST Framework is intended to be a practical reference document. Its methodological principles should help teachers make concrete decisions about:

- curriculum objectives and interdisciplinary connections;
- the central enquiry question;
- historical sources and STEAM evidence;
- teaching methods, tools and resources;
- individual and collaborative tasks;
- differentiation and inclusion;
- student products and assessment.

This practical orientation reflects the structure of WP3. The Framework provides the foundation for the training modules, teaching scenarios and Learning, Teaching and Training Activities (LTTA). The scenarios will translate the principles into lesson plans, while the LTTA will provide teachers with hands-on experience in using, evaluating and adapting the project results.

3.8 Expected learning outcomes

The expected outcomes of PAST teaching can be organised into four domains.

Domain	Expected outcomes
Knowledge and understanding	Students explain relationships between historical developments and scientific,

	technological, environmental, mathematical or artistic processes.
Disciplinary reasoning	Students evaluate evidence, compare interpretations, apply appropriate methods and justify conclusions.
Application and creation	Students model, design, calculate, reconstruct or communicate a response to a historically grounded problem.
Reflection and citizenship	Students consider consequences, values, sustainability, inequality and ethical responsibility.

These domains are interconnected. A PAST activity may require students to understand a historical process, analyse documents and data, produce a model or visualisation, and then assess the social and environmental consequences of the development studied. Together, the outcomes connect historical enquiry, integrated STEAM education and responsible citizenship with the practical aims of the PAST project.

4. Pedagogical approaches and teacher competences

The PAST approach requires teaching that is student-centred but carefully structured. Effective interdisciplinary learning depends on well-designed tasks, clear purposes, visible thinking and gradual movement towards learner independence. It should avoid both excessive teacher direction and loosely organised activity without clear learning outcomes (Margot and Kettler 2019; EEF 2021).

4.1 Guided enquiry

Guided enquiry organises learning around compelling questions and supports students in moving from evidence to reasoned conclusions. Teachers help students locate, evaluate and compare different forms of evidence.

In History, this may include:

- primary sources and artefacts;
- maps, timelines and photographs;
- historical accounts and visual evidence.

In STEAM, it may include:

- measurements and datasets;
- diagrams, models and simulations;
- field observations and design constraints.

The teacher's role is to make the enquiry process visible, manageable and intellectually demanding. Students should gradually learn to formulate claims, consider counterclaims and justify conclusions with evidence (NCSS 2013; National Research Council 2005).

4.2 Project-based and challenge-based learning

Project-based and challenge-based learning are particularly suitable when students must apply knowledge from several disciplines to address an authentic problem.

It may involve:

- reconstructing a historical technology;
- analysing urban growth using historical and spatial data;
- modelling the spread of a historical epidemic;
- preparing a museum-style explanation of scientific change;
- investigating the environmental legacy of industrial development.

The final product should demonstrate genuine understanding and evidence-based reasoning. It should not be a decorative activity added to the lesson without a clear connection to the enquiry question (Shernoff et al. 2017; Margot and Kettler 2019; Đukičin Vučković et al., 2026).

4.3 Collaborative learning

Collaboration is important both for interdisciplinary planning among teachers and for student learning. The WP3 materials emphasise co-creation, contributions from local experts and teaching scenarios that define appropriate forms of work.

In the classroom, purposeful collaboration may require students to:

- divide and compare source-analysis tasks;
- examine different interpretations;
- co-design a model or solution;
- evaluate the quality of evidence;
- prepare a joint multimodal presentation.

Teamwork should involve shared responsibility and meaningful intellectual contribution rather than simply dividing a task into unrelated parts (Milanković Jovanov et al., 2022; Stajić et al., 2025).

4.4 Meaningful use of digital tools

Digital tools should be selected because they improve access, interpretation, collaboration, feedback or communication - not merely because they are new or attractive.

Useful tools may include

- digital archives and virtual heritage resources;
- interactive maps and timelines;
- spreadsheets and data-visualisation tools;
- collaborative documents;
- modelling and simulation environments;
- multimedia production tools.

Digital work in PAST should also develop students' critical digital judgement. Learners should be encouraged to examine the authorship, origin, reliability, bias and limitations of online sources, datasets, maps and visualisations, rather than accepting digital information at face value. Teachers should therefore connect technology use with source criticism, data literacy, copyright awareness and responsible participation. This is particularly important in History–STEAM learning, where persuasive visualisations or interactive resources may still present incomplete, selective or misleading evidence (European Commission 2017; Leščešen et al., 2021; Stajić et al., 2023).

