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AGORA

MAPPING THE NARRATIVES OF STEAM

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ABSTRACT

FilmEU Agora is structured as an open process of exploration, grounded in lived experience and collaborative dialogue. This project explores the theme of "Mapping the Narratives in STEAM", seeking to understand how STEAM is already present, enacted, and interpreted across diverse contexts. Narratives, within the terms of this project, function as a means of revealing underlying assumptions, values, and relationships that shape how interdisciplinary education is understood, especially in the context of art education. These narratives include, for example, STEAM as structural challenge, as a question of visibility, as a philosophical position regarding knowledge, and as a lived practice embedded in creative and technical work.

The Agora can therefore be understood as both context and method: a structured environment in which STEAM is explored, and a process through which its meanings are produced. By foregrounding collaboration, dialogue, and lived experience, it provides a basis for examining how interdisciplinary education is not only conceptualised, but enacted. Rather than pursuing consensus or a singular definition, the Agora foregrounds the identification of multiple – and at times competing – narratives that reflect the varied ways STEAM is understood and enacted across institutional, disciplinary, and cultural contexts.

This paper explores how STEAM is understood across different institutional and disciplinary contexts, how it is enacted through creative and technical practices, and where tensions arise between these lived realities and existing educational structures. In doing so, it seeks to contribute to a reframing of STEAM – it rejects disciplinary compartmentalisation and argues for a more accurate articulation of how learning already takes place. At the same time, the paper recognises STEAM as an evolving field of educational practice, shaped through ongoing dialogue, experimentation, and interdisciplinary collaboration.

Our proposals are shaped by concrete examples drawn from the authors' work, including teaching approaches, creative production processes, and collaborative projects. We believe that knowledge is generated not through detached observation, but through engagement with practice as it unfolds.

KEYWORDS

01 STEAM Education

02 Problem-based & Interdisciplinary learning

03 Practice-based Research

04 Higher Education

05 Creative Education

06 FilmEU

07 Narrative Mapping

08 STEM Policy

1. INTRODUCTION DECONSTRUCTING THE OBVIOUS

STEM has become one of the dominant organising frameworks in contemporary education policy. Across Europe, it is closely aligned with questions of competitiveness, innovation capacity, and the development of future skills. It presents itself as both a set of disciplines – science, technology, engineering, and mathematics – and as a strategic response to economic and societal change (European Commission, 2025a).

Within this setting, a central tension quickly becomes apparent; as a description of how learning and problem-solving actually occur, STEM is, at best, partial. While policy frameworks continue to emphasise STEM as a driver of economic and technological development, the practices through which learning occurs – particularly in creative disciplines – consistently involve forms of integration that exceed this description.

It is within this shift toward integration that the concept of STEAM has emerged. The addition of the Arts within STEAM may be understood less as an expansion of STEM, and more as an *attempt to make visible dimensions of learning that were never absent, but insufficiently recognised*. While STEAM expands the disciplinary frame, it does not fully resolve the limitations inherent in how education is described through such frameworks. Both STEM and STEAM rely on the aggregation of disciplines as a means of defining learning.

Effective education depends not only on disciplinary knowledge, but on the relationships between different forms of knowing and doing. STEAM supports deep learning. It moves learners from knowledge to analysis, creative application and critical reflection (Bass, Hu Dahl, Panahandeh, 2016).

Across a range of educational contexts – particularly those grounded in creative and practice-based disciplines – learning does not occur through the combination of separate fields, but through processes in which technical, creative, and analytical modes of thinking are continuously intertwined.

2. MAKING STEAM VISIBLE

Over time, the interpretation of STEM within education has evolved. Early approaches often treated the constituent disciplines as discrete areas of knowledge, delivered through subject-specific curricula. More recent policy and research initiatives have emphasised integration, recognising that contemporary challenges – whether technological, environmental, or societal – do not present themselves in disciplinary terms. As a result, there has been increasing attention to interdisciplinary and problem-based learning models, alongside the development of transversal skills such as critical thinking, collaboration, and creativity (European Commission, 2026).

STEAM has increasingly emerged as a strategic framework for addressing complex societal, ecological, and technological challenges through collaboration across the arts, sciences, engineering, and humanities. In the context of European Higher Education and the development of European Universities, STEAM is often associated with interdisciplinarity, innovation, impact in societal or research and development contexts, and new forms of employability for artists.

STEAM fosters innovation through the integration of artistic and scientific thinking, cultivating creativity, strengthening problem-solving and adaptability, and supporting deeper learning through experience (Yakman, 2008; Kolb, 1984; Robinson, 2011; Freeman et al., 2014).

This paper maps existing STEAM practices across FilmEU member institutions to make visible the interdisciplinary relationships that already underpin creative screen education. **By identifying both the opportunities and tensions that emerge from these practices, it contributes to a wider discussion about the future of education**: how learning can become more integrated, how educational systems can become more resilient, and how the Arts can be recognised and valued as an essential dimension of human experience rather than an optional complement to scientific and technological knowledge.

The following pages explore how STEAM becomes visible through the practices of directing, cinematography, editing, and visual effects.

