Interactive Classroom
Working Group

Future
Classroom
Lab

Makerspaces in schools

Practical guidelines for school leaders and teachers

Case Study

HTL-Hollabrunn, Austria

European Schoolnet

Makerspaces in schools

Practical guidelines for school leaders and teachers

Case Study:

HTL-Hollabrunn, Austria

Authors:

Hermann Morgenbesser, Future Learning Lab Wien, Austria

Jill Attewell

Editor:

Anja Balanskat, European Schoolnet

Jim Ayre, European Schoolnet

Acknowledgements:

Nanna Sagbauer - Teacher
Wolfgang Bodei - Headmaster

Picture credits:

HTL-Hollabrunn, Austria (cover, pp. 3, 4, 5, 6, and 7)

Introduction

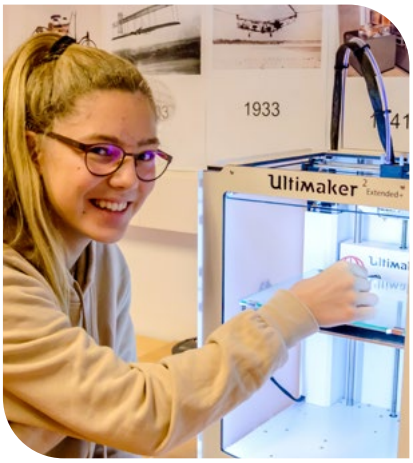
Makerspaces, which are designed for hands-on, collaborative, creative work, are a fairly recent addition to some schools in Europe and worldwide. Students in school makerspaces can work with materials such as paper, cardboard, wood, metal, plastics, clay, fabrics, electronic components, microcontrollers, 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 context and the school



HTL-Hollabrunn is located in Lower Austria in the Weinviertel region. The town of Hollabrunn is north west of Vienna and has approximately 8,000 inhabitants or 13, 000 inhabitants if the populations of the surrounding 21 villages are included. There are approximately 5,000 pupils or students attending schools in Hollabrunn. At HTL-Hollabrunn there are 1,300 students aged between 15 and 19 years old and 145 teachers. Approximately 1,000 students travel everyday by train or bus to the school with the rest of the students living from Monday to Friday in a student hostel located on the campus.

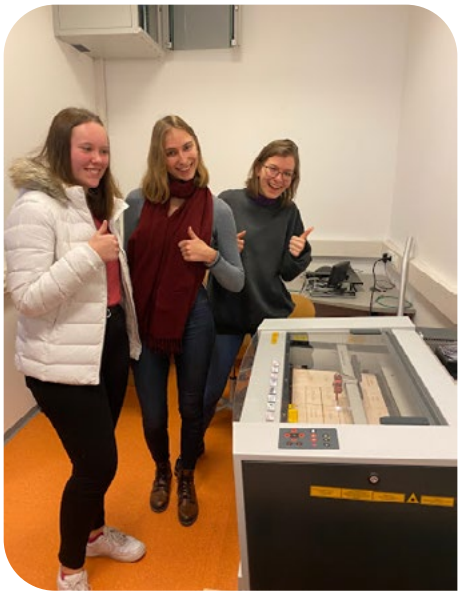
HTL-Hollabrunn is a Vocational School which includes different types of VET (vocational education and training) departments. Each of the VET departments has a specialist focus, these are: electronic engineering, electrical engineering, mechanical engineering, informatics and industrial and business management. The VET departments each specialise in a particular type of engineering i.e. electronic engineering, electrical engineering or mechanical engineering.

HTL-Hollabrunn has an excellent reputation regarding its relationship with local industry and its contribution to the local economy.

Every year the school has many projects running that involve industrial partners, including different types of labs fully sponsored by industry partners. The school also takes part in educational projects that involve industry partners as well as schools in different European countries via the Erasmus+ programme.

HTL-Hollabrunn is proud of its record of investing in innovation and in educational technology. It is reputed to have the best technical school Industry 4.0 lab in Austria and the next step will be the implementation of the online connection of this lab to a similar lab in a partner school in Portugal.

Motivation and aim



The teachers' and headmaster's motivation for opening a makerspace was a desire to recruit more students and to make technical education more attractive. The original idea came from two teachers.