4.5 Reflective teaching and transfer to practice

Interdisciplinary teaching is unlikely to become sustainable if professional development provides only ideas or examples. Teachers also need opportunities to rehearse techniques, receive feedback, plan classroom application and reflect on implementation.

The Education Endowment Foundation recommends professional development that:

- develops teachers' knowledge;
- strengthens motivation;
- builds practical techniques;
- embeds new practice over time.

These principles are directly relevant to the PAST training modules and LTTA, which should help teachers move from understanding the Framework to applying and adapting its results in their own classrooms (EEF 2021).

4.6 PAST teacher competence domains

On the basis of these pedagogical approaches, the Framework identifies six competence domains.

Competence domain	What the teacher should be able to do
Interdisciplinary curriculum competence	Identify meaningful connections between History and STEAM, align them with curriculum aims and design coherent learning sequences rather than disconnected activities (Margot and Kettler 2019; Shernoff et al. 2017; Milanković Jovanov et al., 2022).
Historical enquiry competence	Formulate historical questions, select and interpret sources, address chronology, continuity and change, causation, perspective and consequence (National Research Council 2005; NCSS 2013).
STEAM pedagogical competence	Use authentic contexts, problem-solving, experimentation, modelling, engineering design and iterative improvement in age-appropriate ways (Margot and Kettler 2019; Shernoff et al. 2017; Đukićin Vučković et al., 2026).
Digital competence	Select, adapt and create digital resources for evidence analysis, collaboration, differentiation, feedback and student production (European Commission 2017).
Assessment competence	Assess knowledge together with reasoning, evidence use, application, collaboration, communication and reflective judgement (NCSS 2013; Stajić et al., 2025).
Inclusive and ethical competence	Make learning accessible to diverse students, support different forms of participation and address historical, scientific and technological issues responsibly. This supports SDG 4 and the project's commitment to socially responsive

	education (United Nations 2015; Đukićin Vučković et al, 2019).
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These competences are interconnected. Effective PAST teaching requires teachers to combine disciplinary knowledge, pedagogical judgement, digital capability, assessment literacy and sensitivity to ethical and inclusive practice.

5. Integrating history and STEAM

5.1 Theme-based integration

The most effective way to integrate History and STEAM is through **theme-based curriculum planning**. Instead of beginning with a subject label, teachers select a historically meaningful phenomenon that naturally generates questions across several disciplines.

A suitable theme should allow students to investigate both:

- the historical context, causes, experiences and consequences;
- the scientific, technological, engineering, artistic or mathematical dimensions of the phenomenon.

This ensures that the contributing disciplines are connected through a shared enquiry rather than presented as separate or loosely related activities.

5.2 National PAST contents

The national contents identified in the PAST Recommendations Framework reflect the distinctive historical, cultural, scientific, technological and environmental heritage of the participating countries.

They include:

- Lithuania: landscape and demographic change; ecological disasters and environmental movements;
- Serbia: medieval monastic architecture; the history of mining and metallurgy;
- Poland: early Slavic settlements and medieval state formation; industrialisation in the nineteenth and twentieth centuries;
- Italy: Humanism, the Renaissance and the Scientific Revolution; the Panisperna Boys, nuclear physics and the Atomic Age.

These themes connect national heritage with wider fields such as geography, ecology, architecture, engineering, mathematics, industrial technology, astronomy, physics, ethics and the history of science.

5.3 International PAST contents

The PAST Recommendations Framework also identifies themes shared across the curricula and educational traditions of the participating countries. These include:

- ancient civilisations;
- historical epidemics, immunity and public health;
- geographical discoveries and navigation;
- railways and industrial centres;
- Nikola Tesla and electrical technology;
- the scientific heritage of Łukasiewicz, Curie and Czochoński;
- global climate change.

Shared themes enable teachers in different countries to work with common reference points while incorporating local examples, archives, heritage sites and historical experiences. They therefore support both cross-national learning and adaptation to national curricula.

5.4 Curriculum connections

History can connect with different STEAM areas according to the topic and enquiry question.

STEAM area	Possible connections with history
Science	Disease, medicine, materials, radioactivity, environmental change, climate and agriculture
Technology and engineering	Architecture, transport, electrification, mining, industrial systems and communication
Arts	Visual culture, heritage, design, architecture, representation and public communication
Mathematics	Chronology, measurement, geometry, demographic data, cartography, statistics and modelling

These connections should arise from the historical phenomenon rather than being added artificially. Each discipline should provide concepts, methods or evidence that contribute directly to the central enquiry.