Film Directing	
Integrated Knowledge	Cognitive psychology informs audience engagement, attention and emotional response. Spatial cognition and proxemics inform blocking, movement and screen composition. Production technologies, including pre-visualisation software, support planning, visualisation and creative decision-making. Camera, lighting, sound and visual effects operate as interdependent subsystems within a complex environment. Compositional geometry and temporal rhythm shape visual storytelling and the organisation of narrative experience.
Human Capabilities	Creative problem-solving and decision-making under conditions of uncertainty. The ability to balance artistic intent with technical, operational and production requirements. Systems thinking that integrates creative, technical and production functions into a coherent whole.
Innovation & Transformation	Creative demands associated with films such as Avatar accelerated the development of performance capture and virtual production technologies. Film directing has contributed to the development of real-time collaborative workflows that integrate creative and technical expertise throughout the production process. The increasing convergence of production, visualisation and digital technologies continues to transform contemporary filmmaking practice.
Value & Impact	Research on audience attention, engagement and emotion contributes to broader understandings of human behaviour. Staging and narrative techniques provide valuable contexts for research in cognitive science and neuroscience. The formalisation of montage theory, including the work of Eisenstein, has informed computational approaches to narrative analysis and digital humanities research. Film directing demonstrates how complex creative, technical and human systems can be coordinated to communicate meaning and shape audience experience.

Cinematographer (DoP)	
Integrated Knowledge	Optics, photometry, colour science and the psychophysics of vision inform image creation and audience perception. Camera sensors, lens systems, lighting technologies and colour-management workflows support visual storytelling and visual consistency. Electrical load calculations, structural rigging and stabilisation mechanics enable the safe and effective operation of complex production environments. Exposure control, depth-of-field calculations, the inverse-square law and colour-space mathematics underpin technical image design and visual decision-making.
Human Capabilities	Visual literacy and aesthetic judgement in the creation of compelling screen imagery. Precision, attention to detail and informed decision-making under changing conditions. Collaboration across creative, technical and production teams to achieve a shared visual vision.
Innovation & Transformation	Creative demands for improved image quality and visual storytelling have contributed to advances in sensor technology, HDR imaging and colour-management systems. Innovations such as Steadicam, gimbal and drone-based cinematography have transformed image capture and enabled new creative and technical workflows. The evolving integration of digital imaging, virtual production and computational photography continues to expand the possibilities of visual storytelling.
Value & Impact	Advances in imaging technologies associated with cinematography have contributed to developments in scientific, industrial and medical imaging. Approaches to visualisation, perception and image design developed through cinematographic practice have informed wider developments in computational imaging and digital communication. Cinematography provides a powerful framework for exploring the relationship between perception, technology and visual communication.

Editing	
Integrated Knowledge	Perceptual continuity and meaning construction through juxtaposition, including concepts such as the Kuleshov Effect, inform editorial decision-making and audience understanding. Non-linear editing systems, codec architectures, and AI-assisted tools support the organisation, management and creative manipulation of media assets. Editorial workflows coordinate visual effects, colour grading, sound design and mastering through structured production pipelines and version-control systems. Timecode arithmetic, frame-rate conversion and temporal sequencing underpin the organisation and manipulation of moving-image content.
Human Capabilities	Critical judgement and decision-making in shaping narrative structure, pace and meaning. Pattern recognition and the ability to identify relationships across large volumes of material. Attention to detail, organisation and workflow management within complex production environments. Systems thinking that integrates narrative, technical and operational requirements into a coherent whole.
Innovation & Transformation	The development and adoption of non-linear, non-destructive editing transformed creative workflows and influenced software design across multiple sectors. Advances in AI-assisted editing continue to transform content discovery, media management and production processes. The increasing integration of editing, visual effects and virtual production technologies is reshaping post-production workflows and enabling new forms of creative collaboration.
Value & Impact	Editorial principles relating to continuity, sequencing and event segmentation have contributed to research in perception, cognition and narrative understanding. Computational analysis of temporal structures in film and video has contributed to developments in video summarisation, media analytics and machine learning. Editing provides a powerful model for understanding how meaning emerges through the organisation, interpretation and communication of complex information.

Visual Effects and Animation	
Integrated Knowledge	Physics-based simulation, including fluid dynamics, thermodynamics and motion systems, informs the creation of realistic and expressive visual environments. Anatomy, biomechanics and the study of movement underpin character animation and performance. Pipeline development, character rigging and distributed rendering rely on engineering principles that enable efficient and scalable production workflows. Linear algebra, differential equations, Bẽzier curves and Monte Carlo methods underpin simulation, rendering and animation processes.
Human Capabilities	Creative experimentation through simulation, modelling and visualisation. The ability to translate scientific and mathematical concepts into compelling visual experiences. Systems thinking that integrates creative intent, technical processes and production requirements.
Innovation & Transformation	The demands of visual effects and animation have helped drive innovations in graphics processing, rendering technologies and computational tools. Motion capture, photogrammetry and digital modelling have expanded creative possibilities and enabled wider applications across industry, research and education. The increasing convergence of visual effects, artificial intelligence and real-time technologies continues to transform contemporary screen production.
Value & Impact	Developments in rendering and simulation have contributed to advances in scientific visualisation and computational modelling. Motion capture technologies have informed applications in rehabilitation, sports science and human movement analysis. Techniques such as photogrammetry and digital reconstruction have supported work in heritage preservation, navigation and spatial documentation. Visual Effects & Animation provides a reference point for understanding how artistic, scientific and computational knowledge can be integrated to model, interpret and communicate complex ideas.

