INTEGRATING STEAM IN
TEACHER EDUCATION

Insights from a
Finnish-Uruguayan
Collaboration

The Finnish-Uruguayan partnership for fostering STEAM approach in teacher education (the FinnUruSTEAM project)

Integrating STEAM in Teacher Education: Insights from a Finnish-Uruguayan Collaboration

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WELCOME
MESSAGE

The Finnish-Uruguayan partnership for fostering STEAM approach in teacher education (FinnUruSTEAM 2023-2025) is a collaborative initiative between the University of Eastern Finland, University of Jyväskylä, and University of the Enterprise in Uruguay. Supported by the Finnish National Agency for Education through the Team Finland Knowledge program, the project aimed to integrate STEAM (Science, Technology, Engineering, Arts, and Mathematics) approaches within teacher education programs in both Finland and Uruguay.

By leveraging the expertise and experiences of teacher educators from Finland and Uruguay, the project sought to develop innovative STEAM-oriented teaching and learning practices suited for diverse educational contexts. Through international joint workshops, networking activities, and the exchange of best practices, the FinnUruSTEAM project generated a wealth of insights, which are now shared in this publication.

While the value of STEAM education in preparing students for the demands of the 21st century is widely acknowledged, its integration in teacher education remains challenging. Common barriers include siloed curricula and limited resources. In response, our collaboration explored possibilities within our institutions and national contexts to support teacher educators and policymakers in their efforts to cultivate teachers' competencies in STEAM approaches.

[1]This publication brings together key reflections and practical insights from our joint efforts. Our goal is to deepen understanding of effective strategies for integrating STEAM approaches in education and to offer a resource for educators committed to nurturing STEAM-literate teachers.

Check out our project page!

1 https://uefconnect.uef.fi/en/the-finnish-uruguayan-partnership-for-fostering-steam-approach-in-teacher-education/

On the behalf of the entire
FINNURUSTEAM PROJECT TEAM

We hope the insights shared in this publication will inspire and empower teacher educators around the world to further integrate STEAM approaches into their study programmes. To find out more about the outcomes of the FinnUruSTEAM project, we encourage you to visit the project website. There, you will find a collection of webinar recordings featuring STEAM initiatives of the project partners. We invite you to engage with these resources and join us in an ongoing exchange of ideas and best practices as we collectively continue work towards strengthening STEAM education worldwide.
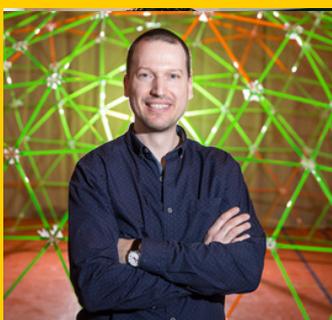

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FRAMING STEAM IN THE PROJECT

As part of the FinnUruSTEAM collaboration, we have engaged in various activities to explore and advance STEAM approaches in education. One of these has involved working toward a shared understanding of how STEAM can be interpreted and applied across different educational contexts. At its core, STEAM refers to an integrative approach to teaching and learning encompassing Science, Technology, Engineering, Arts, and Mathematics. Yet, its definition remains fluid, and interpretations vary widely.

In this project, we frame STEAM as a continuum of pedagogical approaches that integrate multiple disciplines to collaboratively address real-life problems. Each discipline contributes its own conceptual frameworks, methodologies, and modes of communication, with clearly defined educational objectives. This contrasts with more limited forms of integration, where often one discipline leads and others play a supporting role.

STEAM encourages learners to see that real-life phenomena are rarely confined to a single discipline. Instead, they often require multiple, overlapping and complementary perspectives to be understood and addressed purposefully.

In practical terms, a STEAM approach begins with the definition of a scenario, i.e., a problem or challenge to be explored. Ideally, these scenarios are based on relevant, real-world phenomena that demand insights from several disciplines. They should be concrete yet malleable, allowing for authentic, integrative inquiry that embraces complexity.

Teachers and students are encouraged to co-create and investigate these scenarios together. The problems or challenges are designed to create productive tension, sparking curiosity and inquiry. They are open-ended, without predetermined solutions, and gain depth when situated at the intersection of disciplinary rigor and the social-emotional engagement of the learning community.

FRAMING STEAM IN THE PROJECT

Depending on the context, meaningful STEAM scenarios may also incorporate ethical considerations, sustainability issues, and their social significance further enriching the learning experience and connecting it to broader societal challenges.

