

STEAM
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STEAM Education



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Introduction to STEAM Approach

STEAM → Science, Technology, Engineering, Arts, and Mathematics

New **transdisciplinary perspective**

Integrates the humanities approach into the classic STEM approach

The arts integrate with traditional disciplines to enhance creative aspects and go beyond the boundaries of the classic STEM approach

The STEAM method arises as an evolution of the STEM model, created to respond to labor market needs

The introduction of the arts represents a step forward in promoting a broader and more creative vision in problem-solving

The STEAM approach finds applications not only in the educational context but also in business, artistic, and technological fields.



What is the STEAM Approach?

The **arts** stimulate lateral and creative thinking, supporting the development of innovative solutions

By involving the arts, inclusivity and understanding of different cultural perspectives are encouraged

The arts contribute to making the learning process more interactive and engaging, enhancing the experiential aspect

Encouraging **divergent thinking** alongside standard convergent thinking

Creativity improves:

- Stress management and increased self-efficacy
- Social skills (communication, teamwork, trust among team members, autonomy, engagement)
- Satisfaction and retention

In addition to vertical knowledge, students develop skills in **negotiation** and **problem-solving**

Activities such as documentation, drawing, and even physical activity are encouraged

Students play an active and important role in the learning process



Students' Perspective

The STEAM approach fosters the development of a growth mindset, where **mistakes are seen as learning opportunities**.

It increases students' autonomy, enabling them to manage their own learning process independently.

It enhances **multitasking skills** and the **ability to adapt to variable and complex contexts**, better preparing them for future work life.

Students are encouraged to:

- solve their own problems
- build communities (even outside the classroom)
- be open-minded
- trust one another and manage conflicts
- value diverse knowledge within student teams

Self-reflection is also an important part of the learning process



Teachers' Perspective

Teachers come from diverse disciplines

The success of activities depends on the enthusiasm and engagement of the teachers

Teachers assist in problem modeling by **encouraging reflection, communication, autonomy, and self-efficacy**

Teachers help students see problems as opportunities to be solved creatively and collaboratively as a team

Teachers must **overcome disciplinary barriers** and collaborate with colleagues from different sectors to ensure the effectiveness of the transdisciplinary approach.

Continuous training for teachers becomes crucial to correctly apply the STEAM method and stay updated on educational innovations.

Teaching according to the STEAM approach requires greater flexibility and the ability to **adapt lessons to** the needs of **students** and the context.



What are multidisciplinary, interdisciplinarity and transdisciplinarity?

Multidisciplinary, Interdisciplinarity, and Transdisciplinarity are essential for addressing complex challenges (climate change, global health crises, sustainable development, cybersecurity, urbanization...)

Integration of diverse fields (science, politics, economics, sociology...)

Understanding how to facilitate collaboration among different disciplines

Evolution of knowledge integration

- **Multidisciplinary**
Use of knowledge and methods from separate disciplines
Broad overview of the problem, integration not necessary
- **Interdisciplinary**
Disciplines interact and integrate
Combines methods to arrive at new solutions
- **Transdisciplinary**
Transcends disciplinary boundaries
Involves external actors beyond academia
Utilizes diverse methodologies and approaches



Importance and Benefits

Why is it important?

Modern problems require integrated action

- Multidisciplinarity: Diverse perspectives
- Interdisciplinarity: Synergies and innovative solutions
- Transdisciplinarity: Holistic and inclusive approach

Benefits

- Multidisciplinarity: Comprehensive view, Multiple perspectives
- Interdisciplinarity: Integrated knowledge
 - Innovative solutions
- Transdisciplinarity: Holistic approach
 - Broad engagement
 - Transcends disciplinary boundaries
 - Addresses complex problems with coordinated interventions



What means holistic?

The term "**holistic**" refers to considering the whole system rather than just individual parts. It emphasizes the interconnectedness and interdependence of elements within a system.

Interconnectedness

- All components are linked and influence each other.
- Changes in one area can impact the entire system.

Integration

- Focuses on the complete picture, integrating various perspectives and disciplines.
- Encourages collaboration across different fields.

Systemic Thinking

- Promotes understanding how elements work together to achieve common goals.
- Emphasizes balance and harmony within systems.



Practical Examples and Applications in Teaching - Transdisciplinarity

Community Technology Garden

- Science: Botanical knowledge
- Technology: Sensors and monitoring systems
- Engineering: Automated irrigation systems
- Art: Study of aesthetic and emotional impact
- Mathematics: Growth data analysis

Community Engagement: Participation of schools and residents

Involvement of all disciplines and local stakeholders to create a sustainable and integrated garden, with a holistic and inclusive approach.



From STEM to STEAM

From STEM to STEAM → Integrating the Arts (A) into Science, Technology, Engineering, and Mathematics (STEM)

Objective → Prepare students for the challenges of a complex and interconnected world

Expected Benefits → Promote creativity, innovation, and critical thinking



A in STEAM

Integrating the Arts into STEAM goes beyond adding decorations or superficial elements. It requires deep and meaningful integration

This approach enriches the learning experience and develops crucial cross-disciplinary skills, such as the ability to communicate complex ideas in a visual and engaging way.

