SPACE*LAB Erasmus+ Project 2021-1-IT02-KA220-SCH-000032535

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SPACE*LAB

BLENDED TRAINING COURSE FOR PRIMARY TEACHERS

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Introduction

STEAM Education

This training course has been realized within the framework of the Erasmus+ European project Space*Lab, project reference: 2021-1-IT02-KA220-SCH-000032535.
This is a blended training course about STEAM Education.

The first part of the course is dedicated to the description of STEAM approach and the differencies with the former STEM.
Then you will find out how this approach is connected with the development of the so-called soft skills. In particular we have focused in the so-called 21st century skills, among which the most significant ones in education are presented.

The second part of this course is then more practical. Here there are presented some teaching and learning methodologies, which are suitable for building up a real STEAM classroom, with specific activities annexed.

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Introduction

STEAM Education

The training course has a duration of 10 hours, devided in two days.

The first day (5 hours) is devoted to the theoretical explanation of the STEAM approach and its main features and implications in education. The second day (5 hours) is dedicated to practical activities to succesfully implement the STEAM approach, with the support of specific teaching and learning methodologies, such as Project Based Learning (PBL) and Design Thinking.

The first 5 hours are meant to be held online and the second 5 hours should be carried out face-to-face.

However, thanks to the specific resources and materials at your disposal, it is possible to hold all course activities in both distance and face-to-face modes.

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DAY 1

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Why is STEAM education important?

The importance of the STEAM approach lies not only on the integration of the arts and sciences, but on a general understanding and a new mindset about the purpose of school education.

School education is normally considered only as a mean to prepare our students and next generations for high school or college, or for a specific profession. Anyway, in a rapidly changing world, like today's society, this schooling idea runs the risk of preparing future generations for jobs that in 10 or 20 years may not even exist anymore.

Actually, the purpose of school should be preparing students for life after school, regardless of the career each student might choose. This is not to say that formal education is not important; on the contrary, it is essential that students receive the most comprehensive education possible. But to get students motivated and successful, it is critical that they understand the connection between school and the external world. Often school and real-life are seen as separate worlds by students, and this is also due to the fact that subjects are often taught separately from each other, without making connection to the real world.
This is especially true when we talk about the connection between STEM disciplines and the art.

Many teachers regard STEM disciplines and the arts as diametrically opposed. The former are considered objective and logical, the latter subjective and intuitive.

Actually this is only a superficial perception. In fact, many scientists and engineers regard the arts as an essential element of their own success. The arts, integrated with the sciences, enable the development of fundamental skills such as:

- Creativity
- Innovation
- Collaboration and Teamwork
- Communication and Expressive Skills

The purpose of STEAM education is precisely to enable students to learn content knowledge and skills together. And to see their application in real life.

Researches show that STEAM is a promising approach to positively impacting student achievement and teacher efficacy. That's because students that are taught with STEAM approach don't only learn the subjects' standards and contents, but they are taught how to learn, how to experiment and how to create.

What is STEAM education?

STEAM Education is an approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking.

Susan Riley

STEAM is an educational approach that integrates the arts into STEM disciplines and concerns the entire educational curriculum, from the lesson planning, to the delivery of the content, to the assessment strategies. The STEAM approach improves student achievement by including creativity and high order thinking skills in the learning process.

STEAM is not just about art integration but goes beyond that: it is not about simply adding the arts to the STEM curriculum; it is about awakening curiosity, putting theory into practice, learning to develop creativity and connecting it with practical skills.

When it comes to art integration and STEAM, many students and teachers in STEM disciplines often struggle when asked to be creative. This happens because we often tend to confuse creativity with the technique required to make something. In reality, creativity in the sciences is associated with innovation.

The STEAM approach empowers students general understanding of the real-world, letting them experiment through the connection of STEM areas together with arts practices, elements, design principles, and standards. This provide them with a wider, interdisciplinary and multidisciplinary learning experience that makes them discover unexpected links between subjects and real-life.

From STEM to STEAM

The moving from a STEM approach into a more complete STEAM has taken root in recent years and it has become necessary in order to meet the learning needs of students in today's society. And the first subjects to benefit from it are precisely science subjects.

