Maker {School}

Maker-centred learning approach for primary education

An Introduction

The University Of Sheffield.

Maker{Futures}
www.makerfutures.org

Introduction

Maker{School} is part of the University of Sheffield's Maker{Futures} initiative to support STEAM (science, technology, engineering art & maths) learning, makerspaces and maker education in schools, early years settings, libraries and community spaces throughout the UK. Maker{School} is designed specifically for schools and covers makerspace projects and guidance for early years and primary settings.

Maker education & Makerspaces

A growing movement internationally, maker education provides children and young people with the skills, knowledge and habits of mind to make projects in relation to real world problems using both high- and low-tech tools, materials and technologies. Makerspaces encourage children to not only develop the knowledge and skills to create, make and mend things, but they also support the development of 21st century transferable skills such as creativity and critical thinking through nurturing a maker mindset.

Although closely linked to STEM subjects, making can enhance all areas of the curriculum and provides an interdisciplinary practice at the crossroads of every subject. Many schools are now keen to develop their own makerspace or maker education provision. This document provides a brief introduction to the Maker{School} approach. For more information on what we do, visit www.makerfutures.org

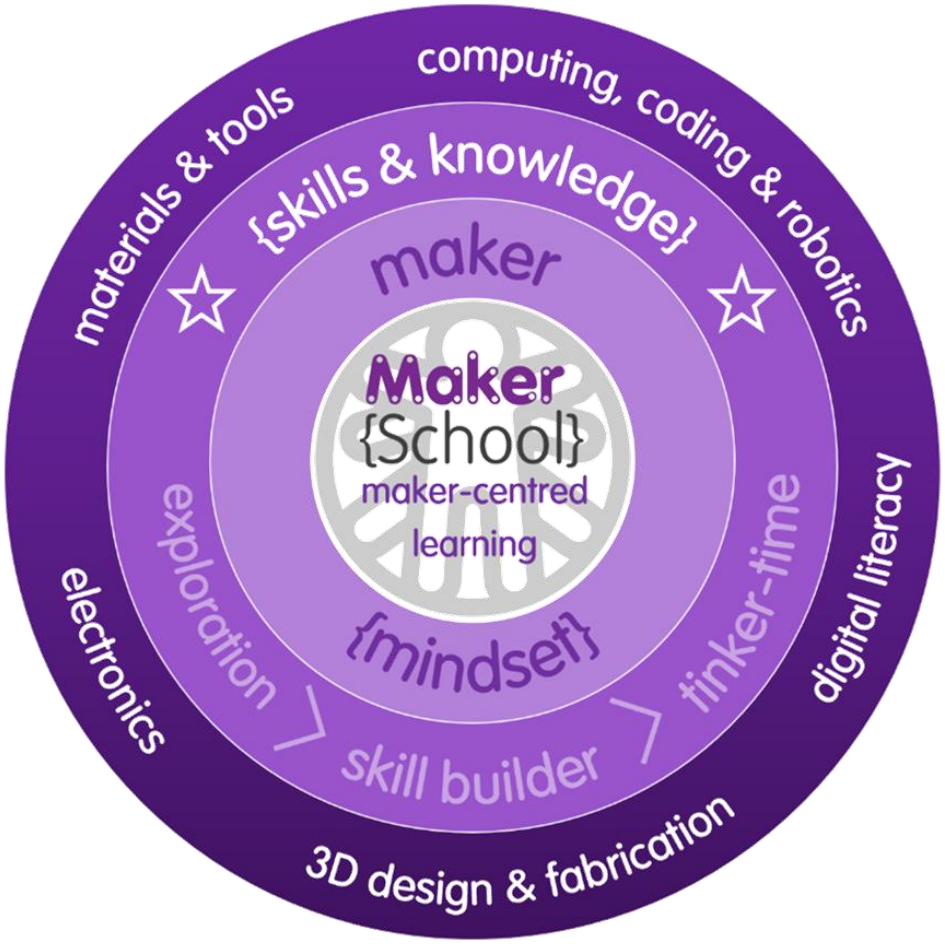


Fig 1. Maker{School} Model of maker centred learning

Maker{School} Model

Our model of maker-centred learning (see fig 1) puts the child at the centre of making. Developing as a maker is more than simply learning the skills and knowledge to manipulate materials, use tools, and code software. It is important to start with the characteristics we want to nurture. Learning to 'think like a maker' is encapsulated in the Maker{Mindset}.