While the previous examples focused on four practices that make STEAM particularly visible, similar patterns of knowledge integration, capability development, innovation and impact can also be observed in sound design, production design and screenwriting.

STEAM education can lead to unexpected results. Developing creativity and out-of-box-thinking skills might bring breakthroughs in fields we did not expect. More holistic education will give everyone a better basic skill background that should make them more adaptable and resilient in this rapidly changing world. - Audrius Dambrauskas, LMTA

Learning should not be limited to theory or separated subjects. Instead, different fields such as science, technology, engineering, arts, and mathematics should be seamlessly integrated through practical activities. – Katrin Sigijane, Tallinn University BFM

It is also important to emphasise that making mistakes and experimenting are natural parts of the learning process. New ideas and solutions emerge when learners are encouraged to try and are not afraid of failure. In addition, considering the growing importance of neurodiversity (such as autism, ADHD, etc.), it is essential to highlight that the STEAM approach provides an effective way to create an inclusive and supportive learning environment. This approach considers individual differences and supports all learners according to their developmental level and existing skills. – Reeni Metsküla, Tallinn University

Making STEAM visible enables educators, institutions and policymakers to better understand how artistic, scientific, technical and production knowledge are integrated in practice. It also reveals the human capabilities that emerge through this integration, including creativity, critical thinking, collaboration, systems thinking and adaptability.

STEAM offers a way of thinking about education that reflects the interconnected nature of contemporary life. By bringing together different ways of knowing, STEAM can support richer learning experiences, more resilient educational systems and a deeper appreciation of the role of the Arts as an essential dimension of human understanding, creativity and flourishing.

3. PRACTICAL EXAMPLES OF STEAM IN ACTION

STEAM can be understood as a method or practice within artistic contexts because of its interdisciplinary nature, which is inherent to most art projects.

The processes of making, designing, storytelling, and technological experimentation do not align neatly with disciplinary boundaries, but instead operate through their interaction.

There are two directions within this process:
→ when STEM looks towards the Arts
→ when the Arts include STEM.

The question is not necessarily how STEAM should be applied in art education, but rather how it is already present within artistic practice itself. STEAM intervenes in almost all art projects through:
→ the instruments needed (photography, video or cinema cameras, computers to work with images, AI, XR, etc.);
→ the themes or ideas explored (the expanded field of art, where subjects other than art are incorporated into artistic practice);
→ the need for connection between art and life.

In this sense, STEAM exists almost "naturally" within contemporary artistic practice because interdisciplinarity is already part of the way art is produced, developed, and understood.

Some of the obstacles to STEAM practice and methodology are the current school structures and their division into specific study areas, each attached to particular spaces: laboratories, classrooms, studios, etc. To erase these frontiers and limits is to challenge a strong historical tradition. It requires articulation, shared installations and resources, and strong institutional support – not only to break down these barriers, but also to address the juridical and bureaucratic regulations through which schools operate. Furthermore, the criteria for funded projects often exclude the arts, reducing STEAM to STEM.

While the academics on this project frequently articulated STEAM in relation to pedagogy, institutional structures, and disciplinary frameworks, the student cohort tended to describe it through lived experience, creative practice, and personal development. This distinction does not represent a division, but rather a complementary set of insights, highlighting the multiple levels at which STEAM operates.

REFLECTIONS FROM PRACTICE

The narratives emerging from this Agora project draw on practice-based examples across film, animation, visual arts, and emerging media literacy. Across these disciplines, imagination, audiovisual storytelling, experimentation, technical systems, and communication operate simultaneously as a normal condition of practice rather than as separate activities.

Film production, for example, combines experimentation, technical design, creative decision-making, and quantitative calculation, while much of the knowledge involved is carried through practitioner experience rather than formal documentation. Because "art imitates life", these processes are understood as naturally interconnected. For some participants, this integration was also motivational, with one student describing how an early fascination with "real magic" evolved into a VFX career through technical and scientific learning. Artistic production often resembles scientific inquiry, involving cycles of observation, experimentation, reflection and refinement. Art and science can be understood as reciprocal ways of generating knowledge and understanding, each informing and enriching the other. Their value lies in the unique contributions they make individually and in the new forms of insight that emerge through their interaction. In emerging areas such as XR, games and interactive media, the integration becomes even more pronounced, requiring the coordination of computational systems, interface design, narrative construction, and embodied experience. Here, art and technology are experienced not as separate domains, but as deeply interconnected in practice.

→ 'A' STANDS FOR HUMANITY

By Mah Ziaei

When we talk about STEAM, we first need to look at what we actually mean by "A" for Art. Unlike Math or Tech, Art is naturally ambiguous, fluid, and hard to define. It can take many shapes and forms - from logical and practical design to the fully conceptual. From a traditional STEM perspective, Art is often seen as a tool, an add-on decoration, or in the best-case scenario, it acts as a high-potential creative language used to communicate ideas and knowledge in a more engaging and impactful way. Essentially, it's seen as being in service of STEM. But as a conceptual artist who experiences art through the senses, emotion, intuition, and ethics, I want to argue that the "A" should be considered way beyond an aesthetic tool. Art is a unique mindset, an attitude, and a way of being. It is not only equally important as the other components of STEAM; it is the essential base and ground. It is the existence of humanity behind any STEM narrative.

