IO3

STEAM - H Teacher Training Modules

Steam-h - Improving STEM learning experience in primary schools through a steam-based multidisciplinary approach

STEAM - H Teacher Training Modules
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The editing of this document was finished on December 2020
Project website: **www.steamh.eu**

Co-funded by the Erasmus+ Programme of the European Union

"Steam-h, Improving STEM learning experience in primary schools through a steam-based multidisciplinary approach" is an Erasmus+ Strategic Partnership - KA201 Development of innovation project.
Project Number: 2019-1-IT02-KA201-062224

This document has been created by the collaboration of the whole Steam-h partnership:
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Science - Tech - Engineering - Arts - Maths - Humanities

Steam-h

Improving STEM learning experience in primary schools through a steam-based multidisciplinary approach

Intellectual Output n.3
Teacher Training Modules

Introduction to the STEAM-H PROJECT:

This training program is a product of Steam-H, an Erasmus + KA2 innovation development project co-funded by the European Commission. Eight partners from four different countries, Italy, Germany, Spain and Ireland, have developed the following training program.

It is designed to be delivered by a trainer/collective of trainers with experience in STEAM education and approaches, but to engage primary teachers with little or no experience in the area. The program consists of approx 28-36 hours of interaction, instruction, activity and discussion.

The purpose is to encourage teachers to understand STEAM education, to try a variety of STEAM approaches, to further their own education and training in this area, and to share and encourage other primary teachers and educators to engage. Module 1 provides a definition of STEAM as an educational approach; focuses on using STEAM approaches and methodologies within the context of the Primary classroom; describes links with maker culture; and explores the positive impact of inclusive STEAM activities on different groups.

Module 2 explores three key aspects of effective STEAM activities for schools: the preferential use of active/participatory teaching methods; working in interdisciplinary contexts; and planning STEAM activities using simple tools to meet the need for a transformation in education.

Module 3 focuses on inclusion and how the STEAM learning approach can help, especially in cross-disciplinary experiential learning contexts. It differentiates the learning in ways that are highly individualised, foster creative thinking and innovative practice with course content, and create an environment that is inclusive and equitable.

Module 4 provides guidance for teachers and educators new to the approach on choosing, and matching STEAM activities that are desirable, feasible and viable in terms of space and place, with the technological capacities of the teacher, students, and school facilities.

Module 5 goes even further in supporting the integration of high-tech activities, such as those used in Maker Spaces and FabLabs, into lessons in primary schools, such as 3D modelling and 3D printing, electronics and soldering, stop motion films and coding.

Finally, Module 6 is a collection of case studies, presenting different types of STEAM activities and situations, and showing the impacts of STEAM lessons on students' learning.

All learning modules have the same structure: Brief introduction to the subject / Total duration of the module / Possible learning outcomes / Overview of the proposed activities / Specification of the materials and equipment required / Steps to implement them in the classroom.

In addition, printable handouts are available that are linked to the suggested steps, as well as some additional resources.

We also encourage you to read all of the other results from STEAM-h such as the IO1 Competency Map, IO2 Open Educational Resources, and IO4 Handbook for more information and tools for incorporating STEAM into your lessons.

STEAM-H

Science - Tech - Engineering - Arts - Maths - Humanities

Course Content

Module 1: What is STEAM?

Short overview of the topic:

This module aims to provide a clear definition of STEAM as an educational approach; to focus on using STEAM approaches and methodologies within the context of the Primary classroom; to describe links with maker culture; and to explore the positive impact of inclusive STEAM activities on different groups.

[For more on STEAM approaches read our document:
STEAM-H Competence Map].

Duration of the module: 2 hours

Learning Outcomes:

The participants will be able to:

- identify the areas associated with the terms STEM and STEAM.
- understand and use a STEAM approach in the classroom as part of the formal education system.
- understand the link between STEAM activities, maker culture and non-formal learning.

Activity overview suggested and the steps to implement it:

This module aims at providing basic knowledge about using STEAM approaches. A group of 8/10 participants will reflect on the advantages and challenges of implementing a STEAM approach through the integration of STEM subjects with humanities and arts.