In the following section, we turn our attention to the integration of disciplinary perspectives within STEAM education. Building on the framing of STEAM as a continuum of pedagogical approaches, we explore how educators can thoughtfully navigate the distinct characteristics of different disciplines.

Photograph by Niko Jouhkimainen

Key Takeaways

FRAMING STEAM IN THE PROJECT

STEAM is framed as a continuum of pedagogical approaches integrating multiple disciplines.

Real-life scenarios serve as starting points for inquiry and collaboration.

Effective STEAM learning involves co-creation, complexity, and relevance.

Ethical, social, and sustainability dimensions enrich STEAM scenarios.

INTEGRATING DISCIPLINARY PERSPECTIVES IN STEAM

Integrating disciplinary perspectives in STEAM education requires both flexibility and a commitment to disciplinary depth. Disciplines differ in how they approach knowledge—through their questions, processes, learning environments, and expected outcomes. Meaningful integration involves navigating these differences thoughtfully and reflectively. It's not just about combining content, but about engaging with the distinct ways each discipline contributes to understanding and learning.

STEAM approaches call for a thoughtful examination of how knowledge and skills are understood across different disciplines and contexts. This includes reflecting on what kinds of knowledge are considered valuable and recognizing the diverse ways of knowing that students and collaborators bring to the learning process. Integration, therefore, involves not only disciplinary content but also perspectives on knowledge, ensuring that all contributions are acknowledged and respected.

Beyond learning environments that often focus on structured, discipline-specific settings such as laboratories, classrooms, or controlled experiments, STEAM approaches embrace a diverse range of settings. These include museums, community spaces, and digital platforms, and opportunities for authentic, creative productions such as art installations, speculative future scenarios, and explorations of socio-scientific controversies. Such environments support interdisciplinary inquiry and foster engagement with complex, real-world issues.

Working across diverse learning environments naturally invites collaboration with different kinds of experts. For this collaboration to be meaningful, educators and experts must be open to seeing themselves as learners. When they work together, they model the kind of collaboration that STEAM education thrives on: one built on communication, trust, and mutual respect. By taking on the dual role of facilitator and co-learner, they demonstrate the skills and attitudes needed for working across disciplines in a way that is authentic and inclusive.

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STEAM outcomes may include science fairs, engineering prototypes, or mathematical models that demonstrate technical proficiency and problem-solving. These outcomes are typically rooted in inquiry-based learning and real-world problem-solving, where students integrate artistic and humanistic perspectives to deepen their understanding and engagement. Rather than being predetermined, these outcomes emerge in unexpected ways.

STEAM approaches foster open-ended, exploratory, and interconnected learning experiences. This encourages learners to engage with complex issues from multiple disciplinary angles, ultimately cultivating a more holistic and integrative understanding. This flexibility to incorporate a range of inquiries allows educators to design learning experiences that are responsive to diverse learners. Moreover, it allows aligning learning with curricula emphasizing 21st-century skills and competencies—such as creativity, collaboration, and critical thinking. STEAM practices actively support the development of these while remaining grounded in discipline-specific knowledge and skills. This integrated approach ensures that STEAM initiatives support both practical skill development and deep conceptual understanding, enabling meaningful and sustained engagement.

By embracing the diversity of disciplinary perspectives in STEAM, educators can create engaging, relevant, and interdisciplinary learning experiences that empower students to tackle complex real-world challenges.

Having considered the importance of integrating diverse disciplinary perspectives, we now turn to the role of purposeful practice in STEAM education. This next section explores how hands-on activities, when guided by clear learning objectives and reflective inquiry, can deepen conceptual understanding and support meaningful, integrative learning experiences.

Key Takeaways

INTEGRATING DISCIPLINARY PERSPECTIVES IN STEAM

Meaningful integration requires respect for disciplinary depth and diversity.

Educators should reflect on varied ways of knowing and valuing knowledge.

STEAM embraces diverse learning environments beyond traditional settings.

Collaboration with experts models inclusive and authentic learning.

PURPOSEFUL PRACTICE IN STEAM

STEAM approaches often involve hands-on learning in various forms. These activities powerfully connect conceptual understanding with practical processes, but only when guided by a clear sense of purpose. To design meaningful STEAM experiences, educators need to stay mindful of both the learning objectives and the intentionality behind each activity.