STEM subjects alone do not take into account several key components, such as the development of so-called soft skills, which are crucial both to enhance the learning process and for professional success.

In recent times, STEM programs in schools have been implemented more and more frequently, as skill in these subjects is increasingly in demand in the job market.
Although these initiatives are a great start for exploring these four areas of study, they lack the critical process of creativity and innovation, among others.

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Students in STEM programs may have more hands-on learning opportunities, but they are limited to only science, technology, engineering and math. The learning process requires more than understanding these areas: it requires application, creation and resourcefulness. STEM alone does not foster these essential elements.

STEAM is a way to take the benefits of STEM and complete the process by integrating these principles into and through the arts.

STEAM takes STEM to the next level: it enables students to connect learning in these critical areas with arts practices, elements, design principles, and standards, so that the full range of learning tools is available to them. STEAM removes limitations and replaces them with wonder, critique, inquiry and innovation.

STEAM and 21st Century Skills

The STEAM approach allows for the development of a set of competencies or skills that are crucial in both the learning process and job career.

The focus of the STEAM approach is on improving the whole learning process, and this affects equally the development of both cognitive and noncognitive skills.
Cognitive skills concern conscious intellectual endeavors, such as logic, reasoning, or critical thinking. However, to improve cognitive processes, noncognitive skills are equally important. These are skills in which the intellect is still involved but in a less conscious effort; for instance initiative and social skills.
The development of both cognitive and noncognitive skills will enable much more effective learning. This makes it easier and meaningful for the student to make connections between school subjects and the real world, which is one of the great advantages of STEAM.

These cognitive and noncognitive skills are called "soft skills," as opposed to content knowledge, defined as "hard skills."

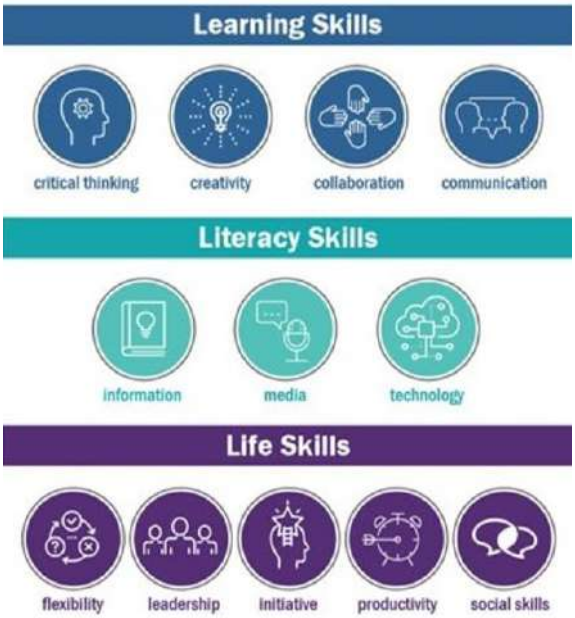
In the STEAM lesson, it is important to implement and develop the soft skills, in order to support students in using them effectively.

What are the 21st Century Skills?

The 21st Century Skills are a set of cross-cutting skills or competencies that are well connected to the development of the learning process. The term refers to a broad set of knowledge, skills, work habits, and character traits that are believed to be critically important to success in today's world, particularly at school and in contemporary workplaces.

We can divide them into three categories:

Learning skills (the 4 C's) are acquirable qualities and habits that allow a person to learn and work efficiently.



Literacy skills focus on how a person can discern facts, pieces of information and the technology behind them. The focus is on determining trustworthy sources and to separate them from the misinformation that floods the Internet.

Life skills focus on intangible elements of a student's everyday life. These intangibles focus on both personal and professional qualities.

Learning skills

- **Critical thinking**: the process of questioning sources and challenge assumptions to make well-informed judgements based on solid evidence

- **Creativity**: Thinking outside the box and see concepts under a different light

- **Collaboration**: Working with others efficiently to achieve a common goal

- **Communication**: conveying ideas in an effective way by using a variety of methods

In educational enviroment these skills are better known as the **4Cs**.

