

Ahead

The Classroom as a MakerSpace

Set up toolkit



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INTRODUCTION

In the 21st century STEAM has a big presence in daily and professional lives of humans, and there is a high chance that you are already doing more on STEAM education than you might think. To make the next step into the world of STEAM, our toolkit gets you directly underway to turn your classroom into a Makerspace! It does not only provide you with the latest insights on the matter, but also includes examples and practical templates & tools for you to quickly take action and achieve concrete results.

Our toolkit comes in 6 steps or chapters. First we will make sure we really get to understand the concept of a MakerSpace in education and why it makes sense to turn the classroom into one. Then we will start with creating an overview of what you already do and have regarding STEAM and multidisciplinary education. By the time we reach step 5 and 6, we have lift off: we are setting up our classroom as a makerspace!

“Our toolkit gets you directly underway to turn your classroom into a MakerSpace!”

Six Steps

- The Classroom as a MakerSpace: what is the concept really?
- Why would you turn the Classroom into a MakerSpace? The bigger picture.
- Planning the Activities; Top Tips To Get Started with Innovative Activities
- Funding; What do you need for a Classroom MakerSpace?
- Step-by-step guidance to getting started and STEAM implementation;
- Resources to support the teaching and learning of STEAM subjects, lesson plans, practical examples through real life examples, case studies



Preface: What is Full Steam Ahead?

“Ideal classrooms always change, are a mess & have no teacher desk. They encourage interactions & personalization.” [B. Arnold, 2017].

Despite the huge advances in technology, not much has changed when it comes to how we view learning and how we design learning environments.

The transmission model of education is still the name of the game, although in some circles there are signs of its erosion.

It is time to change the direction of teaching/learning by for once and for all turning it around and allowing it to originate from the pupil.

Imagine a classroom where pupils are the ones driving the learning and are empowered to pursue things that matter to them. To let them employ multiple modalities as they are accessing human and digital resources to drive their own learning.

The aims of the Full Steam Ahead project (and by extension, this toolkit) are to change the way classroom management, the curriculum and the pupil's behaviors are developed by introducing STEAM subjects.



This new strategy in the classroom works by integrating real life situations into curriculum, increasing the results of students in subjects beyond the knowledge of the disciplines, but also soft skills and positive behaviors facing collaborative work, work routines, new challenges, unpredictability, failure in work, and others.



STEP 1

THE MAKERSPACE
CONCEPT



"At its core, a Makerspace is a space designed and dedicated to hands-on learning and creativity"

The Classroom as a Makerspace: What is the concept really?



A Makerspace is a designated area of your classroom or a school in which your students learn to use materials and tools to create something unique.

Having a Makerspace in a classroom is a fast-growing trend in education. Some people refer to this trend as the **Maker Movement**.

There are lots of different ways to define a Makerspace. **Essentially a Makerspace is a space designed and dedicated to hands-on learning and creativity.** Maker movement activities usually include the use of digital technology and involve designing and constructing real or virtual things.

However, **Makerspaces don't necessarily HAVE to include digital technology.** Makerspaces come in all different shapes and sizes. A Makerspace might include the following:

- craft station
- electrical circuits station
- construction and design station
- robotics Station
- animation & storytelling station
- digital station
- LEGO Station.

The Makerspace link with STEAM

Makerspaces are a hands-on method for STEAM learning, giving students space to explore science, technology, engineering, arts, and mathematics.

A STEAM design challenge is a great way to motivate your students and to get your first Makerspace activity off to a flying start.





“It is never enough for a Makerspace”
– Mr. Gonçalo

MakerSpace Example 1: **AEJE school, Portugal**

<http://www.aeje.pt/Paginas/default.aspx>



AEJE is a family-owned business that operates in the education sector (teaching, training and online consulting). The idea to open a Makerspace in the school first came from the innovation plan of the principal. He then hired Ana Paula and Gonçalo (AEJE’s teachers – who are responsible for the Makerspace), and the first Makerspace in AEJE took off in August 2020.

