

Maker's Red Box

**Fact or fiction:
four maker education
myths, debunked**



Education needs a rethink.

“Our students, when they graduate, are going to look for jobs that haven't even been created yet, and that's scary that we are not going to be preparing students for gainful employment if we don't make changes to curriculum,” a secondary school head teacher explained in a recent survey carried out by [EdWeek Research Center](#). More than half of the 586 school and district leaders who responded saw updating curricula to get students ready for the jobs of the future as a top-of-agenda issue.



A lack of available best practices, models and resources, however, is greatly holding them back. More than a fifth of school leaders surveyed said their schools don't have the resources necessary to deliver on their commitment to meaningful, career-focused learning. So what they resort to is doing the bulk of the redesign on their own. *“We're trying to build a plane as we're flying it,”* said one of the head teachers surveyed. *“There's really not a ton out there to help.”*



We've said it before and we'll say it again: maker education might just be the answer to these educational woes. It's a movement, a methodology, a mindset and a community all at once that blends future-proof hard and soft skills development with a strong focus on design and learning by doing. And it does so by challenging children to think, create and solve problems using a mix of traditional crafts and digital technology, such as 3D printing, laser cutting, sewing or coding.

Having run over 1,000 maker courses, we've seen first-hand how misconceptions often hold educators back from embarking on their maker ed journey. Just to mention a few: it's pricey; only suitable for STEM subjects and students already interested in those areas; it requires special expertise and tons of extra effort from teachers. The truth is, it's an investment of time, resources and effort that students, teachers, schools and education systems can all benefit from.

In this eBook, we'll take a closer look at the four most widespread maker education myths and sort fact from fiction, including:

Why maker ed is a great fit for teaching STEM and non-STEM subjects alike

How hands-on learning can engage students with all kinds of interests and career plans

Why anyone can run a maker course, whether they teach science or music

What you really pay for when investing in setting up your own makerspace

1 Are maker classes only for teaching maths or programming?

Maker education isn't about teaching maths in a school lab instead of a classroom. In essence, it's teaching anything, anywhere, through discovery. Here's why it beats subject-based learning when it comes to getting kids excited about the Thales' theorem, Harari and everything in between.

Subject-based teaching is far from being the default or only – let alone the most effective – way to go when it comes to education. It's not even the oldest method, having been around for some 150 years. Prior to that, curriculums were divided into different subjects only in secondary and university-level education. In elementary schools, competencies were developed on an ongoing basis in mixed-age groups, not in rigidly scheduled, siloed classes. One minute students were practising on the abacus, the next they were learning to write in cursive.

Learning: from burden to benefit

Granted, subject-based curriculums break down information into blocks that can be built into a body of knowledge in a systematic way. But if that system essentially entails teaching a timeline of scientific discoveries that are otherwise taken out of context, it's just not effective enough. Not to mention that it completely neglects problem awareness and problem-based learning. Learning is a complex and intensive process, so children must be given a clear and immediate goal that keeps them going.

For example, in most schools, chemistry education starts with learning about compounds, organic and inorganic, then molecules, atoms, protons, neutrons, electrons and so on. This is a great way to study chemistry but not to understand it. It doesn't explain why butter melts in the frying pan or how salt prevents ice formation on the road, even though these are just the type of real-life examples that could engage primary school students in learning about chemical reactions.

The other problem with discipline-based education is that textbooks fail to equip students with the skill they'll need the most in the real world: how to find the right information instead of being handed it on a plate.

In the digital age, answers are everywhere. But which ones are reliable? Or valid? Or the latest? The critical and analytical skills required for validating information are near-impossible to acquire through textbook learning. This is mostly because it goes against everything these skills stand for: namely, putting pre-packaged truths above discovery. One of the reasons why fake news is spreading like wildfire today is that entire generations have grown up wired to learn this way.



How to get kids into Harari and the Thales' theorem

Not only is maker pedagogy suitable for teaching a variety of concepts, interdisciplinarity is at the very core of its philosophy.

It challenges students to come up with solutions using their maths, physics or chemistry skills simultaneously, without ever drawing a line between them. Bringing real-life experiences into the classroom both helps children develop a deeper understanding of scientific concepts and improves their memory. This is especially true for hard-to-grasp theories like Thales' theorem or Gay-Lussac's law. Plus, why would we even want to teach kids formulas that took scientists years to uncover without telling them what problems they can solve using them, in and outside of school?

The same goes for topics like history, literature or social studies.

In the very first session of our **City of the Future** course, students learn how communities are formed and structured, roughly based on Harari's interpretation of history. In a Finnish school, for example, Maker's Red Box was used to teach English as a foreign language, among other things. Our **Superheroes** course focuses on digital storytelling, helping kids explore their own strengths and relationships and how these shape their lives. Which, if you think about it, is what teaching literature should come down to: understanding what drives us and our peers and building empathy for each other.