Literacy skills

- **Information literacy:** Understanding facts, figures, statistics, data and learn to distinguish facts from fiction

- **Media literacy:** Understanding the methods and outlets in which information is published

- **Technology literacy:** Understanding the machines and applications that make the Information Age possible and the best way to use them

Life Skills:

- **Flexibility**: Deviating from plans as needed and adapt to changes
- **Leadership**: Motivating and guiding a team to accomplish a common goal
- **Initiative**: being intrinsic motivated and starting projects, strategies, and plans on your own
- **Productivity**: ability to prioritize, plan and manage the workload
- **Social skills**: Meeting and networking with others for mutual benefit, interacting effectively with others.

However, finding activities that foster 21st Century Skills, when planning a STEAM lesson, is not enough. It is important that these soft skills are considered in the assessment as well.

During and after the lesson, it is very helpful to provide formative assessment sessions with focus on soft skills and their application; this will make students more aware of the importance of these competences and how to integrate them into their own learning process.

The STEAM Lesson

One of the most effective ways to break down a STEAM lesson is to divide it into six different steps.

We can consider these steps as different moments of the cognitive process, from identifying a problem, to detecting possible solutions, to reflection about the conclusions achieved during the STEAM lesson.

The six steps are placed in logical consequentiality, allowing the development of a student-centered environment and promoting self-directed and inquiry-based learning at the same time.
In each of these steps the focus is both on content knowledge in STEM, arts and soft skills. Consider that they are effective regardless of which area you are teaching in.

The steps are:

1. **Focus**
2. **Detail**
3. **Discovery**
4. **Application**
5. **Presentation**
6. **Link**

Let's have a look at this steps one by one:

Focus

This first step is about finding an essential question to answer or problem to solve.
It's important to have a clear focus on both how this question or problem relates to the STEM and the Art content areas you've chosen.

Detail

Look for the elements that are related to the problem you want to solve.
Observe the correlations between different content areas, why the problem exists and how it can be solved.
Discover key background information, skills (both hard and soft ones) that students have or need to acquire to address the problem.

Discovery

This step is about active reasearch; students are researching possible solutions, as well as what ISN'T currently working in the solutions that already exist.
The teacher can use this stage to analyze the gaps the students may have and teach those contents explicitly.

Application

After students have analyzed a problem or question and the solutions that already exist, they can begin to create their own solution to the problem.
Here they are using the skills, processes and knowledge that were taught in the discovery stage.

Presentation

Once students have created their solution or composition, it's time to share it.
It's important that the work is presented for feedback; it'a also a way to let the student express its own perspective concerning the question or problem to investigate
Students then learn how to give and receive input.

Link

This step is what closes the process. Students can reflect on the feedback that was shared and on their own skills and process.
Thanks to this reflection moment, students can revise their work where needed and produce an even better solution

Tips for Teachers

While designing and implementing a STEAM Lesson, consider the following aspects:

- Observe students' knowledge on a particular topic or subject,
- Have a brainstorming session and ask your students how and what they would like to learn,
- Plan and design a new STEAM lesson considering the 21st Century Skills you want to include in the lesson
- Review student formative and summative assessment and revise the lesson.

The STEAM Lesson

What does a real STEAM lesson should include?

Of course the planning and designing of a STEAM lesson is a very important step on our way to STEAM; but to turn in practice what on the paper or in our mind seems to work, might be a bit difficult.
Here there are some points that your lesson should not miss:

STEAM Outcomes

The learning Outcomes deriving from the learning experience you have designed and planned should of course belong to the STEAM Area. You can build up a simple check-list to help you revise your lesson.

Intentional Connection

The best quality STEAM lessons should intentionally connect at least 2 aligned standards or topics from the school curriculum. These standards should purposefully be selected in content areas and topics that make sense together.

Inquiry Based

Any good STEAM lesson is grounded in inquiry, problem-solving and process-based learning.
When planning your STEAM lesson, pay close attention to the essential question and the process surrounding its exploration.
Ask yourself: what problems are being investigated and solved? How are both contents being used to explore the problems? Why is the process important to the question posed?

