BUILDING LEARNING LABS AND INNOVATIVE LEARNING SPACES

Practical guidelines for school leaders and teachers

Contents

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1. Introduction

1.1. Background

The Future Classroom Lab (FCL) in Brussels was created in 2012 by European Schoolnet (EUN), its 34 supporting education ministries and several industry partners, to help visualise how conventional classrooms and other learning spaces can be reorganised to support changing styles of teaching and learning. The FCL aims to be an inspirational learning environment, challenging visitors to rethink the role of pedagogy, technology and design in their classrooms.

An EUN internal review in 2018 exploring *"Stakeholders' perceptions of the role, activities, services and impact of the Future Classroom Lab"* found that *"the clearest indicators that the FCL is having a positive impact are evidence of increased support from Ministries of Education for alternative learning spaces and **the creation of large numbers of local learning labs** in several European countries."* To date, EUN has identified at least 40 FCL-inspired labs across Europe and beyond. Additionally, Portugal, which is a special case, has around 150 labs implemented or in development.

The 2018 review identified a need to develop guidelines to support schools that wish to create their own learning labs or to adapt their learning spaces in other innovative ways. This guide provides practical guidance to school leaders and teachers in this situation by drawing on other European Schoolnet guides, tools and research and, particularly, on the experiences of six schools that have been inspired to build their own learning labs.

These guidelines have been informed by the experiences of an increasing number of teachers, school leaders and teacher educators who have been inspired by the FCL in Brussels to set up their own versions of the FCL, often with very limited funding. Six of the schools and their innovative learning spaces, based in Belgium, France, Germany, Portugal, Spain and Turkey, are described in the detailed case studies as part of the guidelines.

> "Never be afraid to try to convince your school leaders with a good idea. You never know, you could get lucky or luckier than you expect."
> *(Tip from a case study school)*

1.2. How does this guide complement previous EUN publications?

This guide maps out, for school leaders and teachers, the journey from the initial thought that your school may benefit from a learning lab, through planning and implementation to use and evaluation of the impact of your own learning lab. It includes case studies focusing on the experiences of schools in six countries which were inspired to set up a learning lab after seeing or learning about the FCL in Brussels.
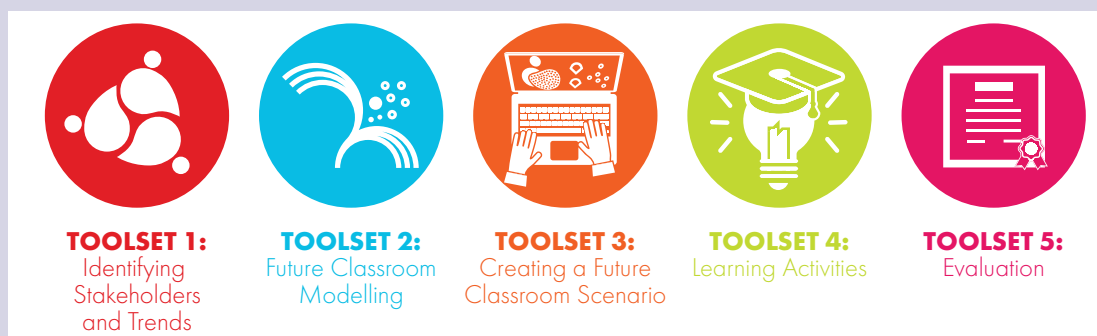
PREVIOUS PUBLICATIONS AND RESOURCES

Guidelines on Exploring and Adapting Learning Spaces in Schools[1] aims to provide practical advice and support to schools that are starting to explore how to develop and adapt learning spaces in order to enable the introduction of innovative pedagogies using technology. It begins by looking at some of the key literature on learning spaces in schools, considers the key benefits of adapting learning spaces, gives suggestions for how schools can start to consider different learning spaces with some important considerations for school leaders, and provides practical advice for teachers who want to adapt their classroom, including an introductory audit tool.