Steps

Step 1: Introduction to the topic (30 m)

First, the trainer briefly introduces the module (objectives, duration estimated, resources to be used and expected results). The trainer can use the following video to explain what STEM is in general and why it is important to students: **"Stem Animation".** Complementing this, the trainer can use this video introducing **"What is STEAM Education"** and describe the key role of art, and the arts, in this context.

Step 2: Definition of STEAM (1 h)

The trainer provides a definition of STEM and STEAM to participants in the context of school education, using the following documents **"Definition of STEM and STEAM"** and **"STEAM in the Primary Classroom",** giving them some reading time. Then, the trainer starts a discussion with the partici-pants about their previous teaching experiences on STEM or STEAM areas. The trainer can also use the videos available in the section "Extra resources" to show some examples of STEAM activities.
The trainer asks the participants to connect the **10 robotic projects kids can really make!** video, with the STEAM approach:

- What learning skills do these projects awaken in children?
- Do you find the "A" of "art/arts" in these projects?
- As a teacher, do you consider that the technological base that these projects have, is amenable or difficult for you?

Then, the participants talk in small groups about how these activities could be implemented in their subject areas and in specific lessons.

Participants can give feedback in a (virtual) forum and present their ideas about the advantages and challenges of using STEAM activities in the classroom.

Step 3: STEAM extracurricular activities (30 m)

The trainer explains the link between the STEAM approach, the maker culture and informal learning using the following documents: **"The influence of the Maker culture"** and **"STEAM extracurricular activities".**

Handouts

Step 1

- **Stem Animation** (video)
- **"What is STEAM Education"** (video)

Step 2

- **Definition of STEM and STEAM**
- **STEAM in the Primary classroom**

Step 3

- **The influence of the Maker culture**
- **STEAM extracurricular activities**

Extra resources:

- **STEAM Education** (video)
- **Engaging students with STEAM explorations** (video)
- **10 robotic projects kids can really make!** (video)
- **SteamonEdu Project**
- **Raising self-efficiency in STEM, a way to provide opportunities for all - Grimalt Álvaro, C., & Couso, D. (2018)**

Module 2: STEAM Why & How?
General Introduction

Short overview of the topic:

This module will focus on three key aspects of effective STEAM activities for schools: the preferential use of active/participatory teaching methods; working in interdisciplinary contexts; and planning STEAM activities using simple tools to meet the need for a transformation in education.

Duration of the module: 6/8 hours

Learning Outcomes:

The participants will be able to:

- define the main characteristics of a STEAM project
- identify the different STEAM disciplines in a project idea
- connect the structure and main characteristics of a STEAM project
- plan the first activities of a new STEAM project

Activity overview suggested and the steps to implement it:

This module provides a tool for participants to develop and refine an idea for a new STEAM project, from initial challenge to the final product/educational experience.

Participants working together will be able to plan a STEAM project defining key elements: Contents, Context, Technological Instruments, Educational Objectives, and Classroom Activities

Participants will be able to describe the different disciplines to be included using STEAM as interdisciplinary approach.

Steps

Step 1: Introduction to the topic

The trainer will show the following video about the importance of speed of change on society: **"Did You Know"**

The trainer will explain the importance of Active Methodologies to adapt school action to speed of changes. The trainer can use the following presentation: **"Teaching Methods".**

Step 2: Main Characteristics of STEAM projects

The trainer will explain the main characteristics of a STEAM project, using the following presentation: **"Definition of the main characteristics of a STEAM project".** The trainer can also present an example of a STEAM project using the following document: **Case study- Cooperation Bluedots Project.**

Step 3: Defining a new STEAM project

The trainer will use the following document **"Canvas to define a STEAM project"** as a tool to help participant to define a new project idea based on STEAM approach. Participants will work in small group to plan a STEAM project defining their key elements: Contents, Context, Technological Instruments, Educational Objectives, and Classroom Activities

Step 4: Presenting the STEAM project idea

Each group will present the STEAM project idea.