Integrity

In a STEAM lesson the art content has to be selected purposefully and it should be taught with integrity and not in service of the other content.
A lesson where students are creating a craft at the end of the lesson cannot be called "STEAM" or adding paint, tape and glue doesn't make it a STEAM lesson.
A STEAM lesson should be actively teaching the arts standard through application of skills students have learned during dedicated arts times.

21st Century Skills

Collaboration, Creativity, Critical Thinking and Communication can be easily integrated in any quality STEAM lesson.
Students are actively engaged in the learning process, collaborate in groups, create original solutions and compositions and explore questions from multiple perspectives.

Equitable Assessments

A true STEAM lesson requires assessing both the content and art standards that were selected and taught.
Remember that assessment is not the same as evaluation. Assessment is a measurement of growth, not only a final judgment.

Making Meaning

Making connections between the content knowledge and its real-world applications is a way for students to understand that what they're doing in the STEAM classroom matters.
Students should know that what they create and apply has real possibilities and opportunities to work in the world.

How to reach STEAM goals?

Here there are some practical tips for you to implement a successful STEAM lesson:

Collaborative Planning

Collaboration is a key element; one of the most important things in implementing STEAM is to keep in mind that it is a collaborative effort; there cannot be just one person teaching STEAM.

Professional development for all staff

The STEAM education involves teachers from all disciplines, and ideally the school as a whole. All school staff should be involved in the training and implementation of STEAM education.

Adjusting schedules

Creating dedicated lesson plans is another key aspect of a STEAM lesson; adapting the lesson schedules to a new, multidisciplinary way of learning and teaching

Standards and assessment alignement

Find a meaningful connection between different subjects for students and teachers. The topics and subjects integrated into the STEAM lesson should be always of equal importance and not one serving the other. The same consideration applies to the assessment.

STEAM schema-mapping

Try to develop lesson plans together with other teachers and to align the learning objectives of different subjects, as well as the assessment standards. STEAM is interdisciplinary, and this also applies to assessment methods.

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DAY 2

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How can we implement STEAM in Class?

STEAM and Project Based Learning

STEAM is not just the integration of the arts into STEM disciplines, nor is it just the mastery of all those subjects. STEAM goes further: it is an integrated approach in which students answer questions, solve real problems, and research independently. Steam is connected to real-life. It is student-centered and inquiry-based, and students are empowered to connect school subjects with their real-world applications. The STEAM approach performs at best when the learning process is based on interdisciplinary projects.
This is where STEAM connects with another inquiry-based teaching method: Project-Based Learning (PBL).

PBL is a great way to integrate multiple subjects together, and STEAM can be a great opportunity to create interdisciplinary projects, involving science, technology, art, but also other subjects beyond STEAM disciplines, such as history or foreign languages.

Both PBL and STEAM foster the development of soft skills, since collaboration, creativity, time-management, and problem-solving are essential to perform multi-subject projects. In PBL and STEAM these skills are also assessed by the teacher, using both summative and formative methods, also in connection with the 21st Century Skills.

What is PBL?

Project Based Learning is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging and complex question, problem, or challenge.

John Larmer

Project Based Learning (PBL) is a student-centered learning method based on projects.
PBL is an inquiry-based and problem-solving methodology in which students are engaged in solving real-world related problems.

Projects are complex tasks, centered on challenging questions or problems. Students are engaged in researching original solutions to meaningful and relevant problems or questions. In PBL, the students are collaboratively engaged in planning, problem solving, and researching over extended periods, preferably from one week to a semester.
By learning through projects, students gain autonomy and responsibility, develop soft skills, apply content knowledge, and learn in a more meaningful and deeper way. At the end of the project the students should demonstrate their knowledge by creating an original product and submitting it to a real audience.