It also explores the national context across eight European countries (Austria, Czech Republic, Estonia, Ireland, Italy, Norway, Portugal, Switzerland) and includes case studies presenting key issues that need to be addressed when schools make the decision to change and adapt learning spaces.

The Future Classroom Toolkit[2] takes teachers, school leaders, education policymakers and technology suppliers on a journey through the processes necessary to create and implement Future Classroom Scenarios. A Future Classroom Scenario is a narrative description of teaching and learning that provides a clear vision for innovation and advanced pedagogical practice supported by technology.

The Toolkit can be used to introduce or scale up innovative use of digital technologies in a school or across a number of schools within an education system. The Toolkit consists of five Toolsets:

TOOLSET 1:
Identifying
Stakeholders
and Trends

TOOLSET 2:
Future Classroom
Modelling

TOOLSET 3:
Creating a Future
Classroom Scenario

TOOLSET 4:
Learning Activities

TOOLSET 5:
Evaluation

The Future Classroom Toolsets

The EUN Industry Partners Code of Practice[3] outlines the general principles under which European Schoolnet agrees to work with industry partners and other organisations that provide cash sponsorship and/or in-kind support related to European Schoolnet projects, studies, awards, events, training courses and services, including the FCL, the Learning Resource Exchange for schools and any European Schoolnet related activity. These principles were approved by the European Schoolnet Ethics Committee and by Ministries of Education in the European Schoolnet Steering Committee in 2011 and are periodically reviewed by these bodies and amended to take account of current experience and best practice. Schools planning to work with industry partners may find it useful to use this code of practice as a model for their own code.

1   http://files.eun.org/fcl/Learning_spaces_guidelines_Final.pdf

2   http://fcl.eun.org/toolkit

3   http://www.eun.org/about/partners/code-of-practice
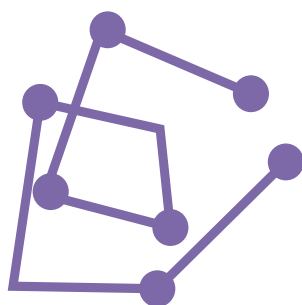
1.3. How to use the guide

We hope you have time to go through the whole guide, but if you want to do more focused reading, the following chart shows how you can find the most relevant and interesting sections for your needs.

HAVE YOU ALREADY DECIDED YOU NEED A LEARNING LAB?

YES

See Sections		
3.1 to **3.3**	←	Building a Learning Lab Stage 1: Motivation
3.4 to **3.8**	←	Building a Learning Lab Stage 2: Feasibility and Preparation
3.9 to **3.14**	←	Building a Learning Lab Stage 3: Team-Building and Planning
3.15 to **3.21**	←	Building a Learning Lab Stage 4: Implementation and Start-Up

NO

		See Section
To Learn about the Future Classroom Lab in Brussels	→	**2**
How the Case-Study Learning Labs are Being Used in 2019	→	**4**
The Benefits and Impact of Learning Labs	→	**5**

TO READ THE CASE STUDIES

Available on the FCL website
fcl.eun.org/guidelines

1.4. Learning labs, makerspaces and fab labs: similarities and differences

Readers of EUN publications related to makerspaces and learning labs, including the Future Classroom Lab in Brussels, will notice that there are similarities between these types of spaces. Also, the term "fab lab" is sometimes used interchangeably with "makerspaces". Let's look into the similarities and differences between these three spaces based on their typical locations, who uses them, the equipment and activities which take place in them, and their primary purpose and focus.

Learning labs are usually located in schools, colleges or universities and used by the students and teachers in these institutions. They are also sometimes used by students and teachers from other institutions. Learning labs are flexible learning spaces that allow for easy reconfiguration according to the needs of the learning activity. Their mission is to host innovative learning through learning activities to incorporate new visions on pedagogy, key competences and technology-enhanced learning. Learning labs also involve and connect different stakeholders and encourage an open culture.

Makerspaces are physical spaces designed for working together, for example through the use of smart tools, rapid prototyping, digital fabrication, and computational technology. Makerspaces may be located in, and exclusively used by, schools or other educational institutions, or located in communities as part of a library or as independent spaces. School-based makerspaces often allow the local community to use the space outside of school hours and may collaborate with external individuals or organisations in setting up and managing the makerspace.