Wrapped around the development of the maker mindset are maker-based skills and knowledge. Within the Maker{School} approach, this is a *learning by doing*, enquiry based approach. Maker skills and knowledge is done through a three stage process; Exploration, Skill builder and Tinker time.

The key skills and knowledge needed as a young maker have been divided into five areas. For the purpose of clarity and identification, these are presented as standalone topics. However, these topics will intertwine as projects develop.

- Materials & tools
- Computing, coding & robotics
- Digital literacy
- 3D/digital design and fabrication
- Electronics.

Developing a **Maker {Mindset}**

Maker{Mindset}

The development of a maker mindset is integral to the Maker{school} approach. With big overlaps in 21st century skills and growth mindsets, these habits of mind are not just about developing as a maker but are a valuable addition to many of the skills needed in the future workplace.

Key maker mindsets include:

- Creativity
- Problem finding & solving
- Innovation
- Collaboration
- Risk taking
- Questioning
- Tinkering
- Iteration (revisiting ideas to improve)

Children need a learning environment where they can discover, develop, and practise these valuable and transferable life skills.

{Skills & Knowledge}

Maker{School} is developing a three stage process to delivering and developing maker skills and knowledge in schools. This process can also be used to enhance existing STEM or STEAM based learning and across the curriculum.

EXPLORATION

Curiosity

This is child-led time to play, explore and become familiar with materials and processes. It takes the current best practice of continuous provision in the early years to provide child-led exploration time for all primary pupils. Exploration time promotes curiosity and provides opportunities to get to know materials, technology, software, and tools. Teachers can support children's exploration by asking open ended questions such as; *What happens if ... ?, How many ways can you ...?, What do you think this might do?, How could we use this?*

SKILL BUILDER

Competence & Confidence

These are sessions of focused, instructional learning to gain or deepen specific skills and knowledge. The collaborative and sharing culture of making means there is a huge amount of free to access material to support teachers in facilitating learning in new areas. This allows the teacher to learn alongside pupils. Skill builder sessions may be facilitated through a teacher, video tutorials, visitors, books, and guides. These structured sessions are short and focused. An example of a skill builder session would be how to design a 3D model for 3D printing.

TINKER TIME

Deep engagement

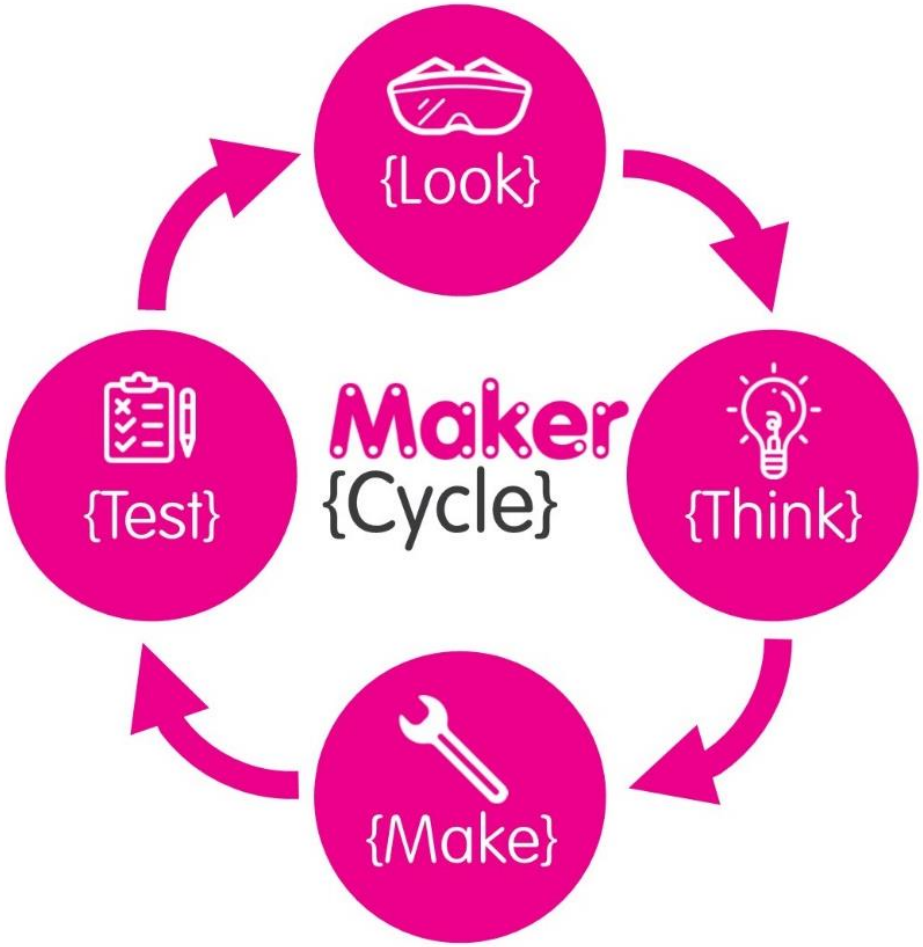
Tinker time builds on the curiosity, confidence and competence developed throughout the exploration and skill builder activities. It gives pupils the opportunity to engage deeply creative thinking, problem solving and iteration, we need to provide opportunities. Tinker time provides the time, purpose, and space for children to consider real world problems, rapid prototype and find innovative solutions. The emphasis is on the process of making and developing the maker{mindset} rather than on the finished product. This approach deepens learning and gives agency to each maker.