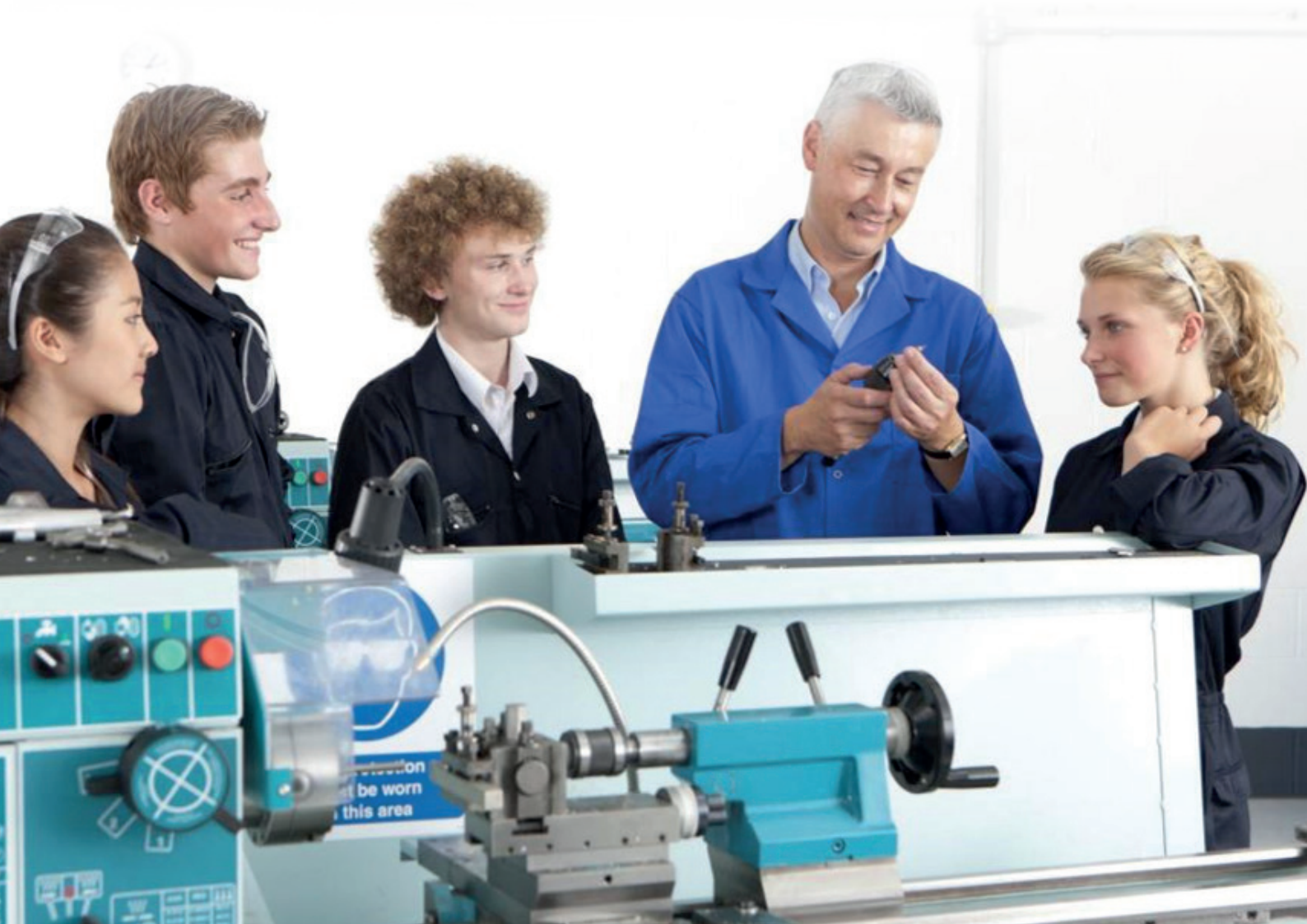
In the beginning, both Ana Paula and Gonçalo could choose between using conventional teaching models or pursuing something new. And they decided for a new concept, which is to use Makerspace in teaching existing school subjects. The school was then remodelled for the new goal: one or two combined classrooms were converted into a Makerspace office, one old classroom was renovated to contain all the tools and equipment and another room is now used for the computers, office chairs and team workspaces.

Most of the current Makerspaces are inspired by those created in Brazil or Germany, which might not fit the budget of every school. Luckily, some tools can be bought cheaper on various websites (AEJE suggests AliExpress).