The role of the teacher

The teacher is no longer the knowledge holder, but the person who shapes the learning environment, a mentor and a facilitator. In PBL, the frontal lecture is still in use but is no longer the privileged method of the instructional process.
Students are engaged in exploring through a process of inquiry and collaboration.
They ask questions, build up hypotheses, research, collect, and analyze data independently; they collaborate with each other by sharing ideas and creating products.
Since PBL is inquiry-based and promotes independent learning, the same steps described for the STEAM lesson can also be used for a PBL project.

The main focus of the PBL method is the question or problem from which the project takes its cue. This foundational question is called the "driving question."

After having defined your driving question, it's time tothink about the project timeline and draft some activities to build up your project together with your students.

Take into account how much time you want to dedicate to students' individual research and frontal lesson. Try also to include some practical activities and think about the possible final products your students might create- but always provide them with choices, and let them choose it autonomously.

At the end, try to find some real audience for the presentations of your students' projects: you can invite the students' parents, the entire school, or the community. Try also to find a specific audience which might have a special interest in the topic. The larger the audience, the better your project will succeed!

To have a real audience to whom students can present their products and project, add meaning and value to their work. They will feel more motivated and involved.

The Driving question

The question addressed at the beginning of the lesson is the framework of the entire PBL project. The connection between PBL and STEAM is therefore clear from the outset. As in the first step of STEAM (focus), the learning process starts from a complex question or problem.
Since the driving question is the essential focus, it should have specific features to be a good starting point for your project.

The driving question must be open-ended.

The driving question should be relevant to the standards addressed by the project but allowing at the same time multiple interpretations and/or solutions. In this way, each answer or solution found by the students is unique and equally valuable. This will ensure that the question allows students to research in different orientations, involving more than one subject.

The driving question should be engaging and meaningful for the students. It should also awaken their curiosity and interests; the answer or solution should be relevant to the students and connected with their real life. A good way to start might be to ask a question or to address a problem related to their everyday life, their environment, or their school community.

Let us now give some examples of driving questions:

A driving question can be...

Exploration of a philosophical question

- When do we grow up?
- Who has power and how do they get it?

A problem solving situation

- How can we improve traffic flow in our city?
- What should we do about the cold lunches in our school cafeteria?
- How can we reduce the spread of viruses?
- How can we improve recycling in our school?

*You can find more examples on the PPT presentation attached to this handout.

Activity

Now it's your turn! Write down your own driving question! Try to guess at least 2.

- Choose one of the proposed driving question (check the PPT slides)
- Formulate your own driving question following the example
- try to connect your subject with at least another one.

Explain now how and which subject and standard your are connecting

Now choose one of you driving questions. Try to connect the subjects and standards, you have selcted before, with Art (visual art, music, painting, dancing...etc.) .

Remember: the Arts should be integrated purposefully. It's not in service of the othe content.

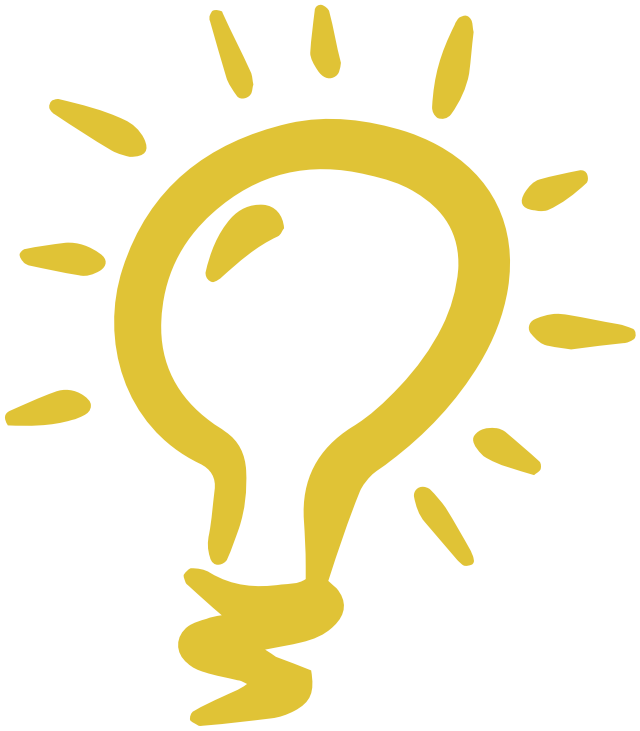
Formulate your new Driving question!