Handouts

Step 1

- Did You Know (video)
- Teaching Methods

Step 2

- Definition of the main characteristics of a STEAM project
- Case study- Cooperation Bluedots Project

Step 3

- Canvas to define a STEAM project

Extra resources:

- Buck Institute for Education - 2015 - Gold Standard PBL Essential Project Design Elements
- STEAM4U NARRATIVE
- Supporting STEM in schools and colleges

Module 3:
STEAM - Why & How?
Inclusion Focus

Short overview of the topic:

Even though STEM education is trying to implement experiential, hands-on learning to engage students with real world content and more authentic contexts for problem solving, some inequities within STEM curricula are increasing barriers to inclusion and perpetuate a lack of women, minorities, and other underrepresented populations entering STEM fields.

Ensuring that each individual has an equal opportunity for educational progress remains a challenge worldwide. Educational attainment and achievement should be decoupled from social, economic and cultural status, to ensure that education and training systems boost the abilities of every individual and enable upward social mobility (Council of Europe).

A STEAM learning approach, especially in cross-disciplinary experiential learning contexts, differentiates the learning in ways that are highly individualised, that foster creative thinking and innovative practice with course content, and that create an environment that is inclusive and equitable. **(STEAM: Creating an Environment of Inclusion and Innovation, Ren Hullender, PhD Holly Hoffman, PhD Julie Cunningham, MA March 2016).**

Duration of the module: 6/8 hours

Learning Outcomes:

The participants will be able to:

- describe the meaning of inclusive education and the different kinds of inclusion
- define the key elements and dynamics of inclusive education in STEM
- describe the key elements of STEAM methodology that support inclusive education in STEM
- plan a STEAM-based activity in order to improve inclusion in STEM for primary students
- observe and evaluate the effectiveness of inclusivity of a STEAM-based activity

Activity overview suggested and the steps to implement it:

This module aims at introducing the basic concepts of inclusive education and its implementation through STEM subjects. We will answer some questions about why and how to create an inclusive environment for STEM subjects and the potential for using a STEAM approach to support this process.

Participants will learn how to integrate STEAM-based activities into their teaching in order to improve students' inclusion and motivation towards engaging with STEM subjects.

Step 1: Introduction to the topic

The trainer will show a video to inspire teachers and initiate reflection on the topic. The following videos can be used: **Inclusion and education: All means all animation** and **Is equality enough?**

The trainer asks the participants to add up to 5 words that come to mind when they think of inclusive education to a word cloud generator (like **Google Wordcloud** or **Mentimeter**).

From the results of the 'inclusive education' word cloud, the trainer starts an open discussion with participants based on the following questions: what does inclusive education mean to you/for you? What different kinds of Inclusive education are you dealing with? What about inclusion in STEM subjects? Does your school have strategies for promoting inclusion in STEM, and how well are they working?

This activity can be carried out in online environments using a forum, **Padlet** or **Dotstorming**

At the end of the session, the trainer summarises the results in a document.

The trainer presents a definition of Inclusive education using the following presentation: **"Definition of Inclusive education"**.

Step 2: Inclusive education in STEM

Following the results of the open discussion, the trainer presents the common key elements of inclusive education in STEM. **Here** is a framework that can support this activity.

Using **Tricider** the participants can vote on which of the elements presented they are using in their daily practice.

Group Activity (open discussion): the trainer will encourage analysis and reflection on the key elements used by the participants.

Step 3: How a STEAM methodology can support inclusive education in STEM for primary students

In this step, the trainer will focus on the main aspects of STEAM methodology that can support inclusive education in STEM. **Here** is a summary.

The trainer can also use the following resource for inspiring participants: **Inclusive Teaching Strategies to Make STEAM Projects Accessible to All Learners**

Step 4: Case studies

The trainer presents how schools plan their inclusive programmes through a collection of case studies **(Case study - STEAM - Creating an Environment of Inclusion and Innovation and Case study - Fostering Critical Reflection in Primary Education through STEAM Approaches).**

Step 5: How to do it: Planning and Evaluating an Inclusive Practical STEAM activity

The trainer invites participants to adopt and adapt their own planning tool/support system for integrating STEAM based inclusive activities into their primary teaching.