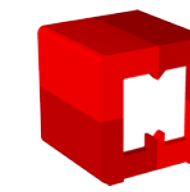
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Maker education: for “geeks” only?

Fact: maker pedagogy promotes STEM and STEM-rich learning. Fiction: that's all there's to it. Let's take a closer look at how storytelling and role play can guide students, no matter their interests, on their path to skills development and self-discovery.

During our City of the Future course, we ask participants to create the city they would like to live in 80-100 years from now using city planning best practices. In essence, it's a thought-provoking experiment to tackle the societal, environmental and technological challenges of the future through a joint creation process. Students play the roles of the city's mayor, architects and engineers as well as any fictitious expert they come up with. Each role offers a wide range of creative tasks, which may be different in nature but are equally important.

CHAPTER 2



Some will only be responsible for a specific area, such as agriculture and food, while others will oversee all city departments as mayor. Some get more involved in designing buildings, some in actually constructing them. They also take turns doing tasks like looking up information on the internet and documenting their findings. Besides their own areas of responsibility, the children also need to work on cross-functional projects, such as building the city's road network. All decisions must be made together, even if this sometimes sparks conflicts.

It's crucial that students with all kinds of interests and career plans understand how a city, and society as whole, works. As participants have their own tasks and goals throughout the course, it's inevitable that they will use different tools and technologies to overcome barriers or make life easier for the inhabitants; this will be the case whether or not they're into "geeky stuff". And that's where frame stories can make a real difference. They have the power to engage and motivate students, from science buffs to artsy types, to combat challenges with the help of technology.

Why is this important, you ask?

Firstly, because in traditional educational settings, children are often put in boxes - like the class clown, the straight-A student, the rule-breaker and what have you. The problem is that if a child gets stuck in the same role for four to eight years, it can easily stunt their potential and inhibit their success. Secondly, in regular classes, children are expected to perform the same tasks within the same time period using the same resources. This often causes them stress and anxiety because, naturally, not all children are the same.



When one size does definitely not fit all

Letting students explore and experiment with different roles and responsibilities is key to developing their awareness of themselves and others; that's how they learn that being "bad" or "mediocre" at something doesn't mean they can't be absolutely brilliant at something else.

Recognizing individual strengths and weaknesses takes a great deal of burden off students' shoulders, decreasing frustration levels and leaving more space for knowledge building and sharing, collaboration and discussion. Maker pedagogy not only anticipates and accepts such differences but builds on them to empower students, so they can become the thinkers, creators, problem-solvers and innovators that tomorrow's businesses and communities will need.

While building the city of the future, makers have a chance to try their hand at all aspects of urban planning, from freehand drawing to conflict management. They learn the ropes of 3D design and how to use 3D printers with confidence on their own. They discover laser cutting as an alternative to printing when making models. They also learn to simulate electronic solutions to problems using a microcontroller to model even their most unusual ideas.



Technology savvy, however, is only a means to unleash makers' creativity – not the goal itself.

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Want to run a maker ed course? You'd better be a computer science teacher then.

Not exactly. All you need is willingness to take the time to learn how to use and make the most of new technologies. Let's explore what skills it really takes to get started with maker education and make the most of it. Spoiler alert: having a degree in a STEM subject is not one of them.

Just last year the Curriculum Development Team of the Reformed Church in Hungary launched a pilot project where six Reformed Church schools set up makerspaces and ran Maker's Red Box courses. The feedback was overwhelmingly positive – from religious studies, literature and STEM teachers alike. Among the main reasons cited for the pilot's success was its ease of use as well as the helpfulness of the teacher's guides and supporting digital content included in the course materials.

CHAPTER 3

This is crucial for two reasons.

Firstly, it shows that anyone can start and successfully run a maker education course as long as they're willing to learn how to use new technologies. With the wide range of user-friendly and affordable digital tools available for education, this is getting easier by the day. Secondly, it underlines the changing role of today's educators in our brave new digital world; that it's about being a guide or mentor, rather than an instructor or holder of the ultimate truth.

In a maker education classroom, teachers' primary responsibility is to support the class in completing tasks and finding solutions to whatever problem comes their way. There's no need for them to know things better.

The biggest challenge for teachers of any background – when it comes to maker education – is not that they don't know how to solder or code. If anything, it's embracing the role that this new, tech-powered way of teaching offers. Once they've done that, a whole new world of opportunities will open up for them; one where students see their teachers as partners and are eager to hear what they have to say. This is something educators hardly ever experience in traditional school settings.

Transforming into the role of a mentor or facilitator does not make educators less-than, but rather, it turns them into adults who are easy to talk to and trust. The result is often an entirely new classroom dynamic, where students focus on their tasks at hand and look to the teacher for guidance, inspiration or feedback. Creating such a learning environment, by definition, doesn't require a math or music or any kind of specialist teacher, just a good one.