Set up Toolkit

In order not to break the budget, it is also important to know what you already own. Gonçalo suggests making a list of existing tools and materials the school owns, that reflect what you are planning to do with the students in the following months. With the same idea in mind, you can then create a list of tools and materials needed – opt for those, that can be combined while working as they save space, time, and money. Last resort – with a good imagination, a pair of scissors, paper and a hard glue, can be used to teach STEAM. It all boils down to creativity rather than state of the art technology.

One thing that will be different from your normal classroom – is the role of the teachers in the Makerspace. The first difference is that students will play a major role in the learning process. They take a problem from a teacher and decide how to solve it by their own means. Only when they need some guidance or support, will the teacher join. The second difference is discipline in teaching. Ana Paula believes that this new concept requires a lot of discipline from teachers as they must ensure their students achieve their learning goals through studying in-class while they have to monitor / supervise the student activities in Makerspace.





“STEAM education has a crucial role to create critical thinkers, inquirers, problem-solvers which we think are the most important skills for future jobs.”

- Aslı ÖCAL, Project Coordinator

MakerSpace Example 2: UMHAIHL school, Turkey



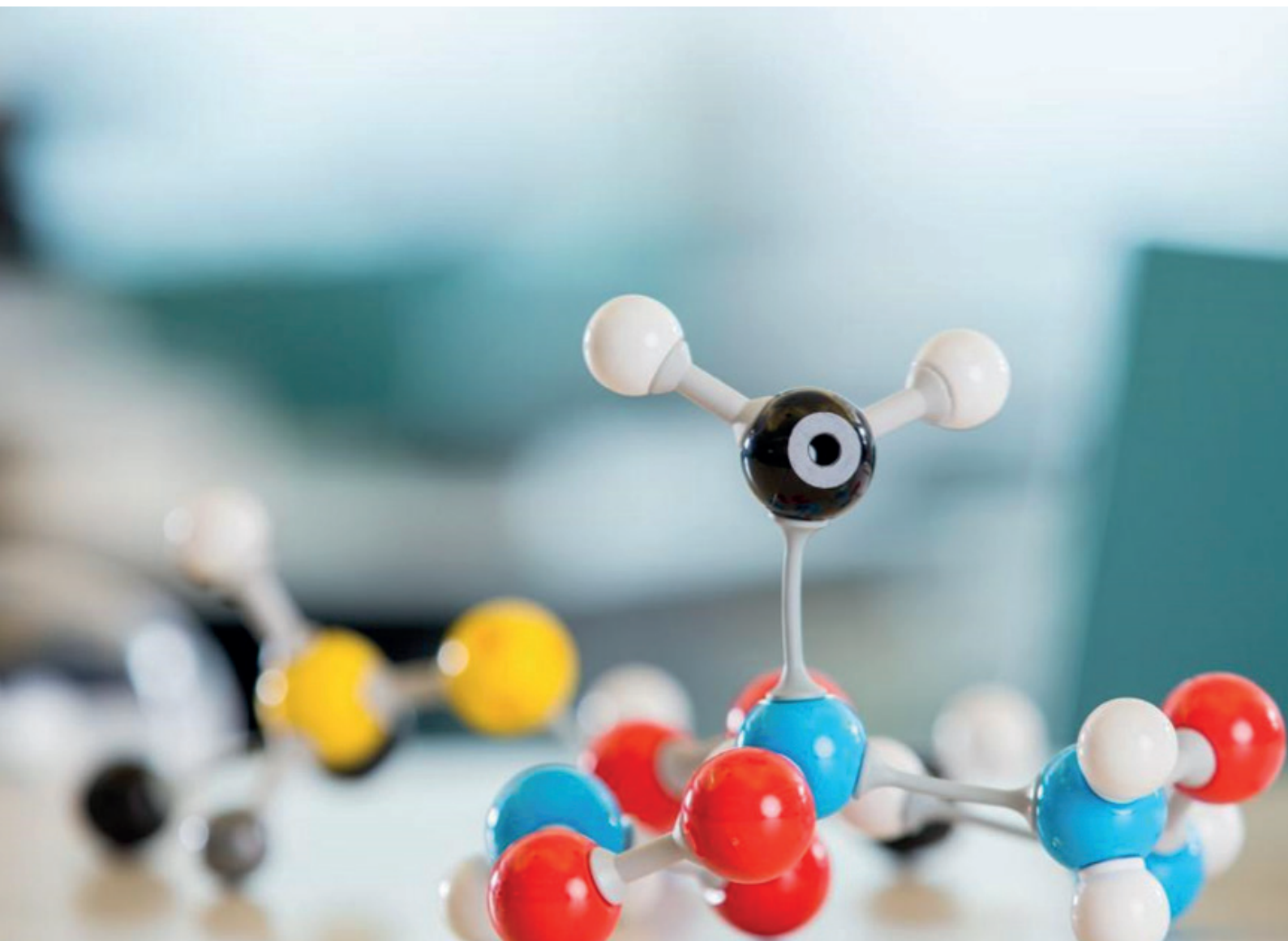
UMHAIHL school provides 4 high-school years for young people aged between 14-18 years old. During the first two years, the pupils focus on Project-based education. After 2 years, in 11th and 12th grades, students are mostly focused on the University entrance studies related with their future jobs.