→ 'A' AS AN ACT OF RESISTANCE

By Bigyan Sapkota

"Art is not a late addition to the human repertoire, and the work of art, its making and uses, belongs to our basic character as human beings." As Alva Noe suggests, art is part of human beings. Our natural instincts drive us towards art. The other natural instinct that transforms into a pattern is habits. We, humans have set patterns of doing things in a certain way in our life that gives a certain outcome. This activity dictates our life; the way we talk, walk, and eat is an organized habit. And the act of breaking the patterns and creating something out of it is art. For instance, dancing disorganizes the meaning of walking and bodily movements. The resistance in the set pattern gives a different outcome and meaning, creating art. STEM is also bound by systematic patterns. The advances in technology and science have made human beings more dependent upon their habits and have formed a set pattern. This has made us delve deeper into the reality of STEM, but in the meantime, it has limited our instinct towards breaking patterns. Art in STEAM acts as a resistance to break the systematic thinking towards something free and fluid. That transcends STEM to STEAM, a more free-flowing state, where human instincts are still valued and the nature of being a human prevails.

The camera team rehearses a complicated move called a "zolly" which incorporates a zoom operated by the DoP, a dolly operated by the dolly grip, and a focus pull operated remotely by the focus puller. Each member of the team is sensitive to the other's movements and operates their own aspect accordingly. These kinds of movements demonstrate that collaborative work isn't only intellectual collaboration but bodily collaboration which requires proprioceptive sensibilities. This embodied collaboration with other bodies and other technology is what contributes most to the learning which happens on these university film sets. – Patrick Gregg, MA by Research, IADT

GIVING THE YOUNG GENERATION THE CHANCE TO BE PREPARED FOR THE FUTURE

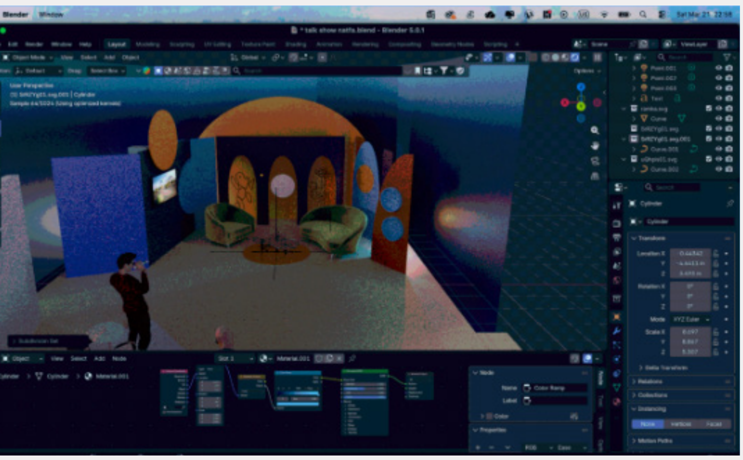
I've been thinking about STEAM mostly through my own work and teaching, not just as a concept. For me, working as a production designer and with visual effects – there's a scientific and technical side – but at the end of the day, everything has to serve the story and the emotion; you're always balancing between precision and creativity. When I teach, I notice that students don't just learn tools – they learn how to think in systems. Even creating a simple scene means thinking about how different elements work together, both technically and visually. That's why I see STEAM more as a way of thinking rather than just a combination of disciplines. For me, the potential of STEAM is in creating spaces where these different ways of thinking actually interact more deeply – like collaborations between artists and people from more technical fields, or new ways of teaching that don't separate them so much. – Yoann Stoev, PhD Student, NATFA

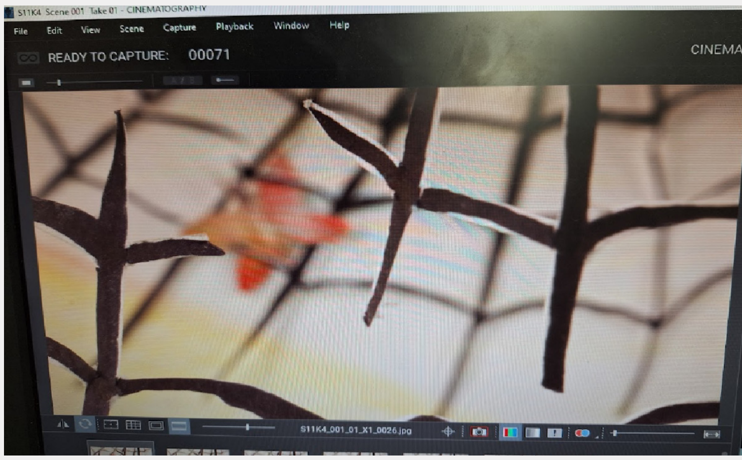
TO LEARN NEW THINGS, TO SEE MANY NEW POSSIBILITIES NEVER SEEN BEFORE

As an Animator: Science is important, because animators should be very informed in the laws of physics, plastic anatomy of both humans and animals, basic principles of human behaviour and psychology. *Technology* and *Engineering* serve as enabling tools in animation practice, with software such as Adobe After Effects and DaVinci Resolve helping to support the animator's creative process. *Mathematics* is a big part of animation, useful for calculations of a frame rate, timing and spacing.

As an Educator: When the students have problem with something technical (problem with tripods, magic arms, cameras, lighting or mathematical (e.g. calculation of frame rate), we can use all the STEM disciplines as a useful tool to find solutions. A creative idea may come from every single one of those disciplines.