Stimulating Creativity → The Arts provide a means to explore and experiment with different forms of expression, fostering creativity and innovation that are essential in the modern world.



Creativity as a Systemic Process

Holistic Approach:

Creativity is not just an individual trait but a dynamic interaction among three key components (Csikszentmihalyi view)

The Three Components:

1. The Individual:

- Personal qualities and intrinsic motivation drive creativity

2. The Domain:

- A structured body of knowledge that provides resources and boundaries

3. The Field:

- Societal gatekeepers who validate and influence the acceptance of creative ideas



Implications

Understanding Creativity:

- Collaborative Nature: Creativity thrives in social contexts, emphasizing collaboration over isolation.

Conditions for Flourishing Creativity:

- For Individuals: Access to learning and intrinsic motivation.
- For Domains: Flexibility and openness to innovation.
- For Fields: Cultural recognition and support for novel contributions.

Creativity is a collective process influenced by personal passion, domain expertise, and social validation.



Design check

Enriching and engaging approach for students

Objective → Share insights and tips on the design and effectiveness of STEAM activities

- Transdisciplinary Approach
- Inquiry-Based Learning
- Relevance to the Real World
- Collaboration and Communication
- Creativity and Innovation



Steps for designing and testing

1. Identification of Learning Objectives
2. Selection of a Relevant Theme or Problem
3. Planning for Interdisciplinary Integration
4. Detailed Development of the Activity
5. Piloting and Refinement Based on Student Feedback

Continuous Monitoring of Progress

Gathering Feedback and Challenges Faced

Collaboration in Learning and Additional Feedback

Adaptation of Future Activities Based on Experience



What is Project-Based Learning (PBL)?

PBL is an instructional approach that encourages students to learn by engaging in real-world projects.

Key Features:

- Student-Centered: Learners take an active role in their education.
- Inquiry-Driven: Projects start with a driving question that guides exploration.
- Collaborative: Students often work in teams, fostering communication and teamwork skills.
- Authentic Tasks: Projects are relevant and connected to real-life issues.



Benefits of PBL

Enhanced Learning Outcomes:

- **Critical Thinking:** Students develop problem-solving skills through hands-on experiences.
- **Engagement:** Increases motivation and interest in learning through relevant tasks.
- **Skills Development:** Fosters collaboration, communication, and self-management skills.

Real-World Relevance:

- **Application of Knowledge:** Students apply theoretical concepts to practical situations.
- **Preparation for the Future:** Builds skills that are valuable in the workplace and everyday life.

PBL transforms education by creating meaningful learning experiences that prepare students for real-world challenges.



Example of a STEAM Activity

Educational Initiative → Design and Creation of a Smart Pot

Target Audience → Students aged 14 to 18

Objectives → Integrate technology, sustainability, and creativity

Project description

What will we do?

- Creation of a smart pot with advanced sensors and recycled materials
- Monitoring of air pollution, humidity, temperature, pH, and water level
- Interaction through an LCD display with various animations



Learning Objectives

- Learn to design and build an integrated system using sensors and microcontrollers.
- Apply concepts of automation and environmental sensing.
- Explore the interconnection with issues of air pollution and urban ecosystems.
- Work in groups to solve problems and prepare a final presentation of their work.



Activity Details

<p>Day 1 - Design of the Smart Pot Students will explore the importance of sustainability and automation in plant care. The design of the pot layout and the selection of sensor placement will be crucial for ensuring a functional and effective system.</p>	<p>Day 2 - Assembly of Components Students will address the details of how the sensors and microcontroller work. Activities involving the connection and configuration of the sensors. Creation of an intuitive display system to show the detected information.</p>	<p>Day 3 - Microcontroller Programming Writing the code needed to detect and display data from the sensors on the LCD. Implementing animations for the pot's emotions in response to the collected data. Crucial phase for effective communication with users.</p>
<p>Day 4 - Study and Programming of Emotions Exploration of human-machine interaction in the context of the smart pot. Students will develop and implement animations on the LCD display that express environmental conditions and plant well-being. Objective: increase user engagement.</p>	<p>Day 5 - Optimization and Presentation In the final phase, students will reflect on the overall effectiveness of the smart pot. Optimization of the integrated system based on the feedback received. Preparation of a project presentation.</p>	



Conclusions

STEAM for Students → enhances critical thinking, communication, creativity, and collaboration in addition to vertical knowledge

Prepares students for real-world challenges

Promotes continuous improvement of self-efficacy

STEAM for Teachers → a transdisciplinary approach to enhance, among other things, the importance of communication and collaboration

The STEAM approach is increasingly expanding in schools and universities around the world, also influencing educational policies.

It is expected that the method will continue to evolve, integrating new technologies such as artificial intelligence, robotics, and virtual reality.

STEAM is destined to become a reference model not only for education but also for continuous training and lifelong learning in professional contexts.



Let's Practice

Design a simple, a single activity that integrates technology and art using a STEAM approach. Your task is to think creatively and plan an exercise where students can combine artistic expression with technological elements in an engaging way. The goal is to have students use their knowledge of science, technology, engineering, and math to enhance their artistic creations and make them interactive or dynamic.



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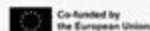
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