Fab labs can refer either to organisations that are part of the network run by the Fab Foundation (that emerged from MIT's Center for Bits & Atoms Fab Lab Program) or it can be used as a generic term, short for "fabrication laboratory". Fab labs enable personal digital fabrication and are related to Do It Yourself (DIY) and free and open-source movements. Normally, fab labs are open to the public at little or no cost.
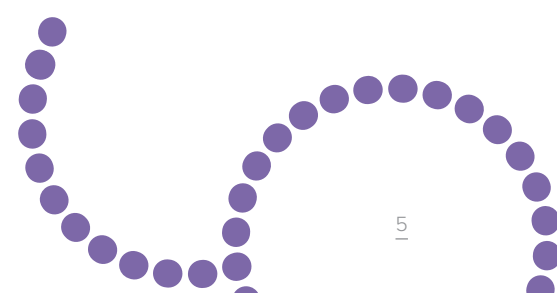
2. The EUN Future Classroom Lab

2.1. Introduction

The FCL created by European Schoolnet in Brussels is an inspirational learning environment, challenging visitors to rethink pedagogy, technology, learning space design, and how learning spaces can be adapted. One of its major purposes is to sustain and mainstream results from European Commission funded projects.
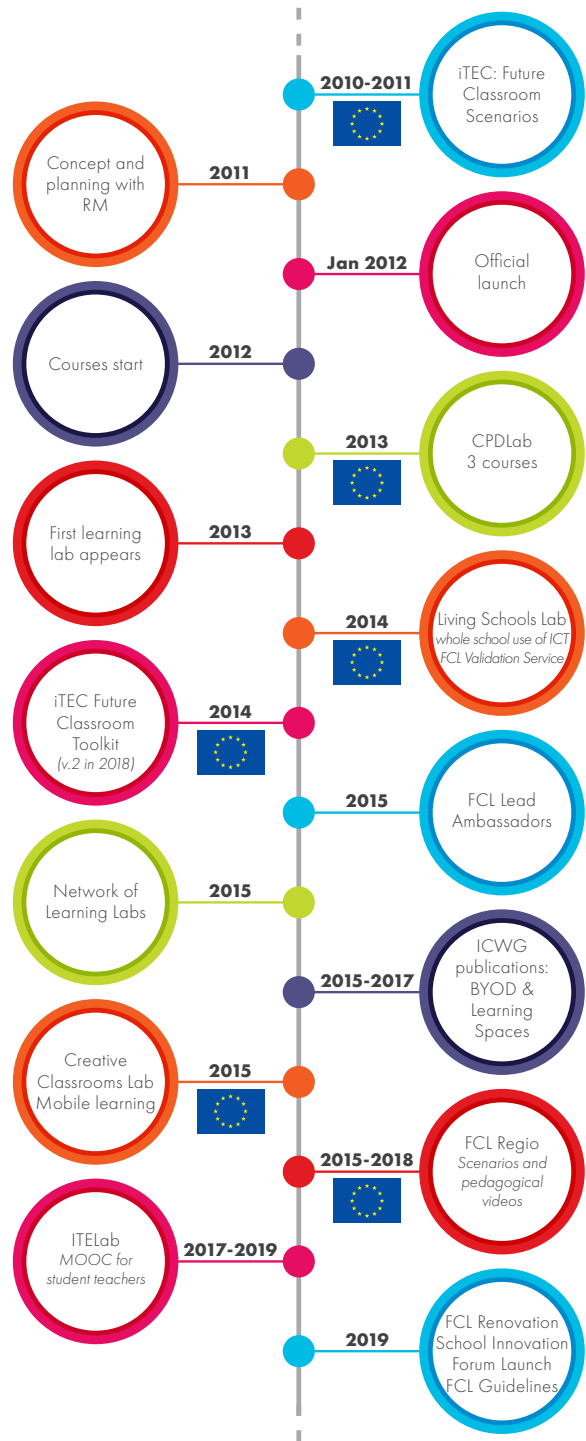
The FCL grew out of the iTEC project funded by the EC's 7th Framework Programme in 2010-14 during which European Schoolnet and 14 Ministries of Education developed and evaluated future classroom scenarios and learning activities in over 2,500 classrooms. Since then, the FCL has helped support a number of EU and privately funded projects as well as activities undertaken by ministries in the EUN Interactive Classroom Working Group (ICWG).