Mehmet Türkmen, the principal of the school, shares that the school opted to include Makerspaces in the school after seeing that the 3 Science Laboratories were not sufficient enough to satisfy the needs and wishes of curious students. Those pupils, that were enthusiastic to go one step further in their research lacked facilities to do so. In order to let its pupils grow to the fullest potential, the school started incorporating Makerspaces into classes.

Set up Toolkit

Another reason for creating Makerspace in the school was to carry the Turkish Ministry of National Education 2023 Vision at school. 2023 Vision Document by Ministry defines educational changes that are envisioned to be carried out by schools, those include: Design–skills Workshops are to be established in all schools, or the curriculum to be organized according to the interest, ability, and temperament of our student. In order to reach those goal, UMHAIHL adopted a Makerspace mentality and killed two birds with one stone.

The school strongly believes that STEM education has a crucial role to create critical thinkers, inquirers, problem-solvers which we think are the most important skills for future jobs. According to Asli ÖCAL, a project manager at UMHAIHL, the school aims to create a similar space for the primary schools in the neighbourhood and make it available to the younger pupils with the guidance of the students. “We aim to contribute to the creation of a STEAM climate and sharing science by opening our Makerspace to the use of younger students in other schools around us.” - Asli ÖCAL





STEP 2

THE BIGGER PICTURE



“The maker movement leads to a new pedagogy – ‘Tinquiry’ – Tinkering + Inquiry”
– Peter Skillen

Why would you turn the Classroom into a Makerspace? The bigger picture.



As mentioned, probably you are already doing more on STEAM education and multidisciplinary than you actually might think. A Makerspace would be a natural next step.

But why exactly should you create a makerspace in your classroom?

The benefits of having a Makerspace in your classroom are off the charts!

“Research has shown that Makerspaces are highly effective at developing children’s creativity, critical thinking, design thinking and digital skills.”

– *Macquarie University’s Department of Educational Studies*

A Makerspace will also encourage:

- **High levels of student engagement**
- **Increased student confidence**
- **Development of creativity**
- **Development of problem-solving skills**
- **Increased collaborative learning**
- **Hands-on experience with design**
- **Experimentation and construction**
- **Connections between home and school**





To invent, you need a good imagination and a pile of junk."

– Thomas Edison

Step 2 continued

The tremendous benefit for the pupils



From the word cloud provided above, we have selected a couple of reasons to discuss in-depth:

1. Makerspaces are providing the opportunity to innovate

The primary reason why Makerspaces are so in-demand, is because they provide a safe space for hands-on experimentation. Pupils get an opportunity to create and apply personalized learning strategies to make their ideas and products come to life.

2. Creating real-world applications for classroom concepts

With the help of Makerspaces, pupils are given an opportunity to test out all the real-world knowledge they have learned through lectures, videos, or textbooks. They are then able to practice creating solutions to real-world problems.

3. Learning to take failure in stride

As mentioned above, Makerspaces should be a safe space for experimentation, testing, evaluating, and modifying. In the process, the pupils learn that failure is an inseparable part of every creation and how to overcome it.