Maker{Cycle}

To help guide pupils through the problem solving, making process they use the Maker{Cycle} to evolve and iterate their ideas and prototypes. Children begin to understand that entering into a process of continual improvement produces their best work. By developing a culture of trial and improvement, children build resilience.

The Maker{Cycle} is a concept similar to the design cycle, or the engineering design process, and provides a simple cyclical approach to making, prompting children to look, think, make and test. Makers work through these four stages of the process regularly, reflecting real world innovation and creative problem solving. Children develop the confidence to try new things and test their ideas little and often and they learn to evaluate their work and make improvements.

Through doing this, they discover what works and what does not and where the gaps are in their maker skills and knowledge. In turn, this leads them to pursue further exploration and skill builder sessions. Teachers can help by signposting children to where they can develop their skills further independently or perhaps start a display where children can add their ideas for new skill builder sessions.



Key Areas of Making

The skills and knowledge required for making depends on what you want to make, and *that* depends upon what needs making. The need arises out of a problem and as problems come in all shapes and sizes, it is important that maker education covers a wide base of both skills and knowledge. The Maker{School} curriculum focuses on five key areas.

1. Materials & tools
2. Computing, coding & robotics
3. Digital literacy
4. Digital design & fabrication
5. Electronics

It is important to note that although these five disciplines are grouped as separate entities, maker education and making often blur the boundaries between each area as projects develop and disciplines are intertwined as tinkering occurs and solutions are sought. Many schools will already be covering subjects that fall within these areas. Some makerspaces choose to focus on specific areas, but we feel that it is useful for children to have some experience in each of these areas.

Creating a school makerspace

You do not need a state-of-the-art workshop to begin your own school makerspace. Where some schools have the space (and budget) available to have a dedicated makerspace room, housing tools, materials and equipment such as 3D printers, laser cutters and computers, others are able to cohabit an existing school space such as the computer room, library or corner of a classroom. For others, a trolley of key tools and resources can work well and allows different classes to access the equipment.

We believe it is the *way* maker education is facilitated to nurture a maker mindset that is most important, and the tools and space have a supportive role. You can certainly develop a broad maker centred learning programme on a tight budget. Begin by collecting any maker related tools and equipment that you already have in school. For example, construction toys (Lego, K'NEX), craft materials, circuits or electrical components, cardboard and scrap materials. As you begin projects, you will start to see the areas you want to expand. Think about asking families to collect craft or scrap materials or visit a local scrapstore. For more expensive pieces of equipment, consider a fundraising drive or apply for funding externally.

As part of the Maker{School} programme, we are currently developing a range of support and guidance to help UK schools to provide maker centred learning. Keep up with what we are doing via the website www.makerfutures.org and through our social media platforms.

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