The trainer provides participants with a **Template for the activity** description and a **rubric** or set of instructions to follow. The participants, divided into groups, will plan a STEAM-based activity for improving inclusion in STEM.

Handouts

Step 1

- Inclusion and education: All means all animation
- Is equality enough?
- Definition of Inclusive education

Step 2

- Key elements of inclusive education in STEM subjects

Step 3

- Inclusive Teaching Strategies to Make STEAM Projects Accessible to All Learners
- How Steam methodology that can support inclusive education in STEM

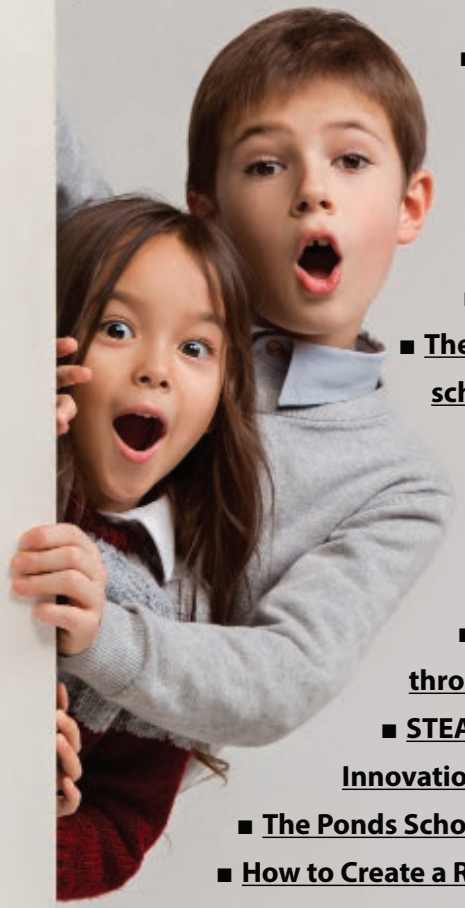
Step 4

- Case study - STEAM - Creating an Environment of Inclusion and Innovation
- Case study - Fostering Critical Reflection in Primary Education through STEAM Approaches

Step 5

- Template for the activity description
- Rubric

Extra resources:



- **Inclusive education for learners with disabilities**
- **Towards inclusion in education: status, trends and challenges: the UNESCO Salamanca Statement 25 years on**
- **What an inclusive, equitable, quality education means to us**
- **Global education monitoring report, 2020: Inclusion and education: all means all**
- **Scoping Progress in Education (SCOPE)**
- **Profiles Enhancing Education Reviews (PEER)**
- **The eight essential elements of inclusive STEM high schools**
- **STEM Classes and Kids with Special Needs**
- **5 MAJOR BENEFITS OF INTEGRATING STEAM EDUCATION**
- **Fostering Critical Reflection in Primary Education through STEAM Approaches**
- **STEAM: Creating an Environment of Inclusion and Innovation**
- **The Ponds School- Inclusive education**
- **How to Create a Rubric in 6 Steps**
- **5 Tips for a More Meaningful Rubric**
- **Gender Equity Checklist**
- **Classroom interactions self-evaluation template**
- **How Do We Actually Know a Lesson Went Well?**

Module 4:
No Tech, Low Tech, Space & Place STEAM Options

Short Overview of the Topic

The focus of this module is to provide guidance for teachers and educators new to the approach on choosing and matching STEAM activities that are desirable, feasible and viable in terms of space and place, with the technological capacities of the teacher, students, and school facilities.

It is important to manage expectations and start from a realistic position - if you have no access/-patchy access to the internet there is no benefit to planning an interactive virtual STEAM activity that requires high-speed access. The very idea of having to use unfamiliar technology may be a barrier to teachers who are new to STEAM and/or not very technically proficient.

Similarly, if you only have a limited space, such as a small classroom with a lot of furniture that will not suit some STEAM activities, but it by no means excludes you from engaging effectively.