4. Building critical thinking and problem-solving skills

Pupils who are actively exposed to the Makerspace movement or design thinking, learn the ability to think critically and effectively – an important skill not only in the professional field, but also daily life.

5. Developing a wide range of 21st century skills

21st century skills include flexibility, collaboration, adaptability, oral and written communication, information literacy, technology literacy, productivity, social skills, leadership, initiative and more. These in-demand skill sets help to develop young minds for future success. With a Makerspace, the pupils learn, maybe not all at once, but definitely a handful of 21st century skills.

6. Sometimes they just need a nudge

There are many students with a brilliant mind, who just lack motivation to use their skills to the full potential. A Makerspace can serve as this “nudge” for them to open up. This can occur for several of reasons. First, as we have already established in the previous chapter, students take the lead during such classes – they can explore the topics that interests them and create a ground for their personalised lesson plans. Secondly, Makerspaces allow freedom in achieving a goal with no punishment for mistakes or unusual approaches (they are even celebrated!), which in turn can relief some pressure from the young minds.

source: <https://www.invent.org/blog/trends-stem/benefits-makerspace>





STEP 3

PLANNING THE ACTIVITIES



“I think of the maker movement as being the web generation meets the real world.”
– Chris Anderson

Step 3 **Planning the Activities**

[Top Tips To Get Started with Innovative Activities]



Where to start, you might ask at this point? And literally where to start?!

The truth is you can set up a Makerspace almost anywhere.

Before you get started, you need to find the right place for your Makerspace. When setting up and initiating a Makerspace, you should ask yourself:

- Who will be using this area?
- What type of space would best suit their needs?
- What is the purpose of this space?

If you decide to set up a Makerspace in your classroom, choose an area that is easily accessible for your students and won't impact your daily routine. It can be challenging to keep the area tidy so it's a good idea to choose a space that is to one side or in a corner of the room.

Consider the possibility that your Makerspace could be used by more than one class and the wider school community. Perhaps you could repurpose an unused room or set up a shared space between two or more classrooms?

What Do You Need to Create a Makerspace?

You're going to need materials and construction tools. The materials that you need will depend entirely on the focus of your Makerspace.

Don't be afraid to ask your school community and parents for help in providing materials and tools. You could create a list of materials and include it in a class newsletter or tack the list up in a local cafe or even post it on social media. Chances are, you'll get most of the materials and tools that you need for free.

A list of materials might include:

- **General craft materials**
- **Cardboard board boxes**
- **Old toys to deconstruct**
- **Batteries**
- **Containers**
- **Glue**
- **Tape**
- **Wire**
- **String**

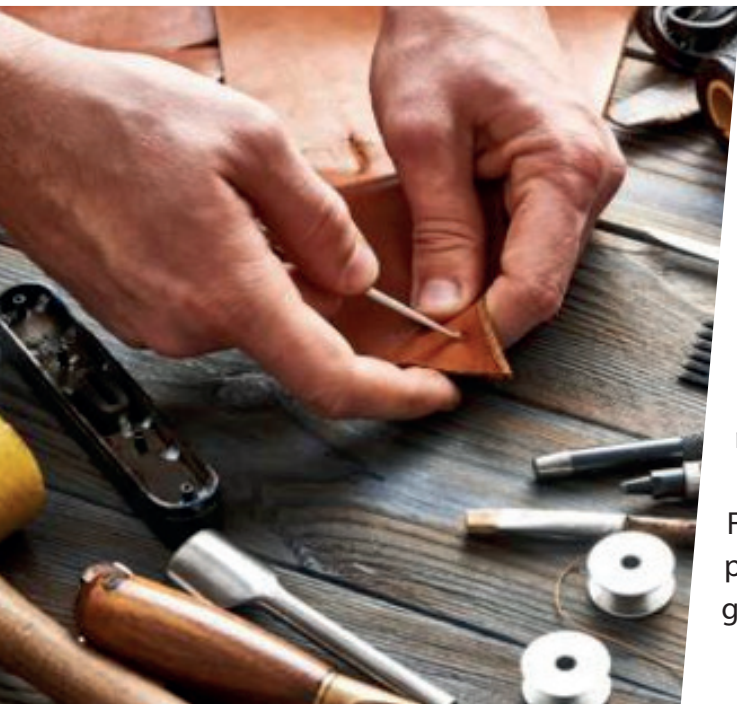
You'll also need lots of clearly labelled storage containers and recycling/waste bins!