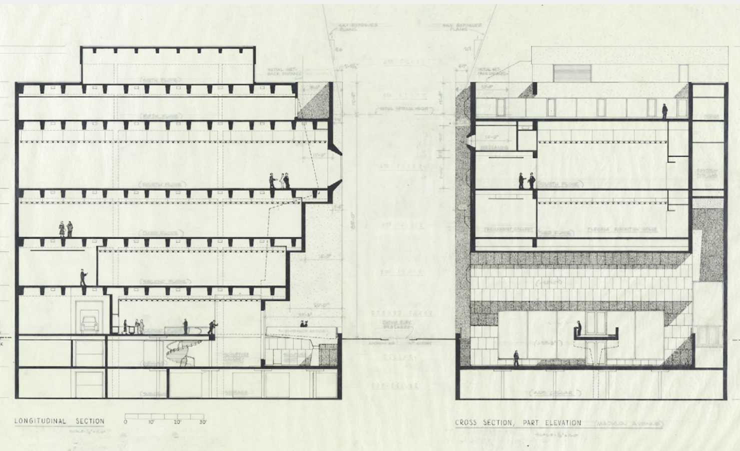
- Kristian Zahariev, PhD Student, NATFA





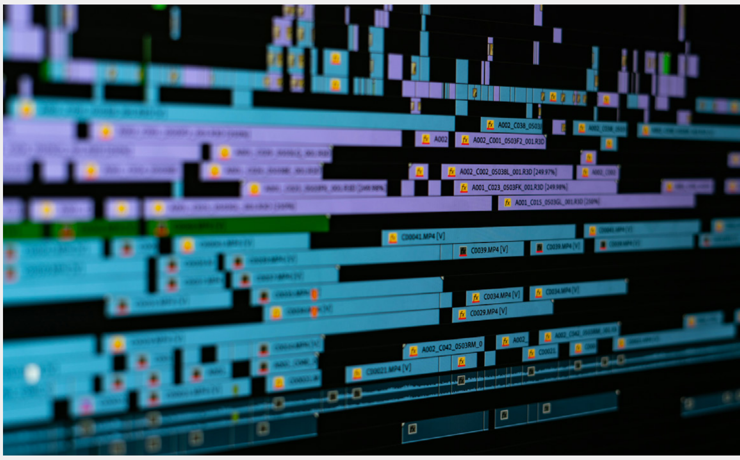
STEAM IN FILM EDITING AND FILM CONSUMPTION

I would argue that my course is an example of STEAM education under the radar. Documentary editing, my personal area of focus, involves constant experimenting and testing, and it also concerns actual sciences such as colour science when it comes to manipulating the image. Editing requires appropriate technologies and the editor's knowledge of them, who applies engineering thinking to construct the timeline, the visual representation of the building blocks of the film. Mathematics is present at every step of the process, from setting frame rates and aspect ratios to modifying visual and sound effect parameters.



Building Plan by Marcel Breuer, 1963

Furthermore, the audience is engaging in STEAM, too, although unknowingly, when consuming video content. They are forming opinions about the piece's artistic value while also paying attention to technical factors such as image quality and dialogue clarity. Recognising more conventional instances of STEAM, like filmmaking and film-watching, could help challenge the traditional divide between the arts and sciences. – Margareta Trapp, Television BA (Hons), IADT



Timeline in Video Editing Application
*(Photo by **Skye Studios** on **Unsplash**)*

Artists can have proficiency in specific techniques and digital media tools, but their work does not exist only to serve a function. The artwork must persist as a territory of beauty, including poetic and aesthetic visions, as well as technical knowledge. In this sense, STEAM, as a methodology already inherent to artistic practice, reinforces an ancient belief that artists are complete human beings. Their work is often led by a "need to do", by faith, intuition, or necessity, and even within research groups their impulse towards beauty is evident and goes beyond pure technique. This is why Art Schools remain important and must continue in deep dialogue with other areas. They allow artists to participate in interdisciplinary projects while ensuring that an essential part of what it means to be human persists – or resists.

4. EXAMINING THE TENSIONS OF STEAM

STEAM education offers a strategic framework for addressing complex societal, ecological, and technological challenges through collaboration across the arts, sciences, engineering, and humanities. Yet beneath these ambitions lie unresolved tensions over the role of the arts, the meaning of collaboration, the nature of knowledge, and the purpose of cross-disciplinary artistic practices.

Rather than attempting to resolve the tensions inherent in STEAM, this position paper argues that they should be understood as productive forces that can help shape more reflective, inclusive, and transformative STEAM approaches.

Tension 1 – Instrumentality versus Intrinsic Value

A central tension within STEAM concerns whether the arts are included primarily to support innovation or recognised as autonomous forms of knowledge production in their own right.

How can the arts contribute to interdisciplinary work without being reduced to a service role?

The example of the Royal College of Surgeons in Ireland concerns the teaching of doctors through the analysis of multimodal cardiovascular imaging, electrocardiography, biomechanical modelling of structural heart disease, medical education through simulation, and narrative medicine. These hybrid environments, where visualisation plays a fundamental role, prepare doctors for real clinical practice. Creating simulations and simulated situations helps young doctors to become better prepared and more self-confident when facing real-life scenarios. At the same time, the construction of these scenarios – including the creation of images, immersive environments, and narrative structures (storytelling) – also belongs to the domain of the arts.

