

Interactive Classroom
Working Group



Future
Classroom
Lab

Makerspaces in schools



Practical guidelines for school
leaders and teachers

Case Study

Alexandra College Junior School,
Ireland



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Acknowledgements:

Jennifer McGarry, Teacher and Coordinator of School's Makerspace and Avril Lamplugh, School Principal.

Picture credits:

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Introduction

Makerspaces, which are designed for hands-on, collaborative, creative work, are a fairly recent addition to some schools in Europe and worldwide. Students in school makerspaces can work with materials such as paper, cardboard, wood, metal, plastics, clay, fabrics, electronic components, micro-controllers, construction kits or programmable robots to create many different objects, and complete many different projects, using a variety of tools and machinery.

This case study is one of 15 developed from interviews with school leaders, teachers and other staff who have set up makerspaces in their schools. The schools are located in nine countries i.e. Austria, Belgium, The Czech Republic, Ireland, Italy, Luxembourg, Portugal, Switzerland, and Turkey.

The interviews were part of research carried out by European Schoolnet's Interactive Classroom Working Group and the schools' experiences, the lessons they have learned and the good practice they have developed, have informed the development of a publication "Guidelines on Makerspaces in Schools".

Find the full report and other case studies here: fcl.eun.org/guidelines

The School

Alexandra College Junior School is a girl's primary school, located in a suburb of Dublin. It has approximately 325 students aged from 3 to 12, 15 class teachers and 8 part-time specialist teachers. It is a private, fee-paying school, with a strong Froebel¹ ethos.

STEAM (Science, Technology, Engineering, Arts and Mathematics) is a priority focus for the school, as well as the use of digital technologies to support and enhance the curriculum. Exploring with technology, particularly in the areas of STEM and STEAM, and teachers sharing effective practice are approaches that are encouraged within the school.

The school has the accreditation "Digital School of Distinction", is well equipped and has a digital technology specialist on-site to support the technology in the school. There are approximately 40-45 laptops and the same number of tablets (iPads) which are shared throughout the school. Each class has an interactive white board. The school also has a selection of STEM equipment, in the form of building and construction or engineering kits, Nexus² products, bridge making kits, etc. This equipment supports STEM teaching and is used within the makerspace. Coding is being taught as a distinct skill in 5th and 6th year classes and the school uses Google Apps.

Motivation and aims

The main reasons for opening a makerspace in the school were:

- ▶ To explore learning and teaching in a different way.
- ▶ To enhance teaching, learning and assessment.
- ▶ To promote 21st century learning including to encourage collaboration and problem solving using logic.

To support and promote a constructivist approach to learning.

1 Friedrich Froebel, a German educator who invented the kindergarten, believed that humans are essentially productive and creative and he sought to encourage the creation of educational environments that involved practical work and the direct use of materials.

2 Nexus The Educators Connection Ltd is a supplier of educational toys, stationery and arts and crafts materials.

It was important to the school that teaching and learning would be very much at the forefront of any new initiatives and the makerspace has facilitated this. Teachers also wanted to use the space to promote the ethical use of technology by students and to help students become creators rather than consumers of technology.



The Makerspace started as a result of study undertaken previously by one of the teachers, Jennifer McGarry, about the importance of the Visual Arts within STEM (STEAM). This gave the teacher the knowledge and inspiration to set up a makerspace when she began teaching. Once the makerspace had been established, the teacher undertook training to improve her use of the space and to enable it to grow and to successfully support the curriculum.

The aims and objectives of the makerspace are:

- ▶ To use the makerspace across many different subject areas, with a particular focus in its early implementation in Visual Arts.
- ▶ To complement many in-class projects, for example a recent project on Living Things from the science curriculum, as well as other subjects and skills.
- ▶ To promote the development of 21st skills, including problem solving, communication and collaboration.

The implementation timeline

Approximately one year was spent planning the development of the makerspace and it was introduced to the school in 2018. The makerspace was used to link and integrate the Visual Arts curriculum with STEM.

Initially the makerspace was only used by one class. It is now used in school time, and as an after school activity, with the 3rd, 4th and 5th year classes.

Next year, the makerspace classes will be in two different class groupings: 3rd/4th and 5th/6th. There is a high demand for these classes in the school.

Building and equipping the makerspace



The makerspace is located within an existing classroom. It has been furnished with shelves and storage boxes as well as a large table. Children within the class can access it on a daily basis and it is used regularly where it can enhance the curriculum. It is also accessed by other students as part of an after-school activity.

There was no dedicated room available to enable a standalone makerspace to be set up. However, the school has found that integrating it into a classroom has the added benefit of allowing the teacher to incorporate it across the entire curriculum, as well as to manage the equipment closely.

Equipment and technology

The makerspace equipment available to students and their teachers includes the following as well as various recyclable and reusable materials.

45 x Laptops	12 x Makey Makey ³ sets
13 x Microbits	12 x Edison ⁴ programmable robots
Lego assortment	Osmo ⁵ set
Green screen set	Makedo ⁶ cardboard construction tool set

Letters are often sent to parents to request recycled and other materials to replenish stocks.