5.5 Planning an integrated topic

Teachers can plan a history-STEAM unit through five guiding questions:

1. What is the historical phenomenon or problem?
2. Which STEAM concepts help students understand it?
3. What historical sources, data or material evidence can students examine?
4. What product, solution or performance will demonstrate learning?
5. What civic, ethical, social or sustainability question emerges?

This sequence preserves the integrity of the contributing disciplines while ensuring that they interact meaningfully. For example:

- Industrialisation in Poland may combine historical evidence about social and economic change with the geography of industrial centres, the physics and chemistry of energy systems, environmental analysis of pollution, and mathematical interpretation of population or production data.
- Medieval Serbian monastic architecture may connect political and religious history with geometry, construction methods, materials, visual analysis and digital modelling.
- Historical epidemics may combine primary sources with biology, public health, migration, cartography and statistical reasoning.
- Global climate change may link environmental history with atmospheric science, data interpretation, ethical reflection and local adaptation planning. These examples follow the thematic and interdisciplinary logic established in the PAST Recommendations Framework (R2.3).

5.6 From theme selection to integrated lesson planning

Selecting an appropriate theme is the first step in designing a coherent PAST lesson or unit. Teachers should choose topics that demonstrate a clear and meaningful relationship between History and one

or more STEAM disciplines. The topic should correspond to curriculum objectives, be appropriate for the learners' age and prior knowledge, and be supported by reliable historical and STEAM evidence.

Teachers should then **define a central enquiry question, identify the concepts and methods** contributed by each discipline, **select relevant sources** and resources, and **decide how students will demonstrate their learning**. Attention should also be given to assessment, inclusion and any ethical, social or environmental questions arising from the topic.

The PAST Integrated Topic Planning Template, included in Annex A, offers a concise structure for this process. It can be used when developing teaching scenarios, adapting PAST materials to national curricula, participating in the LTTA, or preparing a History-STEAM activity for classroom implementation. It supports the practical progression from the PAST Framework to the training modules, teaching scenarios and teacher training activities.

6. Practical guidelines, use of WP3 results and LTTA

6.1 The practical teaching sequence

A PAST lesson or mini-unit may follow six stages:

Stage	Purpose	Possible activities
1. Orientation	Introduce the historical phenomenon and its relevance	Image, artefact, map, short account, demonstration or local example
2. Enquiry formation	Present or refine the central enquiry question	Question generation, initial hypotheses or discussion
3. Evidence investigation	Examine historical and STEAM evidence	Source analysis, datasets, measurements, maps, models or observations
4. Analysis and creation	Interpret, compare, calculate, test, model or design	Group enquiry, practical work, reconstruction or problem-solving
5. Communication	Present a reasoned conclusion or product	Report, exhibition, model, visualisation, debate or digital presentation
6. Reflection	Consider learning, consequences and limitations	Self-assessment, discussion or written reflection

This sequence reflects the enquiry process described in the **College, Career, and Civic Life (C3) Framework for Social Studies State Standards** and the project structures commonly used in integrated STEM education (NCSS 2013; Shernoff et al. 2017).

The sequence is flexible. A short lesson may include all six stages in a simplified form, while a longer project may devote several lessons to evidence investigation, design and communication.

6.2 Teaching methods and resources

PAST lessons should combine methods according to the enquiry question and students' needs. These may include:

- whole-class introduction and teacher modelling;
- guided source and data analysis;

- small-group investigation;
- structured discussion or debate;
- experiment, modelling or practical construction;
- collaborative problem-solving;
- individual reflection and classroom plenaries.

Digital tools should be used selectively. They are most valuable when they help students access sources, interpret data, compare evidence, collaborate, document their learning or communicate findings. Suitable resources may include digital archives, interactive maps, timeline tools, spreadsheets, data visualisations, virtual heritage resources and multimedia production tools.

Technology should support the historical and STEAM enquiry rather than introduce unnecessary complexity. Teachers should also consider accessibility, reliability, data protection, copyright and students' ability to evaluate digital information critically (European Commission 2017; Leščešen et al, 2021; Stajić et al., 2023; Stajić et al., 2025).

6.3 Assessment of interdisciplinary learning

Assessment should reflect the full range of intended PAST outcomes. It should include subject knowledge but also evaluate how students use evidence, connect concepts, apply methods and communicate conclusions.