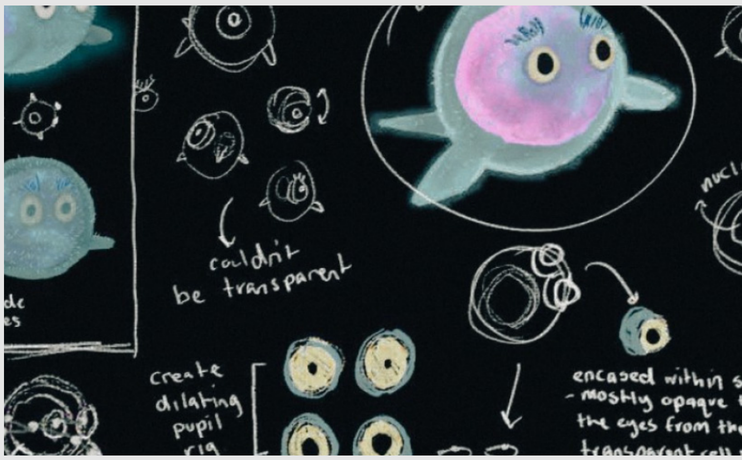
STEAM should move beyond understanding the arts as supportive instruments and instead recognise artistic practice as a distinct epistemic partner, capable of reshaping how innovation, evidence, and impact are understood, constructed, and defined.

Tension 2 – Integration versus Difference

Meaningful transdisciplinary work may depend precisely on the persistence of difference. Disciplines carry different assumptions, languages, temporalities, and methods. When these differences are flattened too quickly, collaboration risks becoming superficial and homogeneous.

Should STEAM aim to dissolve boundaries or to stage encounters where differences matter?

Case study: Professor Rachel Landres, The University of Technology, Sydney. The purpose of this research project, is to teach young children about health, ecology, and other scientific subjects. Digital animation is used as a storytelling resource, allowing the creation of informative short films with characters that connect to children's imagination. In this way, children are encouraged to become curious about issues that relate to real-life problems and situations, motivating future interest in science. However, although digital animation is fundamental to the project's visual storytelling and communication, the animator could not be formally included in the project team because the funding criteria excluded the arts. This reveals a contradiction within many STEAM-related projects, where artistic practices are essential to the methodology and impact of the work, while still remaining institutionally marginalised.



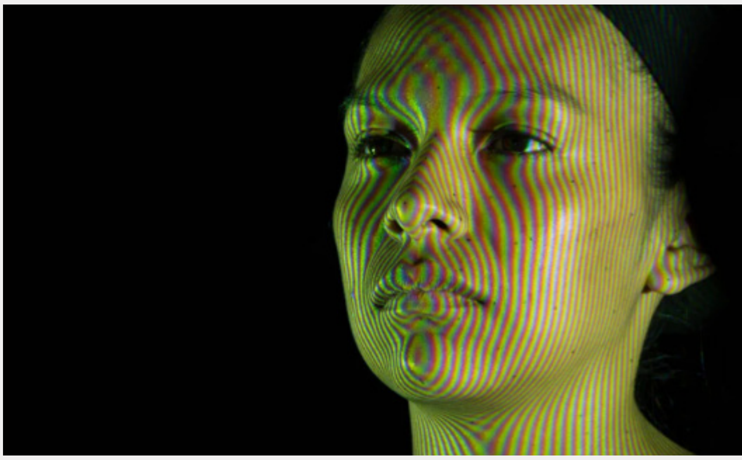
Rather than aiming for seamless integration, STEAM can be reframed as a space of productive difference in which disagreement, friction, and disciplinary specificity are treated as essential conditions for innovation and learning.

Tension 3 – Problem-Solving versus Problem-Posing

STEAM is often associated with solving wicked problems and societal challenges, such as climate change, migration, and social cohesion. Yet artistic practices often operate differently, questioning how problems are framed in the first place rather than delivering solutions.

Is the role of STEAM to solve predefined problems or to help question critically how problems and worlds are (de)constructed?

Carne y Arena is a virtual reality installation created in collaboration with cinematographer Emmanuel Lubezki and ILMxLAB, centred on the experiences of Mexican and Central American refugees crossing the US border. Iñărritu waited ten years for technology to catch up to his creative vision – wanting to dissolve the frame of cinema entirely and place the viewer physically inside the story. The project required advanced VR engineering, spatial audio design, motion capture, and real-time rendering, all in service of a deeply human narrative. It was awarded a special Oscar statuette by the Academy of Motion Picture Arts and Sciences for visionary and powerful storytelling. As a STEAM example it is particularly relevant to film students: it shows how technology does not replace cinematic art but can radically expand what storytelling is capable of.



CARNE y ARENA, 2017 – Selena, a mother from Guatemala, has her image digitally recreated

STEAM should be reframed beyond a purely problem-solving paradigm to one that equally values problem-posing, placing its capacity to question assumptions, reframe issues, and generate alternative understandings of societal challenges at the forefront.

Tension 4 – Competence versus Becoming

European educational and competency frameworks often emphasise measurable standards, transferable skills, and competitiveness. While these dimensions are important, the arts and higher arts education often foreground critical reflection, transformation, experimentation, and personal development. Not all meaningful learning outcomes or work performances can be predefined or quantified.