4 **Maker education: splurge or investment?**

First of all, the question is what we're really putting a price tag on. To answer that, let's take a deep dive into what exactly maker education entails, how it fits into curriculum delivery and what outcomes it can produce, both for educators and for learners.

Maker pedagogy is a set of methodological approaches that supports the development of a variety of competencies. As opposed to memorizing facts, it fosters long-term knowledge retention and a better learning experience. It can take place in any environment, but it's best applied in a workshop setting, where children are free to use and experiment with tools and technologies to see how the things they've learned about in class work in practice - and transform that information into useful, hands-on knowledge.

In terms of theoretical roots, maker education is basically a form of constructivist pedagogy practised in a makerspace environment. The term 'constructivism', however, does not refer to the construction of objects but of knowledge. It goes back to the 1960s, when **pioneers of constructionist and constructivist learning** recognized that students are not empty vessels to be filled with information. They argued that children build new understandings and concepts as they talk or read about our world and connect with others in it, a process that is extremely personal and different for everyone.

Maker pedagogy is probably educators' best bet to make this learning model a reality. In maker classes, children use a combination of cognitive processes as well as skills and knowledge, like maths, writing or reading, without even realizing it. The teacher's task is to create a setting and come up with workflows that facilitate this process with guaranteed results. When developing Maker's Red Box, one of the challenges was to create a learning design where students with different backgrounds and strengths could develop common ground for building knowledge.





But back to the high price myth: if you're just about to buy your first 3D printer or laser cutter so you can run a maker ed course, it will certainly put a dent in your budget. But if you look at all the different ways these tools can be embedded into classroom activities across grades and subjects, it's easy to see how the investment will pay off in the long run. Take buying a new desk as an example. If you get a desk for the sole purpose of folding a single paper aeroplane on it, it's not worth the cost, even if it's the cheapest desk available. Use it for years to come, however, and it becomes an investment you'll be glad you made.

To cite a more practical example: we recently visited a local school that's part of a nationwide initiative to help teachers unleash students' creativity through digital technologies. In one of the classes, the students printed a teddy bear as an award for whoever fared best in the environmental science test. Not only was it a great and easy way to bring children closer to 3D printing, but it was also a motivation booster. Additionally, it proves that investing in maker technologies can go a long way in enhancing the classroom experience - way beyond a course or a workshop.



Ready to get started with maker education?

Here are 6 tips from our experts to make your journey all gain, no pain.

1. HAVE A WORKSHOP SUPERVISOR ON BOARD

Maker courses aren't only for the tech-savvy, granted. But having someone to turn to when you need help with operating or troubleshooting the machinery can make learning a smoother, less stressful and more engaging experience for everyone involved.

2. MIND YOUR TIMEFRAME

Making processes can hardly be interrupted, let alone divided into the 45-minute sessions they normally would be, so make sure to plan accordingly. Preparing a story box, for example, can take anywhere between a 90-minute session to a week-long course.

3. SET CLEAR GOALS FOR YOURSELF AND YOUR STUDENTS

Have a clear idea of what hard and soft skills you're looking to develop with each makerspace activity. Even better, share them with the children, too! Knowing exactly what they'll be learning or getting better at can be a huge motivation booster.

5. MEET THE PARENTS - AND WIN THEM OVER

Seeing students beaming with pride as they present their creations to others is one of the best parts of a maker ed course - and especially so if it's in front of the family. Most parents are more than happy to take part in the demonstration, so don't hesitate to invite them into the makerspace.

4. HAVE YOUR SAMPLE OBJECTS READY

No matter what you ask the kids to create in class, preparing your own version beforehand should always be step zero of the making process. Not only does it give them an idea of what they should be working towards, but also the size of the object in question.

6. GET YOUR STORY STRAIGHT

There's a lot more to running a successful maker ed course than having your lesson plans ready to go. A well-thought-out frame story helps facilitate the learning process by turning tasks into challenges and the acquisition of new skills and knowledge into a collaborative experience.

About Maker's Red Box

Looking for a well-rounded curriculum developed by makers for makers?

Designed to engage and inspire kids aged 11 to 16, Maker's Red Box course materials help you turn kids into avid makers and school labs into inspiring learning spaces. Each box includes carefully designed, STEAM-focused teaching materials, with a comprehensive teacher's guide and supporting digital content, and comes with a starter kit for 12 students.

Using the power of storytelling, the course materials both guide the creative process and help children gain transferable knowledge through hidden learning. They focus on

developing both hard and soft skills like 3D design and printing, laser-cutting, soldering, electronics and robotics as well as teamwork, leadership and critical thinking.

Maker's Red Box contains everything you'll need to plan, prepare for and manage the classes, even if you have never written a single line of code or used a laser cutter before. They come with a detailed, English-language guide, 16 video tutorials and sample objects. The recommended tasks and time frames have been tested to provide full immersion for groups of 12.



INTRIGUED?

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