Health and safety

The makerspace is kept tidy and organised, so that it is easy to retrieve items for activities at any time, and ensuring that makerspace activities are safe. There is a makerspace contract that pupils sign up to which details the rules and regulations for using the space; this includes health and safety issues.

Cost and funding

The equipment and the furnishing of the makerspace was paid for by school funds. Recycled materials are used widely within the makerspace and these are provided both by students and the wider school community. Funding of €500 was needed for the first year, which covered the basic requirements needed to run the makerspace for one year, including Microbits, Inventors Kits, copper tape and LEDs. The recent purchase of some additional items has increased the cost. These include a green screen and engineering kits as well as electronic components.

3 <https://makeymakey.com/>

4 <https://meetedison.com/>

5 <https://www.playosmo.com/en/>

6 <https://www.make.do/>



Sustainability

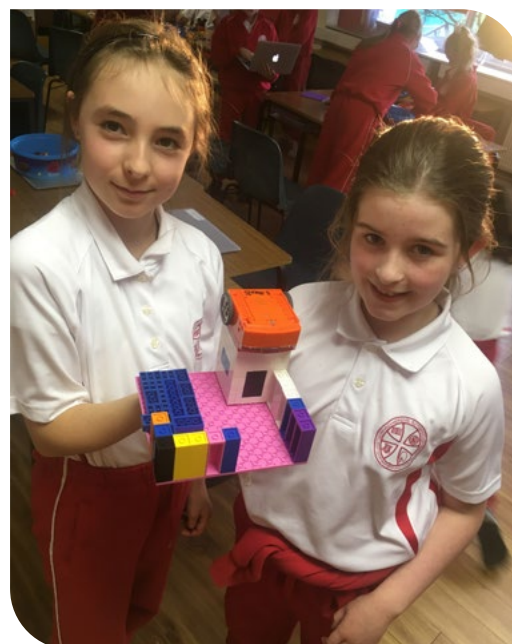
School funds have been used so far to fund the makerspace. It is envisaged that different types of fundraising may play a part in covering costs for future development.

Organisation and management

Makerspace activities are scheduled and integrated into the school day. The space is also used for extra-curricular activities after school on Mondays and Tuesdays; these sessions are extremely popular.

Jennifer acts as the makerspace manager both within the school day and outside of school hours. She is responsible for all aspects of the makerspace with full support from the school Principal. She identifies what materials are needed and provides the necessary information and paperwork in relation to this to the Board of Management of the school for sign off.

She procures all materials and carries out basic technical support on the equipment, with the assistance where necessary of the school's technical support staff. She also creates and adapts lesson plans for use within the makerspace. These can be adapted for different levels as needed.



After the makerspace had been successfully set up for a year, a Digital Learning team was created as part of the school Digital Learning Plan. This plan was drawn up by Jennifer and the Principal in order to expand the use of makerspace equipment and foster new ideas for growth. Four teachers are now on the team and will contribute to further planning and use of technology.

Networking beyond the school

Parents of the school's students have been made aware of the makerspace and future plans for its use. The school also shares its experiences and practice with other schools. At the start of the year, approximately 20 schools attended a joint STEAM workshop that was held in the school. A lot of sharing has taken place in the areas of STEM and also STEAM. The school plans to promote how it has been making use of its makerspace to date to a wider number of schools, in order to spread the word, share experiences and help teachers to learn from each other. In particular the school is planning a STEAM exhibition.

Training and support of teachers

Several formal and informal continuing professional development (CPD) events for teachers have taken place in the school's makerspace. The Principal has observed that the *"teachers are very open to sharing expertise and supporting colleagues. This is a very common occurrence in this school"*.

Jennifer has attended training and upskilled herself regarding the use of the makerspace to support teaching and learning. The plan is that she will train other teachers and organise for external experts to provide training to the whole school staff.

Topics that will be covered in the coming school year include the use of green screen technology as well as coding and how to support learning using robotics, in particular using the Edison programmable robot. The school's digital learning team will provide training and ongoing support on these topics to all staff on an ongoing basis. Jennifer commented that *"CPD for teachers is widely encouraged and supported by school management"*.

The school carried out an audit of teachers' skills and found that, generally, teachers have a good knowledge and understanding of the use of digital technologies. However, the Principal wishes to expand this and to improve teachers' use of digital technologies in the context of teaching and learning. This audit was part of the school's digital learning planning process⁷ in which they have chosen to focus on the following areas of the Digital Learning Framework:

Learner Outcomes

Standard:

- ▶ Students enjoy their learning, are motivated to learn and expect to achieve as Learners.

Statements:

- ▶ Students use appropriate digital technologies to foster active engagement in attaining appropriate learning outcomes.
- ▶ Students use digital technologies to collect evidence and record progress.

Overall the interest in the use of the makerspace and the materials is high. Jennifer, the teacher responsible for the makerspace, has observed that they are *"extremely popular"* and *"there is ongoing interest in and support for the makerspace initiative from all teachers"*.



⁷ www.dlplanning.ie

Teachers are also sharing their own practice with each other, which is consistent with the strong culture of sharing and informal learning within the school. This is being prioritised by the school Principal in order to spread the use of the makerspace to other classrooms.