Can multidisciplinary work in STEAM be framed beyond measurable competencies and outputs towards transformative processes of becoming?

The HEALING NATURE project. "This project demonstrates the power of displaying nature/soothing elements of the environment, through various media in hospital spaces, to support the mental, physical and spiritual health of the individual and the hospital community. Most of the artwork in hospitals is traditional murals, paintings and sculptures". The project adds interactive experience using augmented reality with animated content, to ensure a pleasant and calming hospital environment that also provides a soothing and distracting experience for children.

STEAM should move beyond a narrow focus on competence acquisition and instead support a broader understanding of education and work as processes of becoming differently in relation to others, technologies, ecologies, and society.

EMERGING TENSIONS

What should STEAM look like if it accounted for non-human agencies such as materials, ecologies, and technologies in a profound way?

Most innovation frameworks remain fundamentally human-centred, focusing on human needs, experiences, and benefits. Posthuman and ecological perspectives challenge this orientation by emphasising that humans are always entangled with technologies, materials, ecologies, and non-human forms of life. STEAM offers opportunities to rethink design, development, and innovation beyond anthropocentric assumptions.

STEAM should move toward a more-than-human relationality, where innovation is understood as an ecological and ethical practice that recognises the agency of environments, materials, technologies, and non-human actors.

How can a European STEAM framework remain open to local, situated practices without collapsing into fragmentation?

European Universities and transnational initiatives often seek harmonisation, scalability, and shared frameworks. However, artistic and cross-disciplinary practices are deeply situated in local histories, cultures, and material realities. Excessive standardisation can suppress contextual sensitivity and experimentation.

STEAM can be reframed through the notion of situated plurality, which means that collaboration across Europe does not require uniformity, but rather the ability to connect diverse local practices while respecting contextual specificity.

How can STEAM acknowledge and work with power asymmetries rather than masking them?

Interdisciplinary collaboration is often characterised as horizontal and equal. In practice, however, disciplines do not enter partnerships with the same institutional authority, access to funding, or epistemic legitimacy. STEM fields frequently dominate decision-making, while artistic contributions risk being reduced to symbolic additions.

STEAM should acknowledge collaboration as a process of negotiated asymmetry. Rather than assuming equality already exists, it should create transparent processes for addressing power relations, redistribution, and differing forms of authority.

Can STEAM merge from an innovation paradigm towards a care paradigm?

Contemporary innovation discourse often prioritises disruption, acceleration, and growth, while artistic and ecological perspectives foreground care, repair, and responsibility. STEAM challenges innovation models driven solely by speed, calling instead for more sustainable and liveable futures.

STEAM should be reframed around ecologies of care, where innovation includes maintenance, stewardship, collective responsibility, and long-term impact.

By embracing tensions as generative enables STEAM to evolve into a more critical and responsive framework. It enables institutions to question dominant narratives of innovation, foreground alternative epistemologies, and develop practices attuned to complexity, uncertainty, and relationality.

For European Universities, this implies a shift from integration to negotiation, from solutions to questions, and from outputs to processes. In doing so, STEAM can move beyond policy rhetoric and become a space for reimagining knowledge production, collaboration, and societal engagement.

Ultimately, the challenge is not to resolve tensions, but to design educational, institutional, and research environments capable of sustaining them.

5. A STEAM STRATEGY: LET'S PLAY!

As previously outlined, STEAM should not be understood as STEM expanded by the Arts, but as a purpose-built knowledge infrastructure designed around the equal interdependence of scientific, technical, artistic, embodied, ecological, and social ways of knowing.

To move our strategy into practice, we designed the STEAM Connection Game – a facilitated workshop where students and educators address the inherent tensions of STEAM. The game will try to facilitate an approach where we make STEAM into a living, negotiated practise. A tool for action that drives organisations toward forming a dynamic vision for their STEAM approach.

This game facilitates STEAM as a distinct epistemic architecture – one where knowledge is shaped through exchange, interpretation, and collaboration across disciplines, rather than inherited through hierarchical structures. Here, narrative, ethical reflection, and systems imagination are foundational to innovation, aligning technical knowledge with social relevance, cultural meaning, and civic impact.

STEAM's power lies in its unresolved tensions (e.g., instrumentality vs. intrinsic value, problem-solving vs. problem-posing). **The STEAM Connection Game** does not resolve these tensions but surfaces and navigates them, turning friction into a productive force for learning and collaboration.

The STEAM Connection Game

The STEAM Connection Game is not a supplementary teaching aid but a structured pedagogical instrument for enacting, observing, and refining STEAM in real time. It creates a repeatable test environment where participants:

→ Navigate the interplay of all five STEAM disciplines.
→ Surface disciplinary biases and assumptions.
→ Examine how authority and meaning are constructed across different ways of knowing.
→ Reflect on the 4 tensions of STEAM as they emerge during play.

By making STEAM observable in practice, the game provides an evidence-led basis for designing more integrated, adaptive, and reflexive learning systems. In doing so, it offers more than engagement: it provides a live method for testing the mechanics of integration itself. The game becomes both studio and scaffold – a repeatable environment in which new pedagogical models can be prototyped, evaluated, and brought into sharper focus.