Here some examples of Driving question with the integration of the Arts for you:

- How can the principle of symmetry influence the creation of an original piece of choreography?

- How are geometric shapes incorporated into a dance performance, and how do we perceive these as audience members?

- How can the formation of the three different types of rocks (sedimentary, igneous, and metamorphic) be communicated through an original piece of music?



STEAM and Design Thinking process

What is Design Thinking ?

Design Thinking is a learning model based on projects, similar to PBL, but more hands-on.

It is a method that uses a creative approach to foster problem-solving skills.
The goal of Design Thinking is to improve existing products or solve some real problems by searching for innovative solutions. It is a perfect method for complex, multidisciplinary tasks, since it requires observation skills, teamwork, design and practical skills to realize physical products.

Design Thinking is one of the best methodologies to be used together with the STEAM approach, since it is real-life connected by nature, and requires the practical creation of physical products as the final output of the lesson.

Design Thinking is actually used in many companies for prototype design. The process is applied to existing products with the goal of improving them and/or making them suitable and attractive for a specific target group.

Design Thinking is very engaging for students. They can develop their own ideas independently and choose the prototype to create with an endless variety of possible options. This allows students to greatly develop their creativity and problem-solving skills.

In Design Thinking, students gain knowledge through exploration. The method is extremely student-centered. Students define problems, identify and develop potential solutions, and determine evaluation and review criteria. As in PBL, the teacher works as mentor and facilitator. The learning process with Design Thinking methodology should be focused on real problems; the final products must be genuinely usable and aimed at a real audience.

The Design Thinking process is divided into logical steps, like STEAM.

The steps are:

Observe/Define

Select an existing product/problem and observe what are its weaknesses and what might be improved.

Empathize

Think about the target group the product is addressing. What are the needs of the users? A good idea is to interview possible users to determine what they expect from a particular product and which needs they might have.

Visualize/draft

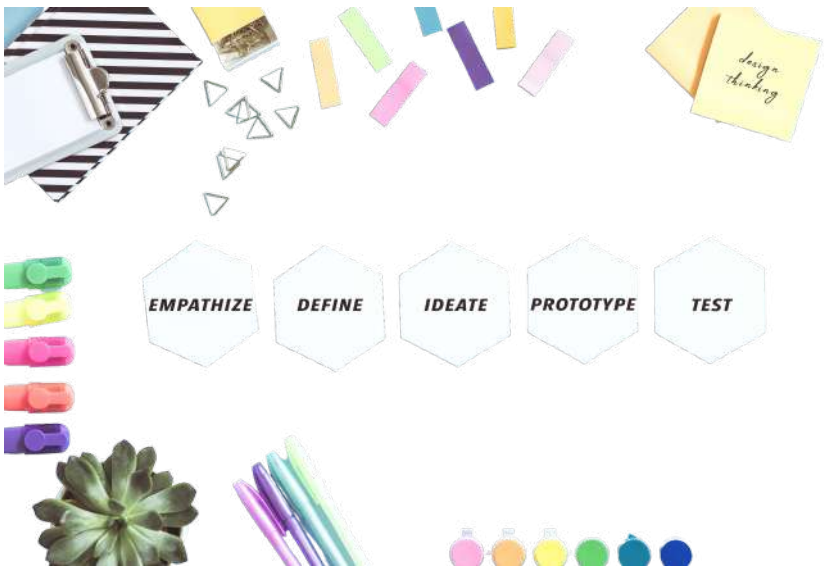
Brainstorm ideas with your working group. Draft the possible prototypes, compare their possible strengths and weaknesses. With your working group choose the final draft(s) to prototype.

Creating prototypes

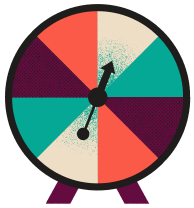
Build your prototype(s). Build a working ready-to-use model of your prototype.