Topics covered will be:

- Pre-planning Checklist - Assessing your Space & Technical Capacity
- Space and Place - Options Available, How & when to use them
- "No-Tech" Options - Arts'n'Crafts, Re-use, Upcycling, & Integrating School Supplies
- "Low-Tech" Options - Tinkering with Technology!

Skills Development for Students in any STEAM spaces using No Tech & Low Tech Activities include:

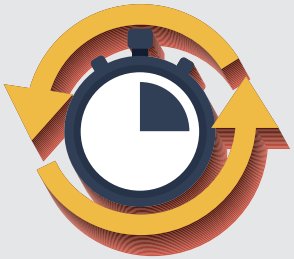
Initiative and intentionality: setting your own goals, asking and responding to feedback, persistence to achieve goals

Social skills: request or offer help in solving problems, inspire or be inspired by new ideas or approaches, make connections to the work of others

Development of understanding: offer explanations for a strategy, tool or result, apply knowledge, strive to understand

Creativity, Imagination & Innovation: using no-tech and low-tech materials and activities encourages creativity and innovation in students. It also encourages deeper understanding of the mechanics of simple materials, and the capacity to use the resources and space available in new and interesting ways.

Total duration of the module : **6-8 hours**



Learning Outcomes

The participants will be able to:

■ understand how to choose, plan and implement STEAM activities that are desirable, feasible and viable in their particular circumstances

■ explore a number of space and place options for STEAM activities inside and outside the classroom and understand how to apply them

■ explore and test a number of "no-tech" options for STEAM activities and understand how to apply them to engage their students

■ explore and test a number of "low-tech" options for STEAM activities and understand how to apply them to engage their students

Activity overview suggested and the steps to implement it:

This module will provide some guidance on simple No-Tech and Low-Tech STEAM based multidisciplinary options both within and outside the classroom. A small amount of planning and matching your STEAM activities to your specific conditions will increase the success of your STEAM activities in a big way.

Steps

Step 1: Step 1: Introduction to the topic (1-2 hours)

The trainer will introduce the module. To begin, the trainer will assess the levels of experience with STEAM activities and spaces in the group - going round the group giving each participant a few minutes to tell the group about their experiences to date, and what they liked about them [or didn't]. If the participants say they have no experience at all the trainer should ask them to describe instead their favourite STEM or Arts or Outdoor Activity or Area in their school, or even their favourite STEAM related school trip.

The trainer will harvest the information as they go around the room, using a white board/ chart/wall & post-it notes, and looking up online the STEAM/other projects mentioned by the participants so that the group can explore each other's experiences further later.

This should highlight to the group that most people have been involved in or visited activities and spaces that could be considered or used in STEAM approaches, and reduce any fear in the group due to lack of STEAM experience.

Then the participants will be introduced to the following document to assist them with understanding their options **"Pre-planning Checklist - Assessing your Space & Technical Capacity".**

The trainer will give the participants a few minutes to go through the document to start them thinking about the specifics of their situation, what they want to do, where and how they might do it.

Step 2: Space and Place Options: How & When to use them (1-2 hours)

The trainer will explain the topic of Space and Place. This can begin with a conversation/discussion about the space the training is taking place in - physically and/or virtually.

The trainer will use this presentation to show a variety of **STEAM Spaces, Places and Activitie**s to give the participants a flavour of the variety of spaces and activities that can and have been used for STEAM Activities.

The participants will be provided with a resource sheet using the following document **"STEAM Space & Place"** providing video and other links showing different types of space and place examples for inspiration and planning.

They will be provided with either large sheets of paper and colouring pencils/markers [or whiteboards] to sketch out rough blueprints of their school and surroundings, on which to highlight the space and resources available to them, to really engage them in planning activities to suit their specific locations. They will be encouraged to print e.g. photos of their school and surroundings, as well as STEAM ideas they have, to add to what will become a sort of "vision board" of their school STEAM planning. This can be added to each individual's collection of templates, checklists and tools provided in the modules so far, and assist them in future planning. They could use e.g. a Google Jamboard and/or Mind Map software to do this either.