The school leaders also believe that the development of a makerspace is consistent with and supports the school's vision, educational goals and objectives, especially as they are a technical school. They also feel the development is an "*absolutely perfect*" way to support their desire to reflect and integrate digital innovation trends.

According to the Principal, the aim of the makerspace is *"to enable students and teachers in HTL-Hollabrunn and local partner schools, as well as other interested external people, to participate in creative, project based, real life learning through making"*.

The implementation timeline

The teachers first had the idea of creating a makerspace in 2017. A team was formed and they spent 18 months planning. The formal opening of the school's makerspace took place at the end of September 2019.

In lower Austria there is an initiative, proHTL NÖ, which financially supports innovative practical training investments and is funded by industrial sponsors in the metal engineering and chemical industries. In 2018 HTL-Hollabrunn won a proHTL NÖ challenge and received Euro 80.000 in funding which enabled them to go ahead with creating the their makerspace.

Building and equipping the makerspace

Existing space at HTL-Hollabrunn was adapted to build the makerspace. Workshop teachers helped with electrical and water installation, painting and installing the IT infrastructure. The total size of the makerspace is about 100 square meters and it consists of three rooms plus a toilet. The three rooms are:

- A mechanical workshop including workbenches, a CNC machine, a laser cutter, 3D printers, a sewing machine, an embroidery machine, a circular saw and a drilling machine.
- A laser room with laser cutter and materials.
- A creative room, which is modular and includes: computers; a chill out lounge; a conference table; an electronics table with electronics equipment; a soldering table, an oscilloscope and a thermopress.

The equipment installed was selected by the maker team in consultation with local industry partners. A list of equipment in the makerspace is available on the school's website[1].

1 http://www.clever-together.at/

In order to ensure the safety of makerspace users, all tools and devices are of high quality and safety standard. Additional safety features for some tools are being built by senior students, e.g. a cover for the CNC machine made from acrylic glass with safety sensors; if someone opens the cover the machine stops immediately.

The school prefers to use open source software when possible, e.g. Inkscape[2] for laser cutting and embroidering.

Although the makerspace is integrated within an existing building, a separate, digitally controlled, external entrance has been added to enable access by community makers.

Cost and funding

The total cost of setting up the makerspace was approximately 150,000 euros. This was paid for by funds from the proHTL NÖ challenge prize money plus industry partners' sponsorship and money from the school's budget.

Sustainability

In the long run, a fee-paying membership model or a community will be created, to make sure that the space can stay open for users outside the School.

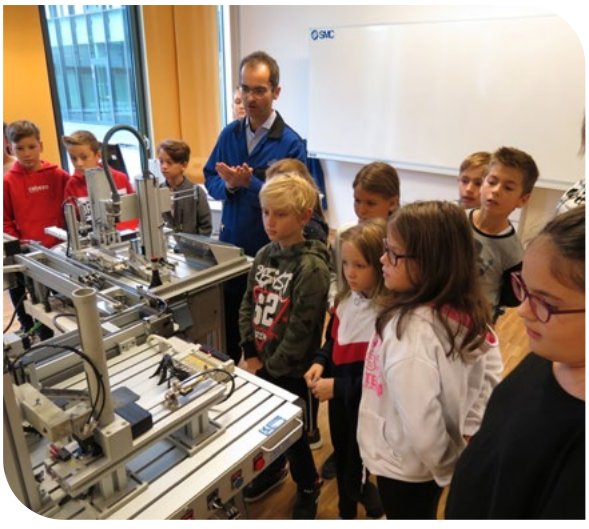
Also, continued contributions from the industry sponsors are anticipated. Currently the two teachers who manage the makerspace also manage the budget.

Set up and maintenance of the tools is carried out by:

- The makerspace managers;
- The craftsmen who teach the technical workshops at HTL-Hollabrunn; and
- Students, aged 17 and over, as part of their paid work as makerspace operators employed by a start-up company.

Organisation and management

The makerspace at HTL-Hollabrunn is new and arrangements for how it will be managed on a day-to-day basis in future are still being developed. Which, and how many, teachers and students will use the makerspace, at what times and how often is yet to be decided and the organisation's timetabling system has not yet been finalised.



Currently, there are two managers involved in the management and running of the makerspace. One is responsible for the whole makerspace and the other handles publicity. There is also a maker, i.e. a person who knows about the tools, works with the teachers and provides technical support.