2.2. The journey so far

European Schoolnet and its 34 supporting Ministries of Education have worked closely with a number of industry partners (30 in August 2019) to ensure that the FCL is not dependent on project funding but can be sustained as an independently funded platform. The FCL has its own annual work programme, and policymakers, industry partners, teachers and other education stakeholders regularly come together in FCL face-to-face training workshops and strategic seminars to develop visions for the school of the future and strategies on how to realise them.

At national level, in 2019, Ministries of Education in 16 countries have appointed Future Classroom Lead Ambassadors who support the implementation of the FCL concept by providing training and advice to schools. Several countries also have an expanding network of FCL local ambassadors who support the Lead Ambassadors, particularly in countries where schools have been inspired by the FCL to develop their own versions of learning labs that are adapted to the local context.

'The history of the FCL' timeline shows events and projects related to the FCL events and projects related to the FCL, including the appearance of other learning labs and their eventual organisation into a network. Visitors to the FCL have been inspired to set up learning labs in more than 20 countries (July 2019 figures). Collectively these provide an innovative model of successful bottom-up mainstreaming of pedagogical innovation.

Timeline (left to right / top to bottom):

- **2010-2011** — iTEC: Future Classroom Scenarios
- **2011** — Concept and planning with RM
- **Jan 2012** — Official launch
- **2012** — Courses start
- **2013** — CPDLab 3 courses
- **2013** — First learning lab appears
- **2014** — Living Schools Lab *whole school use of ICT FCL Validation Service*
- **2014** — iTEC Future Classroom Toolkit *(v.2 in 2018)*
- **2015** — FCL Lead Ambassadors
- **2015** — Network of Learning Labs
- **2015-2017** — ICWG publications: BYOD & Learning Spaces
- **2015** — Creative Classrooms Lab Mobile learning
- **2015-2018** — FCL Regio *Scenarios and pedagogical videos*
- **2017-2019** — ITELab *MOOC for student teachers*
- **2019** — FCL Renovation School Innovation Forum Launch FCL Guidelines

2.3. FCL space and learning zones

The area dedicated to the original FCL was around 170m², divided between an open space (about 140m2) and a separate (class)room (about 30m²).

From the beginning the FCL was created around the concept of "learning zones" that highlight different aspects of learning and teaching, and help guests to rethink pedagogy, use of ICT and learning space design in a variety of learning situations.

From its creation, the open space included five learning zones, namely Present, Investigate, Create, Exchange, and Develop, and the classroom area, Interact. The FCL layout here shows the learning zones in the original design for the FCL, which has subsequently been enlarged and reorganised.

The open space including flexible furniture allows an easy reconfiguration of the individual zones and of the total space depending on the learning activities required for different occasions. The Interact classroom was designed to demonstrate how different classroom layouts and use of innovative use of ICT can support enhanced interaction in a conventional classroom. Together the learning zones form a unique way to visualise how more active learning can be put into practice both at pedagogical and physical level. The concept of learning zones particularly has been the source of inspiration for so many teachers and school leaders.

INTERACT — The Interact classroom reminds both teachers and students to participate actively in the learning process and interact with one another. Interactivity can be enhanced with the use of technology, which can encourage at the same time a more differentiated instruction.

EXCHANGE — In the Exchange zone, students' learning is enhanced by teamwork, learning by playing, brainstorming and peer-to-peer collaboration. This can be either face-to-face or online, synchronous or asynchronous. Sharing of ideas is encouraged and collaboration is facilitated.