[\[Link to PDF - download of list of materials\]](#)

MAKER SPACE

“What we see in the Maker Movement, is that a relatively small amount of people can have a big impact. You don’t necessarily need the world largest company behind you.”

– Dale Dougherty



Which tools do you need for your Makerspace?

When it comes to construction tools, it’s safety first! Safety is an extremely important consideration in any Makerspace program and it’s up to you to make sure that your maker program is safe for you and your students. While a Makerspace is suitable for most year levels, ensure that the tools and the materials that you make available are age appropriate.

For upper years students Makerspace tools might include pliers, scissors, screwdrivers, hammers, sandpaper, tape, glue a glue gun and safety glasses and gloves.

[\[Link to PDF - download of list of tools\]](#)

Storage

After collecting all your tools, consider how they are going to be stored and what would require minimal cleaning after use. Below you will find a few tips on how to maintain your makerspace organized:

- Flatten all cardboard boxes and store them behind a bookshelf or in a box.
- Repurpose old containers you have been storing for smaller materials such as twist ties, toothpicks, screws, etc.
- Label bins for ease of access for both you and students
- If you have a space to hang a tool board or pegboard you can hang many items and materials in a small amount of space
- Rethink your current storage and clear out unneeded materials, move materials you do not use often, condense items, get rid of old files or items you have not used in a while—you will probably be surprised how much space you can find.

source: <https://www.leaderinme.org/blog/makerspace/>





STEP 4

FUNDING



"A collection of tools does not define a makerspace. Rather, we define it by what it enables: making."

– The Makerspace Playbook

Funding

What do you need for a Classroom Makerspace?



Makerspaces can be set up on a very tight or lavish budget based on the need of the pupils. However, not many schools can say that they have millions laying in the back pocket to fund such projects.

It is true, Makerspaces don't have to cost a fortune, and can be set up using pretty simple materials as seen before. In case you do need some budget for turning your classroom into a Makerspace, below you will find some ideas to do so:

- Asking for a financial support from the school
- Applying for a government/regional subsidy
- Crowdfund either the money or the materials needed
- Reach out to your local business specializing in tools

Crowdfunding your Makerspace

If you have decided to crowdfund your Makerspace, whether it is within the local community or in the wider network, first thing is always determining your budget. As suggested above, make a list of all the things you need and realistically write down how much each of the items costs. Think about whether these items are long-term use or will need to be replaced within a couple of days/weeks/months. Plan for those situations as well.

After you have created an estimate budget, you can choose to distribute an outreach programme yourself or upload it on Kickstarter or similar websites. Which you will choose might depend on your personal preferences or the rewards you would want to give for donations. Someone who lives on the other side of the world, might be not as happy with a free pass to the Makerspace as your neighbour.

To distribute a crowdfund yourself (or it can always be done together with the Kickstarter account), you will need to create something that will tell potential donors about your Makerspace and its mission. It can be done online – with a website or a video on YouTube, or offline – with brochures and posters. However, printing costs for offline distribution of the materials should also be counted in.





STEP 5

STEP - BY - STEP



“Playrooms and games, animals and plants, wood and nails, must take their place side-by-side with books and words.”
- Angelo Patri

Step-by-step guidance



To turn your classroom into a Makerspace, there are a couple of steps you need to undertake.

1. Doing research

Find out what kind of Makerspace does your schools need. First, discuss the idea of a makerspace with the head of your school, then with teachers and pupils. You can also include the community to help you outline the perfect Makerspace. Write down what tools will be used and what do the kids want to learn.

2. Finding the budget

After you have established a vision for the makerspace, decide on how to fund it. If the funding comes from schools or the community – that’s great! However, if you need to fund the makerspace yourself, please refer to our Funding chapter.

3. Setting things up

After you have purchased all the necessary equipment, it's time to set up the Makerspace. No matter if it is a couple of rooms or just a corner in your classroom – think about the way to organize it and keep it tidy. Moreover, before opening the Makerspace to your pupils, have a couple of introductory classes in order to discuss general procedures, safety and methods of working.