> **Empowering young people to construct a team and follow through from the expression to the implementation of an idea, gaining the confidence to speak up and engage with the world, and to communicate through a variety of new media visions of social change is part of the solution. These competencies will transform students into leaders and entrepreneurs capable of making their mark in technology and other industries. The capability of a non-profit to develop a rigorous after-school program, led by experts who also serve as mentors, and which exposes young people to industry opportunities, expectations, and soft skill requirements sets the stage for the kind of STEAM workforce development the economy needs.** – Bass, Hu Dahl, & Panahandeh, 2016

Game Design

The game has four phases (Ideate, Merge, Narrate and Mapping) that mirror the real-world challenges of interdisciplinary work:

IDEATE | MERGE | NARRATE | REALISE

→ In the **Ideate** Phase, players generate ideas within their discipline, often revealing Tension 1 (Instrumentality vs. Intrinsic Value) – e.g., does the Art team see their role as 'making Science look good' or as equal partners?
→ The **Merge** Phase forces negotiation between disciplines, surfacing Tension 2 (Integration vs. Difference) – e.g., should Engineering and Art compromise on a shared solution, or maintain distinct approaches?
→ The **Narrate** Phase encourages players to trace a path through the merged ideas, highlighting Tension 3 (Problem-Solving vs. Problem-Posing) – e.g., does the solution address the original problem, or does it reframe the problem entirely?
→ The **Mapping** Phase is where the involved students focus on the path ahead. With a focus on Tension 4 (competence and becoming) the student will review their current competencies and identify the gaps in knowledge they need to fill before they can start realizing their project.

The initial task must be set in such a way that it involves students in a detailed review of their current knowledge of the topic and the background to the problem, or familiarising themselves with existing scientific sources. Then, through design thinking and problem-solving learning, they set their own goals and decide which activities and new skills they need to learn and will use to achieve them. By making these tensions explicit and actionable, the game becomes more than a teaching tool, it is a research instrument for understanding how STEAM can thrive in higher education.

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STEAM, in this context, is not only about acquiring technical or scientific knowledge, but about designing systems that support human behaviour, well-being, and intrinsic motivation. The technology becomes a facilitator, not the focus. Games and digital tools can encourage autonomy, discipline, and self-awareness rather than undermine them. When thoughtfully designed, STEAM-based applications can bridge theory and practice, turning abstract ideas about motivation, psychology, and technology into tangible, everyday progress. I see technology not as an escape from reality, but as a structured pathway back into it. - Margus Lovi, BA Integrated Art, Music & Multimedia, Tallinn University

Institutional and Industry Value

The strategic value of this model extends beyond the workshop environment. **Within higher education**, it offers a practical mechanism for rethinking curriculum design, interdisciplinary assessment, staff development, and collaborative learning across institutional boundaries. By making STEAM observable in practice, the model provides an evidence-led basis for designing more integrated, adaptive, and reflexive learning systems.

For industry, the value lies in the cultivation of graduates better equipped to work across complexity: individuals capable not only of technical competence, but of interpretation, ethical judgement, systems thinking, and collaborative problem framing. These are increasingly critical capacities in environments shaped by uncertainty, accelerated innovation, and social accountability.

At institutional and policy level, the model offers a scalable framework through which STEAM can move from strategic rhetoric to applied method. It provides higher education and industry with a shared lens through which interdisciplinary learning can be tested, evidenced, and developed – not as an abstract ideal, but as a practical infrastructure for future-facing innovation.

Conclusion

This paper has explored how STEAM is understood, experienced, and enacted across the FilmEU alliance through a collaborative process that foregrounds practice, dialogue, and multiple perspectives. In doing so, it has examined the relationship between established educational frameworks and the realities of interdisciplinary work. Returning to the initial provocation, the question is not whether the arts should be added to STEM, but how education might more accurately reflect the processes through which knowledge is already produced. This requires a shift in perspective: from implementation to alignment, from classification to practice, and from separation to connection.

STEM, as it operates within European policy, provides a clear and influential framework aligned with economic priorities, technological development, and workforce needs. STEAM, as it has emerged through research and practice, offers a broader articulation that recognises the role of creativity, interdisciplinarity, and social context.

The value of STEAM lies not in the inclusion of additional domains, but in its capacity to make visible the relationships between different forms of knowing and doing – relationships that are grounded in practice, shaped by collaboration, and informed by lived experience. STEAM points toward future-oriented forms of learning that emphasise adaptability, creativity, and the capacity to engage with complexity, supported through approaches such as interdisciplinary collaboration, experimentation, and inclusive learning environments.

STEAM must be understood as a way of recognising the processes through which learning already occurs. These processes involve the interplay of imagination, experimentation, articulation, and communication, and are evident across both artistic and scientific contexts. What varies is not their presence, but the extent to which they are acknowledged and supported within educational structures.

Ultimately, the contribution of this paper is not to define STEAM, but to re-situate it. By drawing on the narratives emerging from the FilmEU Agora, it has shown that STEAM is less a new development than a re-articulation of existing conditions. The next task is to build collectively on what is already visible in practice, developing educational structures that actively support and sustain integrated and evolving forms of learning.

Taken together, these insights position STEAM not as a fixed model, but as a lens through which to understand the evolving relationship between knowledge, practice, and education. The next task is to build collectively on what is already visible in practice, developing educational structures that actively support and sustain integrated and evolving forms of learning.

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