Possible evidence of learning includes:

- short written explanations;
- comparative source analyses;
- annotated maps or visualisations;
- calculations and interpretations of data;
- models, reconstructions or prototypes;
- design or enquiry logs;
- presentations, exhibitions and debates;
- reflective journals or self-assessment.

Assessment area	Guiding question
Historical understanding	Can the student explain the context, causes, changes or consequences?
STEAM understanding	Can the student apply relevant scientific, technical, artistic or mathematical concepts?
Evidence use	Are claims supported by appropriate sources or data?
Integration	Does the student connect the disciplines meaningfully?
Application and creation	Is the product or solution informed by the enquiry?
Communication	Are conclusions clear, accurate and appropriate for the audience?
Reflection	Does the student consider ethical, social or environmental implications?

Assessment criteria should be communicated clearly and, where appropriate, discussed with students. The C3 Framework is particularly useful because it highlights the development of claims and

counterclaims, the evaluation of evidence and the communication of informed conclusions (NCSS 2013).

6.4 The PAST training package for teachers

Work Package 3 (WP3) – Development of the Training Package for Teachers is the part of the PAST project responsible for transforming the research findings and thematic recommendations developed in WP2 into practical resources for secondary-school teachers. Its purpose is to equip educators with the knowledge, methods and classroom materials needed to integrate History and STEAM in coherent interdisciplinary lessons.

The four WP3 results are:

Result	Description	Use by teachers
R3.1 PAST Framework for Teachers	A structured reference document presenting the conceptual and methodological foundations, pedagogical approaches, interdisciplinary connections, teacher competences and practical guidelines for History–STEAM teaching	Teachers use it to understand the PAST approach, select appropriate themes and make informed planning decisions
R3.2 Handbook with 4 Training Modules	A professional learning resource containing practical examples, case studies and guidance. The planned topics include historical perspectives in STEAM, digital tools, enquiry-based learning and assessment strategies	Teachers use the modules to develop specific competences before planning or delivering a PAST based lesson
R3.3 Collection of Teaching Scenarios	12 ready-to-use teaching scenarios including learning objectives, teaching techniques, materials, tools, technologies and forms of work.	Teachers may use a scenario directly or adapt it to their curriculum, learners, available time and school resources
R3.4 Learning, Teaching and Training Activities	Online professional learning designed to provide hands-on experience in using the Framework, modules and scenarios	Teachers practise the approach, adapt materials, exchange feedback and prepare for classroom implementation

6.5 Using the PAST training package in the classroom

Teachers can use the WP3 results through the following practical pathway:

1. **Select a theme** from the national or international contents identified in the PAST Recommendations Framework.
2. **Consult R3.1** to clarify the interdisciplinary rationale, methodological principles and expected competences.
3. **Use the relevant R3.2 modules** to develop the knowledge or teaching techniques required for the selected approach.

4. **Choose a scenario from R3.3** and adapt it to the national curriculum, students' prior knowledge and available resources.
5. **Introduce the central enquiry question** and explain the relationship between History and the selected STEAM area.
6. **Implement the lesson** through evidence investigation, analysis, practical work, communication and reflection.
7. **Assess student learning** across historical understanding, STEAM application, evidence use and interdisciplinary reasoning.
8. **Record reflections and feedback** to improve the activity and support later piloting and refinement.

A teaching scenario should be treated as an adaptable professional resource rather than a fixed script. Teachers may modify its duration, examples, sources, technologies, student product and level of support, provided that the central enquiry and meaningful History–STEAM connection are maintained.

6.6 Realistic and gradual implementation

Teachers should not be expected to redesign an entire curriculum at once. A more sustainable approach is to begin with one carefully selected lesson or mini-unit, review its implementation, revise the materials and gradually extend the approach.

A manageable implementation cycle is:

Plan → adapt → teach → assess → reflect → improve

Professional learning is more likely to influence classroom practice when it develops knowledge, provides opportunities to rehearse techniques, includes feedback and supports participants in embedding new approaches over time (EEF 2021). The PAST training modules and LTTA should therefore help teachers make realistic decisions about workload, curriculum time, collaboration and available resources.

6.7 LTTA as an implementation bridge

LTTA stands for **Learning, Teaching and Training Activities**. In the PAST project, it refers to organised professional-development activities through which teachers learn how to use the WP3 resources in practice. The LTTA is therefore not a separate theoretical output, but the implementation bridge between the PAST Framework, training modules and teaching scenarios, and their later use in school lessons.