Testing/refining

Test the prototype with your target group and collect their feedback. Then revise your prototype including feedback and suggestions of the potential users.



Activity: the board game



Design Thinking is a complex and engaging process. But how can we put it into practice with our students?
There are so many possibilities but it is not always easy to include them into the practice of our lessons. Therefore, we propose to start with this activity: **the creation of a board game.**

We said that the Design Thinking process starts from an existing product trying to improve it further. But since the process is applied to education we must also adapt the product to our purpose. So we suggest some stages to implement the activity following the steps of the Design Thinking process.

Before to start

Select the learning objectives of the activity and communicate them to the students. It is important that students know exactly the knowledge to learn through the activity. Possibly choose at least two topics from two different standards.

Observe

Divide the students into groups. Each group should brainstorm which already existing board games are most engaging and best suitable for conveying content knowledge to a potential target audience.

Empathize

Think about the target group of the board game. Are they younger students? Are they students of the same grade but from other classes? After selecting the target group, students can interview potential players. What are the needs and difficulties of the target group members? Which topics of the subjects chosen for the game are difficult to deal with? What possible solutions are available?

Visualize/draft

Students go back to their work groups and jot down ideas about different board games. They analyze pros and cons and select the most suitable one to convey the learning content and at the same time to engage the final users. They can adapt an existing game or even better create a completely new one inspired by an existing example.

Creating prototypes

At this point each working group creates its own prototype. We recommend using scrap materials for this activity. It is a great way to raise students' awareness of reusing materials, no additional expense is required, and it is a great boost to develop creativity. For example, students could bring and reuse packaging, shipping cartons, used containers, etc.
At this stage all the materials needed to play should be produced. Important: Don't forget to write down the rules of the game accurately!

Testing/refining

Every game is then tested by the other groups, so that every workgroup will play all the games created by the other goups. They are also asked to provide feedback to the designers of the game. Can the gameplay be improved? Can the game be more engaging? Does the game facilitate learning?
Finally, each group incorporates the feedback and releases an updated and improved version of the game.

This activity is perfect for a STEAM class: it is highly engaging, it fosters creativity and encourages a hands-on approach. It can also be easily geared to every age and grade of the students, since the activity can fit countless of topics and content standards.

STEAM Assessment

Here there are some tips for the assessment of the STEAM lesson.

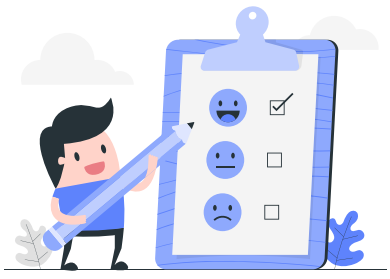
Share your assessment criteria with students and make them part of the process.

If you have developed a rubric or checklist to assess student's work, share it with them. If your students already have experience in project work, invite them to collaborate with you to develop the evaluation criteria so they can reflect more deeply on the steps of their project and what quality work looks like.

During the STEAM lesson, use formative assessment to foster the acquisition of both content knowledge and 21st century skills.

To ensure that students are understanding the content and applying it in a meaningful way, you can use quizzes to assess their knowledge and studying methods. In this case, the quiz is not an evaluation test but it's a method to determine their knowledge, identify misconceptions, and to help them develop their research.

After that, you can also plan frontal lessons and Q & A sessions to clarify the doubts and questions of the students.



in STEAM education the summative assessment of individual standards should be provided by the teacher of each subject.
For example, the science teacher will assess the science content of the STEAM lesson, while the art teacher will assess the students' artistic ability.

However, it is very important that the formative assessment is provided by each teacher involved in the STEAM lesson. That is why collaboration among teachers in STEAM is crucial. Each teacher should provide students with tips and suggestions especially on the integration of different subjects. For example, does the project take into account all the disciplines involved? Is the student making progress in all disciplines?

Here there are some aspects of the STEAM learning that you may assess:

- student persistence
- improvement progress
- meeting of curriculum objectives
- collaboration and teamwork
- content knowledge
- content application
- design success

The STEAM Journal

The STEAM journal is a great tool to be used for both formative and summative assessment.
One of the goals of steam education is to foster creativity. The STEAM journal is perfect for this purpose as well, and it is also very helpful for assessment.