Teaching and learning

There is a small but growing number of lesson plans, created or adapted by the school, which will be added to over time. This is seen as a priority area for further development of the makerspace, in particular as the school wishes to ensure that every activity supports and enhances the curriculum.

Jennifer describes the pedagogy enabled by the makerspace as “*Collaborative, communicative, constructivist, constructionist, experimental and problem solving*”. The makerspace approach and materials complement many in-class projects, for example:

Studying “Living Things” in the science curriculum and beyond

The students were introduced to the topic through traditional lessons, assigned research topics and completed two assignments using Google Slides.

They took part in a “Rainforest Ranger” tour at Dublin Zoo to see some of the animals and habitats they were researching. They researched biomes⁸, chose one to study and chose one animal from their biome as the subject for a report.

Using the makerspace the students created a ‘Biome in a Box’. The ‘Biomes in a Box’ were then used for English and Geography work for the next term.

It is planned that the students will use iPads to take a picture of their work and they will then use a green screen to insert themselves into the world of the biomes. This part of the project will be used for English creative writing as the students imagine what it would be like to be in that biome.

Then the students will be encouraged to bring in recycled household items. This ties in with the Geography curriculum about renewable and non-renewable resources and the effects of waste and pollution on the environment. The students will take another picture with the green screen, this time ‘littering’ the biome with the recycled items that they have collected. They will use this image in Geography to further their understanding about the dangers of waste and to spark debate.

This will tie in with the Persuasive Genre in English, as the students learn how to promote their point of view and argue the case for renewable resources.

Constructing and coding in the Makerspace Club

The students started by learning about basic circuits and electricity through paper circuits. They then learned how to code Microbits. After completing some coding exercises, they coded a step counter and compared this to a FitBit and a shake counter.

The students discussed what they could do with this technology and the implications of their work. They then chose either a FitBit or a shake counter and worked as designers and marketers to create a prototype that would turn their technology into something that fulfilled a human need. The students researched current Fitbits and children’s games on the market to help them decide how to go about designing their prototypes. They then sketched out their ideas and identified the materials they would need.

In the makerspace area the students found their materials and started to construct their

⁸ A biome is a community of plants and animals that have common characteristics for the environment they exist in.

prototypes.

The next step will be taking pictures of their finished work and creating a Weebly website to market their prototype. The students will also create a poster and present this at a future school assembly.



All makerspace activities are integrated into the curriculum, with Science, Mathematics, Visual Arts and English being the most common areas of integration.

Paper circuits tie in with the energy strand of Energy and Forces in Science. Mathematics is supported by many activities, including distance, sequences of steps, problem solving and so on.

The artistic element to the makerspace is very important, with design thinking playing a key role and the concept of designing with a purpose in mind. Problem solving, collaboration and communication are at the heart of these activities.

All activities are also linked to the school's particular priorities. These include:

- ▶ The Digital Learning Framework standards⁹
- ▶ The Froebelian ethos of the school, which supports and encourages collaboration and play based learning.
- ▶ Teaching students to be safe and ethical users of technology, linked to the webwise.ie website and online resources for schools and parents.

Added value and benefits

Benefits observed by the school include:

- ▶ The ability to integrate makerspace activities with different subject areas.
- ▶ Makerspace activities are very inclusive, with multiple levels of ability catered for.
- ▶ Improved team work and collaboration.
- ▶ Improvements in student's self- confidence, including willingness to try new ideas that do not

⁹ available at www.dlplanning.ie

always succeed and to learn from these experiences.

- Students deriving significant enjoyment from working together and helping each other.

Jennifer is comfortable in saying she does not always have all the answers or know why something has gone wrong. This encourages a culture of experimentation among the students.

Also, writing about their makerspace projects has led to improvements in the development of literacy skills for some students.



Challenges

The main challenges identified by the school are:

- Procuring and maintaining equipment.
- Limited time available to plan.
- Managing the space, which can become very disorganised as it is used frequently.
- Timing and scheduling of lessons.

Most of these challenges are gradually being overcome and the situation is expected to improve further with experience. Regarding planning time, reusing lessons created with future classes will help and, although much planning is done in the teacher's own time, there are some opportunities for planning within the school day.

Future plans

The makerspace was set up by one teacher but there is a strong appetite to spread the use of the makerspace to other classes. Planning and resourcing of this needs to be done carefully and is already underway.

The Digital Learning Team will play a key role in broadening its use and supporting other staff in coming on board.

Ultimately the school would like all students to have access to makerspace facilities, starting with junior classes as part of the Aistear¹⁰ curriculum.

Sharing of good practice will continue to be a priority, including putting digital learning on the staff meeting agenda. Internal and external CPD will continue to be encouraged, using outside expertise and experience where it is available. Also, student "STEAM captains" will be recruited and a dedicated Makerspace Team of teachers and other staff will be put in place.

¹⁰ <https://www.ncca.ie/en/early-childhood/aistear>

The case study complements the European Schoolnet's publication "Makerspaces in schools / Practical guidelines for school leaders and teachers" (2020).

Find the full report and other case studies here: fcl.eun.org/guidelines



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