During the LTTA, teachers will become familiar with the main principles of the PAST approach and learn how to identify meaningful connections between History and STEAM subjects. They will explore the Framework, training modules and sample teaching scenarios, and consider how these resources can be adapted to national curricula, different age groups, students' prior knowledge and the resources available in their schools. Teachers will practise formulating central enquiry questions, selecting reliable historical sources and STEAM evidence, planning guided enquiry and project-based activities, and choosing digital tools that support analysis, collaboration and communication. They will also learn how to assess interdisciplinary outcomes, including historical understanding, application of STEAM concepts, evidence-based reasoning, problem-solving, creativity and reflection on ethical or environmental issues.

The LTTA will also provide opportunities for teachers to analyse examples, discuss implementation challenges, collaborate with colleagues and receive feedback on their plans. By adapting teaching scenarios to their own classroom context, teachers can move from general understanding to a concrete implementation plan. **This practical experience is intended to strengthen their confidence, help them anticipate possible barriers and prepare them to use the PAST results effectively during lessons.**

7. Conclusion

The PAST Framework for Teachers provides a shared conceptual, methodological and practical basis for integrating History and STEAM in secondary education. Meaningful integration requires both domains to contribute to a common enquiry, combining historical context and evidence with scientific explanation, technological analysis, design, creativity and mathematical reasoning.

The Framework places theme-based planning, central enquiry questions and evidence-based reasoning at the centre of the PAST approach. Students should investigate reliable sources and data, apply appropriate disciplinary methods, communicate reasoned conclusions and reflect on the social, ethical and environmental consequences of historical developments. This supports subject understanding alongside critical thinking, problem-solving, creativity, collaboration and responsible judgement (National Research Council 2005; NCSS 2013; Margot and Kettler 2019; Shernoff et al. 2017).

The four WP3 results create a practical pathway from professional learning to classroom implementation. The Framework, training modules, teaching scenarios and LTTA are designed to help teachers understand, adapt and apply the PAST approach in different curricula and school contexts. The success of PAST will ultimately depend on whether students understand the past more deeply, reason more carefully with evidence and recognise the relationships between historical change, society and STEAM development.

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Annex A. PAST integrated topic planning template

BASIC INFORMATION	
Element	Details
Title of the lesson or unit	
Student age/year group	
Subject teacher(s)	
Estimated duration (preferably one or two school classes)	
National or international PAST content	
Curriculum topic or unit	
THEME SELECTION AND CENTRAL ENQUIRY	
Guiding questions	Teacher's notes
What historical phenomenon, event, development or problem will students investigate?	
What is the central enquiry question?	
Why is this topic suitable for History–STEAM integration?	

How does it connect with curriculum objectives?	
Why is it relevant to this group of learners?	
What wider European or global process can be connected with the topic?	
INTERDISCIPLINARY CONNECTIONS Complete only the areas that make a meaningful contribution to the enquiry.	
Discipline	Relevant concepts, knowledge or methods
History	
Science	
Technology and engineering	
Arts	
Mathematics	
Other subject	
EXPECTED LEARNING OUTCOMES Students will be able to:	
Learning area	Expected outcome

Historical knowledge and understanding	
STEAM knowledge and application	
Evidence-based reasoning	
Problem-solving, design or creation	
Collaboration and communication	
Ethical or sustainability reflection	
SOURCES AND RESOURCES Teachers should confirm that the selected materials are reliable, age-appropriate, accessible and properly attributed.	
Resource type	Selected materials (worksheets, tools, teaching aids...)
Historical sources, maps, images or artefacts	
Scientific evidence, datasets or measurements	
Digital resources or tools	
Practical materials or equipment	

Local heritage, museum or expert resources	
LEARNING SEQUENCE	
Stage	Main teacher and student activity
Introduction and presentation of the enquiry question	
Historical investigation	
STEAM investigation or practical activity	
Integration and comparison of findings	
Creation of a product or preparation of a conclusion	
Presentation, discussion and reflection	
STUDENT PRODUCT OR PERFORMANCE	
Students will produce or present (The product may take the form of a model, visualisation, reconstruction, report, exhibition, presentation, simulation, podcast or other evidence-based outcome):	
How will the product demonstrate both historical and STEAM understanding?	

Will students have an opportunity to review and improve their work?

ASSESSMENT AND INCLUSION

Assessment may include observation, questioning, source analysis, student products, presentations, self-assessment, peer feedback or a simple rubric.

Area	Planning notes
Evidence of historical understanding	
Evidence of STEAM understanding	
Use and interpretation of evidence	
Assessment method or criteria	
Support for students with different learning needs	
Alternative ways for students to participate or present learning	