2 https://inkscape.org/about/

From September 2019 the makerspace will be open to the outside community, including parents, friends and makers. Outside of schools hours it is planed that the makerspace will be open daily for community use, and use by students over the age of 18, and managed by a skilled, trained operator.

Networking beyond the school

In the next few months following interviews with staff, the school plan to create a network of volunteers around the lab. Currently the school's makerspace officially belongs to the parents association of HTL Hollabrunn and it is not linked to an external maker association. Similarly there is not yet any collaboration with fab labs outside the school and they are still working on building these networks.

Training and support of teachers

Teacher training is carried out collaboration with the Pädagogische Hochschule Niederösterreich (the teacher training academy of Lower Austria) and by in-house trainers, mostly one of the makerspace managers. After initial training, teachers further develop their knowledge and skills by:

- Inquiry based learning and learning by doing
- Collaborative learning, using online resources and reading manuals
- Learning from skilled students who act as buddies for teachers who are new to making

To encourage use of the makerspace, and to disseminate training to more teachers, the start-up company will provide workshops for students from the age of 14 to 19 and their teachers.

Pädagogische Hochschule Niederösterreich also arrange monthly visits by external teaching students working on projects.

Teaching in the makerspace

As HTL-Hollabrunn is a technical school, the teaching of many of the subjects can be enhanced by use of the makerspace. Subjects studied by the school's students range from project development and project management to electronics, computer aided drawing and practical workshops.

One example of an activity that has taken place in the school's makerspace is the development of a small device as part of a competition, "*the maker challenge*" by students working on final year projects and their diploma theses.

Pedagogic approaches, such as the way teachers create an activity to take place in the makerspace, including collaboration with technicians, colleagues or external people, are still being developed. However, teachers have identified some of the pedagogical approaches which use of the makerspace particularly enables, i.e:

- Constructivist learning or learning by doing
- Inquiry learning, including learning by trial and error, seeing failures as part of the process
- Making design decisions based on real experiences
- Collaborative learning, including working in teams

Teachers at the school have acknowledged that a teacher can never know the answers to all questions students may ask when using the makerspace. They recognise that their approach needs to

change from teaching to coaching. This includes *"the biggest challenge for teachers"* of *"supporting the students and helping them to find a way through development circles (which include dead ends and loops) in a non-frustrating way"*.

Collaboration between teachers and students of different disciplines are often necessary and the school has not found this to be a problem.

Added value and benefits

Teachers' descriptions of the added value and the benefits of the makerspace included:

- It is not possible to work with this variety of tools in a traditional classroom
- Students are allowed to, and requested to, include their own ideas in their work and are, therefore, usually very involved in their projects
- Students become more resilient as they learn how to use development failures in a positive way to improve their designs, resulting in development of better artefacts.
- Students develop expertise in using makerspace equipment and tools
- Improvements in students' team work and communication skills
- Improvements in students' problem solving skills
- Students enjoy working in the makerspace setting, *"they love to do projects of their own choosing and interests"*
- More collaboration and development of new assessment strategies by teachers

Challenges

Teachers and the school principal have identified a few challenges:

- Financial issues are a key challenge; however, the budget is guaranteed for the next five years.
- A lot of work on planning and activities must be done outside of school times, and some of this is undertaken by students, whether this is sustainable needs to be considered.
- Currently teachers are able to share what they are doing within a small group of innovative teachers, but dissemination is expected to be a challenge when the school is busy with routine work.

Future plans

The makerspace has recently been opened to all teachers. In preparation for this, and following it, the teachers have been creating teaching materials and developing lesson plans.

The school plans to involve more teachers in the makerspace and may found a new curriculum, with elective periods given to students of the different departments. These students also will be responsible for the use, development and promotion of the makerspace.

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**

European Schoolnet

Future Classroom Lab

Flanders State of the Art

CZECH NATIONAL AGENCY FOR INTERNATIONAL EDUCATION

PDST Professional Development Service for Teachers

INDIRE ISTITUTO NAZIONALE DOCUMENTAZIONE INNOVAZIONE RICERCA EDUCATIVA

SCRIPT Service de Coordination de la Recherche et de l'Innovation pédagogiques et technologiques

direção-geral da educação

GOVERNO DE PORTUGAL | MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

educa.ch

futureclassroomlab europeanschoolnet #FCL_eu

fcl.eun.org/icwg