The STEAM journal is a personal sketchbook in which the student outlines project plans, observations, and drawings. It can be very simple, made from stapled sheets, or an ordinary notebook with rings. You can also use an online flipbook. They work very well for the purpose. Our suggestion, however, is to have students create their own STEAM journal.

The student-created STEAM Journal is perfect for fostering their creativity. Since it is created directly by them, the students themselves can choose the materials and layout. This also gives them the opportunity to create something really unique and customized.
The STEAM Journal can also be made from scrap materials, such as the Design Thinking board game; an introductory activity to the STEAM lesson can be creating the STEAM Journal itself.

Please note: The appearance of the STEAM journal should be left totally to the student and not be part of the assessment. In this activity it is important to leave the student free to create, without them feeling intimidated by the assessment. The important issue is not the appearance of the STEAM journal but how it is used.

How to use the STEAM Journal

The STEAM Journal is both a sketchbook, like Leonardo da Vinci's famous one, and a learning journal, in which students record their learning progress, difficulties, interests, ideas and observations.
The STEAM Journal is perfect for creative note-taking, for example, drawing the steps of an experiment, writing down observations on a topic, a project or an experiment, and designing mind maps. The STEAM Journal is a tool both for the student's self-assessment, since the student has the opportunity to check the progress in his or her observations and knowledge, and a useful tool for the teacher for formative assessment.

The STEAM Journal should be a routine activity; it is important that there are fixed times devoted to filling out the journal. When implemented as a routine activity, the STEAM Journal increases students' observational skills, self-reflection, and self-assessment skills. Find specific times during class, such as devoting a half hour at the end of each week, or you can assign it as homework. The point is that students should know that they can write their observations freely but that the teacher can have access to their STEAM Journal at the same time. It is a safe zone for your students.

How to use the STEAM Journal for assessment

At regular times, such as once a month or every other month, collect the students' STEAM Journal. You can build on these observations to help you check on their learning process:

Quantity and quality of observations:
Are the observations relevant to the lesson activities? Are they detailed? Is there an improvement in the student's observation skills over time?

Connection with other standards and disciplines:
Do the notes and observations connect topics from different subjects?

Real life connection:
Does the student relate his learning to his environment and/or real-world events?

Quality of the research:
Do the observations and notes find a match in the final products presented by the student? Are they connected with independent research?

After gathering this information, schedule an interview with the student or provide written feedback. Don't forget to always note the student's strengths before outlining areas in which he or she should improve. This will help the student understand his shortcomings and empower him to improve on his own.

The information gathered by observing the STEAM Journal can also be used to influence the final evaluation, as the STEAM Journal is a great way to assess soft skills as well.

BONUS

Design your STEAM lesson

Now it's time to plan your STEAM lesson.
Here there are some practical steps to plan your STEAM lesson:

Standards

Choose at least two standards from STEM or other disciplines and connect them with at least one art standard.

Topics

Select the topic(s) of your subject you want to teach in the STEAM lesson, then
think about the art standards, STEM, or other subjects that will be included in the lesson.

Timeframe

Consider the time frames of your STEAM lesson. In this phase, it is important to involve other teachers to establish timelines together for activities involving different standards.

Teaching methodologies and practical activities

Identify the methodologies and the activities you plan to build up your STEAM lesson:
You can use PBL, Design Thinking, or both. Try also to plan some practical activities, considering a specific purpose for each activity related to the learning goals.

BONUS

Try to balance frontal lesson and practical activities, in order that students can apply the content knowledge immediately after acquiring it.

Choose the essential question or the problem to start with

This will be the framework of the entire STEAM lesson.
Share your essential question or problem with other teachers to verify its relevance to other subjects.

-**Plan your assessment**

What are you going to assess? How? When?

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References

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The strategies described here reflect solely the authors' thinking and experience in teaching the STEAM approach to teachers. The references are intended to provide pointers for further investigation.

Credits

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