PRESENT — The Present zone brings the communicative dimension into the learning process. The Present zone is a dedicated area for interactive presentations that, through its design and layout, encourages interaction and feedback. Online publication and sharing are also encouraged.

INVESTIGATE — The Investigate zone promotes inquiry- and project-based learning to enhance students' critical thinking and problem-solving skills. The flexible furniture and the technological equipment available support the learning-by-doing concept.

CREATE — The Create zone encourages creativity. Students work on realistic knowledge-building activities. Interpretation, analysis, teamwork, and evaluation are important parts of the creative process.

DEVELOP — The Develop zone is a space for informal learning and self-reflection where students can work independently at their own pace using personal learning devices, learning diaries and portfolios. It encourages students to develop metacognitive skills on their own and promotes lifelong learning strategies.

Learning zones are not intended to be seen as a gradual process of learning, moving from one zone to the next. Learning activities can be linked between different zones which are mutually interrelated depending on the type of pedagogical approach or learning activity chosen. Every learning zone, though, is implicitly connected with specific pedagogical methods, so the changing roles of the teachers and students should be considered.

2.4. Future Classroom Lab renovation

The FCL was physically renovated in February 2019, and the lab surface now covers approximately 250m². The concept of learning zones is still at the heart of FCL, even if the zones physically and conceptually overlap to a larger extent. The main changes resulting from the renovation are:

- New distribution of the physical surface: Open Space of about 170m², Interact classroom of about 40m², and the entrance (aka Develop zone) of about 40m²

- Allowing a larger focus on the maker movement and the key ideas of maker spaces. This entails creating an environment to develop the maker mindset, including relevant equipment, such as 3D printers, robotics, 3D scanners and trolleys with making components

- Dedicating a larger and separate area for Develop, i.e. informal learning. The current entrance to the FCL is the new Develop zone, allowing a place for networking and sharing, but also self-paced activities and promoting well-being in a school environment.
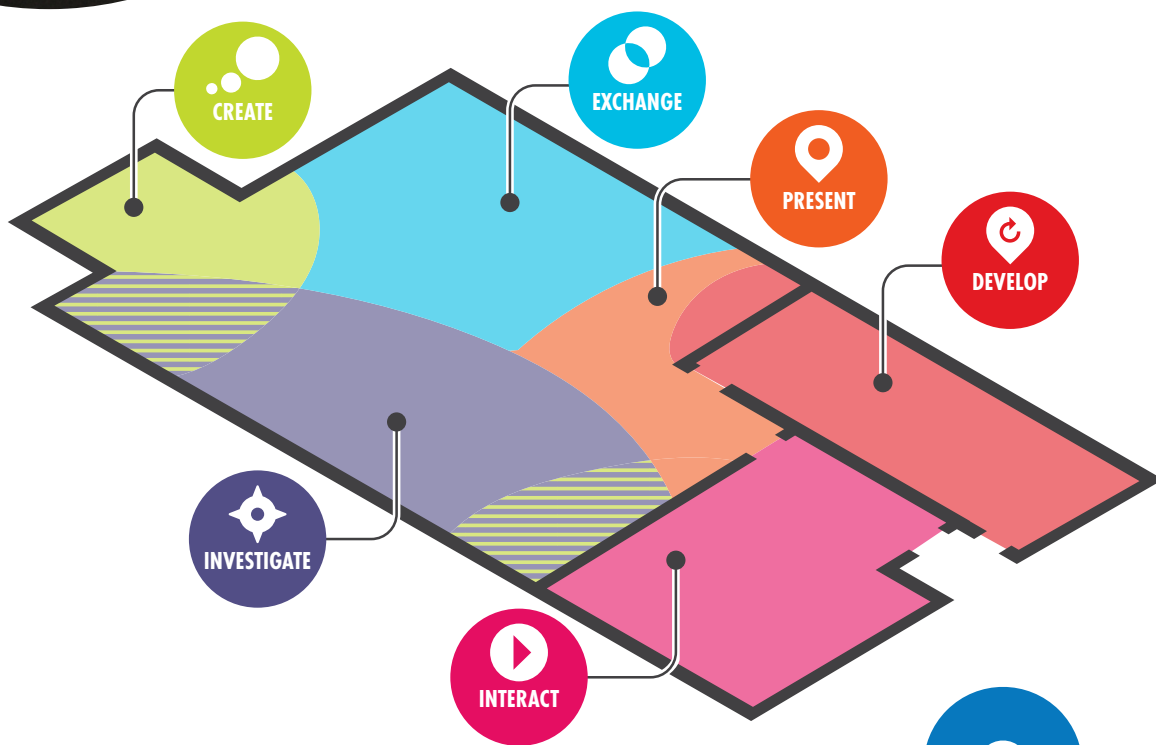
3. Building a learning lab – A four-stage process