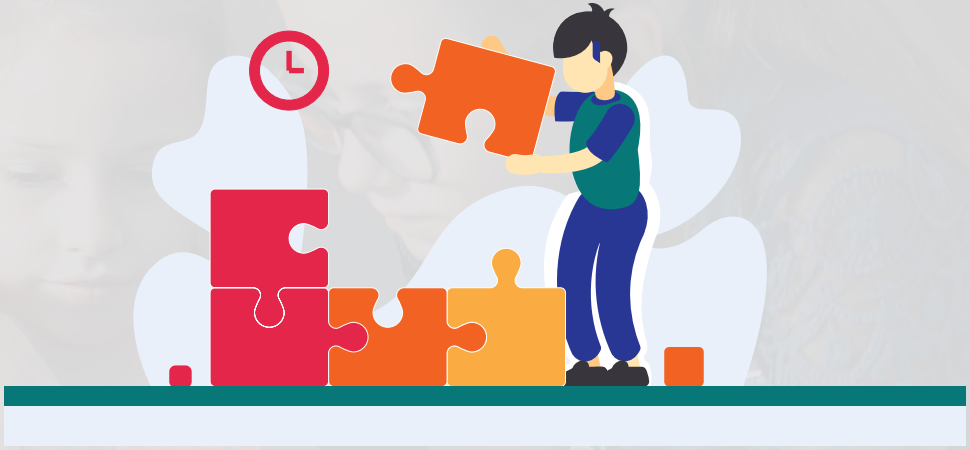
Step 3: "No-Tech" Options - Arts' n'Crafts, Re-use, Upcycling, Integrating School Supplies (1.5-2 hours)

The trainer will introduce the topic of "No-Tech" Options - including Arts'n'Crafts, Re-used/ re-usable materials, Upcycling materials and integrating day-to-day school supplies into new and interesting STEAM activities. Using the document **"No-Tech Sample lesson & activities"**, the trainer will guide the participants through the sample lesson and activity and, as part of the activity they will discuss the potential for using alternative materials, methods and spaces and show the participants some of the alternatives using **this presentation**.

Step 4: "Low-Tech" Options - Tinkering with Technology! (1.5-2 hours)

The The trainer will introduce the topic of "Low-Tech" Options - Tinkering with Technology, using the following document **"Tinkering - Introduction & Activity".**

The participants will work through the theory, methodology and then a sample activity to increase their understanding of Tinkering and Low Tech as elements of STEAM.



HANDOUTS

- Pre-planning Checklist - Assessing your Space & Technical Capacity
- STEAM Space & Place
- No-Tech Sample lesson & activities
- Tinkering - Introduction & Activity

Extra Resources:

- Active Learning Methodologies
- SAMPLE LESSON _ BREAKDOWN FOR TEACHERS FACILITATORS
- The Planets_InfoSheets
- The Planet Report Sheet
- STEAM_Exploring_The_Solar_System
- SOLAR SYSTEM_VocabularySheet
- Case study - “Space week” - summer camp
- Low Tech STEM Engineering Challenges (video)
- Low Tech STEAM Activity Ideas
- Low tech ideas on Pinterest
- What is Tinkering?

Module 5:
High tech in elementary school

Short overview of the topic

Current and emerging technologies can drive the redefinition and reshaping of teaching and learning in accordance with the principles underlying the interdisciplinary STEAM approach, especially through the design of interactive, collaborative, and inquiry-based learning environments.

Learning spaces can ideally be equipped with technologies and materials that are also available in a FabLab or MakerSpace such as 3D modelling and 3D printing, electronics and soldering, stop motion films and coding.

The exploitation of modern technologies in STEAM activity can enhance the quality of learning experiences in which, through hands-on lessons, students can experiment, design and learn potentially all subject areas integrating technology, engineering, maths, art, and other subjects.

Moreover, STEAM activity based on advanced technologies encourages innovation, creativity, communication and collaboration, critical thinking, and problem-solving. Therefore, over time, students develop stronger communication skills, receive more targeted feedback, and learn to get along with a wider range of peers.