4. Test your Makerspace

Not all great things are successful from the first try – making mistakes is normal (and it is also one of the biggest takeaways of the maker movement!). In order to troubleshoot your Makerspace, test it with a small group of pupils in the beginning. See what they like and how they work together in this new environment. If it works – you can successfully integrate a Makerspace into your classroom. If it does not – do not fret – write down all the things that did not go well, adjust them, and test the Makerspace again with a new cohort.

5. Making it last

If your Makerspace passed all the tests and is ready to take off. Think about not only short-term impact it can have, but also long-term broader impact.

“How can it strengthen the community around you? How to integrate it into the wider curriculum? How do I encourage other schools to try the Maker Movement?” – these questions can lead you on journeys that will not only benefit the people around you, but also will create network of like-minded people that will help you in different areas. Perhaps a local smith wants to donate some materials that can be used in a Makerspace, or a library sends a request to book your classroom for a project they are working on. Now, the world is an oyster, and the possibilities of your Makerspace are endless!





RESOURCES AND TIPS

FULL STEAM AHEAD RESOURCES

Full Steam Ahead project offers resources both within the scope of the project, but also those, that originated outside the consortium. Below, you will find a variety of resources – some will be focused on the topics already discussed in this toolkit, some will provide input on the topics not yet discussed, and the third category will hopefully inspire you and show you all the benefits a Makerspace can bring to your classroom.

“Human being biggest wealth is knowledge because it cannot be robbed and always increases by sharing.”

– Austin Kleon

Resource 1 FSA Case Studies



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Resource 2 **LEGO Education**

LEGO blocks can be a great substitute for fancier machinery when there is no need/budget for other materials. You can create your own lesson plans based around LEGO or take a look at LEGO Education Resources for more inspiration. Great thing about them is that you can apply them to any set of LEGOs you already own and do not have to buy the models specifically designed for education if you do not wish to do so.

Resource 3 **Maker ED Resources**

Maker Ed provides training, support and resources to individuals, communities, and institutions, who want to integrate a Makerspace in their learning environment. A great thing about Maker Ed is that they have their resources open for general public. You can filter the available resources by age, subject or topic to find the perfect match for you. And the resources range from anything to lesson plan ideas to troubleshooting in classrooms.

Resource 4 **Making Spaces Toolkit**

In 2015, Children’s Museum of Pittsburgh collaborated with Kickstarter to develop and pilot a model that uses crowdfunding as a way to raise community awareness, support, and funding to sustainably integrate Makerspaces as a learning innovation into schools. Now, they are sharing that knowledge and resources in a Making Spaces Toolkit.

Resource 4 **Create A Makerspace for Your School In 5 Easy Steps**

The resource mention will be useful to those, who wish to deepen their knowledge in almost all the topics described in our toolkit. The 5 steps include: Getting started; Tools and machinery; Finding Space & Time; Making it Work; and Making it Last.



We have also gathered some tips and tricks that might help you to set up your first Makerspace from the teacher's featured in our case studies. These are the things that do not immediately spring into mind when thinking about creating a makerspace, however, are just as important as all the things discussed in this toolkit.



Tip 1

After completing the preliminary studies on the needs of the schools and the field desired to work with their students and teachers, it should be decided what kind of Maker Space to set up. Otherwise, a standard Makerspace might not meet the needs of students and teachers. **(Aylin ERDOGAN, PROGEP Coordinator)**

Tip 2

We recommend to set up close cooperation with related stakeholders and try to be part of the STEM Education Network for the updates in the field. **(Aylin ERDOGAN, PROGEP Coordinator)**

Tip 3

Start small. The reason is that there are many tools and preparation that schools need to learn and study, so if their plans are too big or too ambitious, it will be more difficult (and sometimes even demotivating) for them to achieve. Just take it one step at a time. **(Ana Paula – teacher AEJE)**

Tip 4

Adapt existing teaching methods and subjects with this new concept. It is an important step because if it is done poorly, not all teachers will incorporate Makerspace in their teaching plans. **(Ana Paula – teacher AEJE)**



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