Schools who have built their own learning labs have described a four-stage process starting with the things that have motivated them to start on their journeys, followed by a stage in which they look into the feasibility of building a lab and seek the support they will need, before continuing to the planning and implementation stages.

> "Design a plan for implementation. Think carefully about how you are going to do it, what the key steps are and what is right for your school in your circumstances."
> *(Tip from a case study school)*

MOTIVATION
- Inspiration
- Drivers
- Aims

FEASIBILITY AND PREPARATION
- Research and visits
- Consulting and rallying support
- Auditing space, equipment and resources
- Costs
- Obtaining funding

TEAM BUILDING AND PLANNING
- Building a project team
- Working with IT staff and ICT teachers
- Stakeholder involvement
- Recruiting partners and funders
- Writing a plan
- Developing the initial learning lab design

IMPLEMENTATION AND START UP
- Learning zones
- The physical space, furniture, sound and lighting
- Technologies
- Technical support and technology related challenges
- Convincing the teachers
- Professional development and support for teachers
- Starting to use the learning lab and piloting learning scenarios

Building a learning lab - the four stages
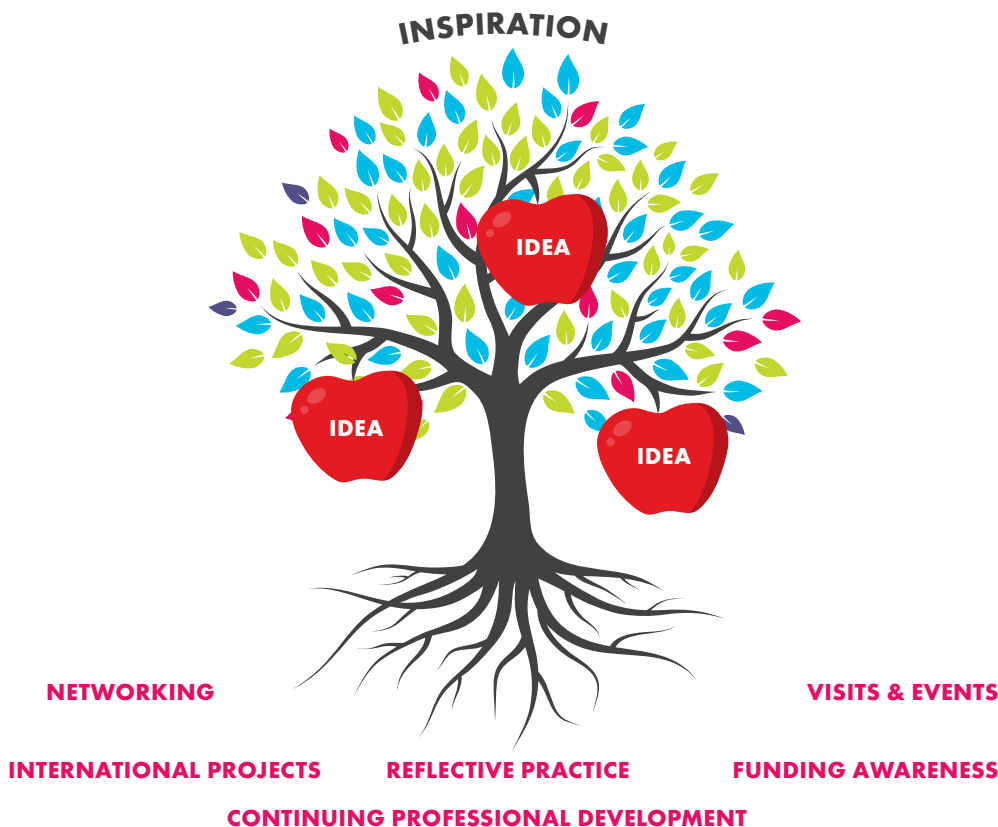
STAGE 1: MOTIVATION