The success of these technologies depends upon having a motivated and interested audience. The teacher or the educator should use the technology to augment and supplement learning in new and different ways and to directly engage students in order to promote their participation and inclusion.

Duration of the module: **8 to 10 hours**

Learning Outcomes:

The participants will be able to:

- implement STEAM activities based on 3D modelling and 3D printing, electronics and soldering, stop motion films and coding in primary schools

- understand the added value of activities based on high-tech for STEAM-based projects

- Research the technologies and resources related to high tech in primary/elementary school and how to source materials and resources.

- Gain new perspectives for using STEAM approaches

Activity overview suggested and the steps to implement it:

This module aims at providing the basic information for implementing STEAM activities with the use of the high-tech tools in educational contexts. The module will highlight the added value of implementing such activities in a STEAM project focusing on 4 main technologies: 3D modelling and 3D printing, electronics and soldering, stop motion films, and coding.

The trainer should have previous competences and experience in using those technologies or collaborate with experts supporting the lesson.

This module is planned for a group of a maximum of 10 primary school teachers.

Steps

Step 1. What high-tech STEAM activities can be implemented in primary schools:

■ The trainer starts discussing the differences between high-tech and low-tech with the participants.

■ The trainer introduces the different technologies which can be used in STEAM projects for primary schools **(Hi-Tech technologies for primary schools** and **Primary school students learn with iPads, 3D printing, CAD, electronics and programming for the future)**

■ The trainer presents real cases **(Case study - "The history of the former airport at Munich Riem" - Project Week at primary school Lehrer Wirth Straße** and **Case study - "Miniphänomenta" at primary school Lehrer Wirth Straße)** on how to implement Steam activities exploiting the potential of the new technologies

Step 2. Exploiting high-tech potential

■ The trainer will carry out a practical activity with the participants. The activity should be based on the technologies and resources available. The following handouts "**3D modelling and 3D printing", "Soldering and Electronics", "Stop Motion Films"** and **"Coding"** will provide you 4 different practical activities based on the main emerging technologies.

■ After having explored the potential of the technology, the participants will be asked to plan a STEAM project based on the technology explored (see module 3 for understanding how to plan a STEAM activity)

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Handouts

Step 1

■ Hi-Tech technologies for primary schools

■ Primary school students learn with iPads, 3D printing, CAD, electronics and programming for the future

■ Case study - "The history of the former airport at Munich Riem" - Project Week at primary school Lehrer Wirth Straße

■ Case study - "Miniphänomenta" at primary school Lehrer Wirth Straße

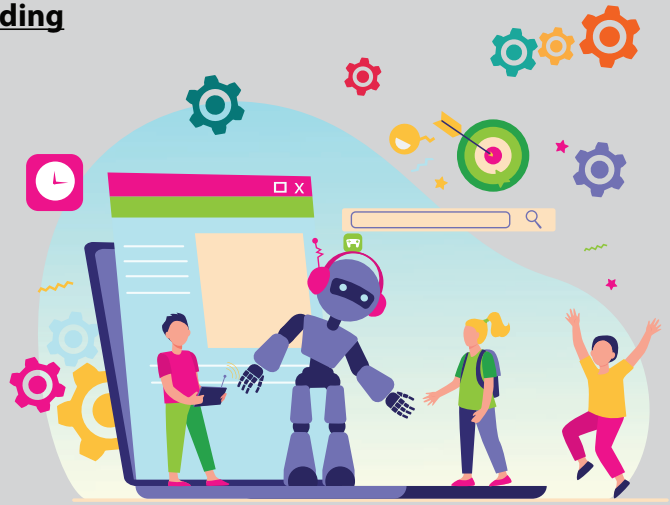
Step 2

■ 3D modelling and 3D printing

■ Soldering and Electronics

■ Stop Motion Films

■ Coding



Extra resources:

- Possible equipment for a Maker Space at a Primary School
- RAISING STUDENTS' INTEREST IN STEM EDUCATION VIA REMOTE DIGITAL FABRICATION: AN IRISH PRIMARY SCHOOL
- Tinkercad tutorial
- Lessons Plan Tinkercad
- How to Make 3D Models With Tinkercad!
- Project gallery - Tinkercad
- Fused Deposition Modelling (FDM) Process at Loughborough University
- How a 3D printer works
- Cura Tutorial
- 7 FUN & EASY LESSON PLANS TO JUMPSTART 3D PRINTING IN YOUR CLASSROOM
- Back to the Future: 3D Printing and the Future of Math Education
- Basic Electronic Components
- Basic Electronic Components Used in Circuits
- Kid Maker: How to Solder
- Safety instructions soldering
- Electronics Class
- How to Make a Bristlebot
- Bristlebot
- Video Tutorials
- Storyboard That
- Cody & Roby
- Coding Unplugged: 7 Awesome Offline Coding Activities
- Dash
- Apps
- Dash and Dot - What is it?
- Coding Dash Robots - Blockly App Basics - Getting to know the Interface
- Blockly for Dash & Dot Lesson Ideas
- Cross-Curricular Lesson Library
- Scratch 3.0 Tutorial #1: Make your first program
- Scratch.Jr – Activities
- How to plan your Hour of Code
- Mindmaps

Module 6: Case Studies

In this section you will find a collection of the case studies presented in the previous modules, illustrating how STEAM methodologies have been implemented in real contexts and demonstrating the results. These case studies can be used to support the overall training program and also as additional resources and reading for participants.

- **Case study- Cooperation Bluedots Project**
- **Case study - STEAM - Creating an Environment of Inclusion and Innovation**
- **Case study - Fostering Critical Reflection in Primary Education through STEAM Approaches**
- **Case study - "Space week" - summer camp**
- **Case study - "The history of the former airport at Munich Riem" - Project Week at primary school Lehrer Wirth Straße**
- **Case study - "Miniphänomenta" at primary school Lehrer Wirth Straße**
- **Case study - RAISING STUDENTS' INTEREST IN STEM EDUCATION VIA REMOTE DIGITAL FABRICATION: AN IRISH PRIMARY SCHOOL**

Conclusion

Our collective experience and research in a variety of STEAM projects, both in formal education settings and non-formal settings such as FabLabs, Maker Spaces and others, has convinced us all that using STEAM approaches of many shapes and sizes in primary education can be extremely beneficial to both students and teachers alike, including:

- for supporting the development of creative, critical-thinking, problem-solving, students through hands-on, practical approaches for improving collaboration and communication skills as students work both individually and collectively in diverse teams, acknowledging and embracing differences in skill sets, interests, capacities and more
- for increasing the enjoyment, engagement and motivation of students, including the less academically-inclined students / students with learning difficulties / students who might otherwise feel excluded for one reason or another [gender stereotypes / marginalised groups/ other exclusion issues]
- for more effective learning, acquiring skills and producing outputs that might have otherwise seemed daunting or very difficult to achieve
- for a more holistic understanding of 'how the world works', by engaging multiple disciplines, experts from different fields, and exploring "real life" contexts and connections
- for supporting and enabling teachers to "flip" their classrooms and engage the students in helping to teach each other, work together and enjoy learning and trying new things.

Overall we suggest that this approach can be particularly beneficial in relation to creating a more inclusive, coherent, creative and relevant educational environment for you and your students.

As such we hope that following participation in the program, as a trainer or a teacher, will have provided you with a better understanding of:
the areas associated with the terms STEM and STEAM
- the use of STEAM approaches in the classroom in the formal education system
- the link between STEAM activities, maker culture and non-formal learning
- how to attempt, define, plan, implement, and evaluate STEAM projects/activities
- the application and benefits of using STEAM approaches to create a more inclusive educational environment
- the space, place, material and technical requirements to maximise your STEAM capacity & match to your specific needs and environment

some no-tech, low tech and high tech STEAM activities and options, including
- the variety of STEAM resources, experiences, supports, training and more available

Now it's up to you! Try it, test it, share it!!

Best of luck, and please feel free to connect with us, we would be delighted to hear about your experiences!

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