Balancing purposeful practices is key to designing effective and reflective STEAM learning environments. Knowledge and skills do not develop in isolation—they emerge through a dynamic interaction between hands-on activities and conceptual understanding. This connection is strongest when learning is built around intentional scenarios that support inquiry and integrate both elements seamlessly. If conceptual learning is emphasized too heavily, students may focus on finding expected answers, and the deeper learning process may go unnoticed. Conversely, if practical activities dominate, learners might become absorbed in the doing, while reflection on conceptual learning fades into the background.

To support robust learning, educators need to find a balance between engaging activities and thoughtful reflection. Experimentation should be guided by clear learning goals, not just an activity for its own sake. Real-world problems offer a powerful foundation for STEAM learning, but they need to be aligned with curriculum content and learning objectives to ensure relevance and depth.
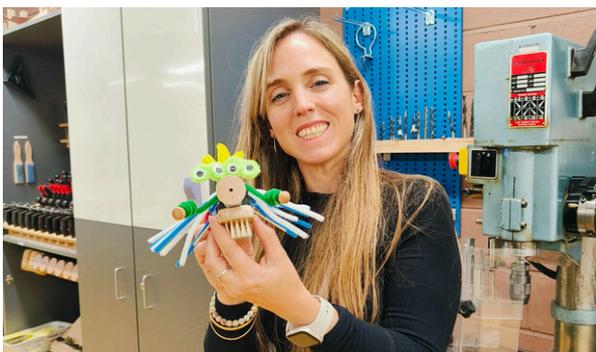
Incorporating intentional moments of reflection throughout the process can significantly enhance STEAM experiences. These moments highlight and give value to students' cognitive engagement and insights, making the learning process more visible and meaningful. By explicitly promoting students' metacognitive awareness across disciplinary boundaries, educators can foster deeper understanding and support pedagogically robust learning.

Building on the importance of intentional design and clear learning objectives, the final section of this publication turns to the role of assessment in STEAM education. It explores how collaborative, transparent, and integrative assessment practices can support deeper learning and reflect the interdisciplinary nature of STEAM.

Key Takeaways

PURPOSEFUL PRACTICE IN STEAM

Hands-on activities must be guided by clear learning objectives.

Balancing conceptual understanding and practical engagement is essential.

Real-world problems should align with curriculum goals.

Reflection and metacognitive awareness enhance learning across disciplines.

ASSESSMENT IN STEAM CONTEXTS

In the context of STEAM education, assessment presents both unique challenges and valuable opportunities, especially when implemented collaboratively by multiple educators. It requires more than simply adapting traditional disciplinary assessment practices: it calls for a shared understanding of the STEAM approach being applied and the criteria that reflects its integrative nature.

To support this, targeted professional development is essential. Training initiatives should bring together educators from diverse disciplines to foster dialogue, build consensus on integrative methodologies, and co-develop appropriate assessment criteria. This collaborative foundation ensures that assessment practices align with the principles and goals of STEAM education.

In keeping with the practices of purposeful STEAM education, educators should be transparent about assessment with students. This means clearly articulating learning objectives and inviting students to participate in defining how their learning will be assessed. When students understand what is expected and are involved in shaping the criteria, they are better equipped to reflect on their own learning process and engage more meaningfully.

Assessing each discipline in isolation can undermine the goals of integrated learning. To truly support the complexity of STEAM education, assessment needs to take a holistic approach: one that captures how students connect ideas and apply knowledge across different disciplines. Rather than focusing on isolated facts or discipline-specific outputs, assessment should reflect how students understand, represent, and transfer key concepts in meaningful ways as well as synthesize perspectives, solve problems collaboratively, and contribute to shared outcomes.

In project-based learning, for example, the emphasis should be on how students combine their skills and knowledge to design or create something relevant, rather than focusing solely on individual contributions. By aligning assessment with the integrated and inquiry-driven nature of STEAM, educators can better support deep learning and authentic engagement.

Key Takeaways

ASSESSMENT IN STEAM CONTEXTS

Photographs by Niko Jouhkimainen

Assessment in STEAM requires shared understanding and collaborative design.

Professional development supports integrative assessment practices.

Holistic assessment captures synthesis, collaboration, and real-world application.

Transparency and student involvement strengthen assessment relevance.

Aligning assessment with STEAM principles supports deeper and more authentic learning.

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STEAM PEDAGOGY IN COLLABORATION

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