This publication focuses primarily on the experiences of schools which have been inspired by the FCL in Brussels to build their own learning labs. However, this inspiration was often combined with other drivers and aims to convince schools that the time had come to take action to make their dreams a reality. Some schools and other educational establishments have also been motivated to create their own learning labs as a result of some of the same drivers and aims even though they were not directly inspired by the FCL. In some cases, these other learning labs have subsequently chosen to join in FCL networks.

3.1. Inspiration

Many teachers, school leaders and teacher educators have been inspired by the FCL in Brussels to set up their own future classrooms and other innovative learning spaces.

Tim Vuylsteke, who led the setting up of Lab21 in Belgium, described the steps taken to build their future classroom as starting with that inspiration and observed: "*You can't plan for inspiration.*"

This is true; however, it is possible to create conditions in which inspiration and ideas are more likely to occur.

INSPIRATION

IDEA

IDEA

IDEA

NETWORKING

VISITS & EVENTS

INTERNATIONAL PROJECTS   REFLECTIVE PRACTICE   FUNDING AWARENESS

CONTINUING PROFESSIONAL DEVELOPMENT

Creating conditions conducive to inspiration and ideas

VISITS, EVENTS AND INTERNATIONAL PROJECTS

Several interviewees at schools which had set up future classrooms after visiting or hearing about the FCL in Brussels first became aware of the FCL because they were participating in international, usually EU, projects, such as Christophe Chignardet from France, who took part in the iTEC project.

Typically, teachers or school leaders who were involved in projects attended project-related events at EUN's premises in Brussels where they had the opportunity to visit the FCL. For example, Carlos Cunha from Portugal participated in the Scientix project, Tim from Belgium was involved in eTwinning, and Tim and Can Erdoğan were involved in the FCL networks in Belgium and Turkey respectively.

NETWORKING

Interviewees mentioned networking with teachers in other schools within or beyond their own country, sharing good practice and ideas with them and being inspired by the information shared with them in return.

CONTINUING PROFESSIONAL DEVELOPMENT AND REFLECTIVE PRACTICE

Teachers who have participated in continuing professional development (CPD) related to technology enhanced teaching and learning, including CPD events hosted at the FCL in Brussels, have been inspired to wish to implement new environments and methods in their schools.

Also, teachers who systematically reflect on their own practice and their teaching environment after seeing the environment in Brussels may consider how these might be improved. Improvement ideas may include the use of different room layouts and technologies and the teacher could be inspired to promote the idea of building a future classroom within their school.

Reflective practice is frequently taught and encouraged in CPD for teachers and often illustrated by the Gibbs Reflective Cycle[4] which was inspired by Kolb's Experiential Learning Cycle.[5] The diagram on the next page, based on Gibbs' Cycle, illustrates how a teacher reflects upon a teaching experience and starts to plan future improvements.

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4   Gibbs, G. (1988) Learning by doing: A guide to teaching and learning methods. Further Education Unit. Oxford Polytechnic: Oxford.

5   Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development (Vol. 1). Englewood Cliffs, NJ: Prentice-Hall.

Reflective practice cycle based on the Gibbs Reflective Cycle

FUNDING AWARENESS

Several interviewees described how they gathered together teaching assets and resources previously in different locations within their schools and even painted furniture and walls themselves when limited funding was available for their future classroom.

Other interviewees felt they had been very fortunate to receive funding to build their classroom. One said he was "*lucky to ask the right question at the right time*", i.e. when the school board or governing body was taking an interest in educational technology and before the budget for the coming year had been finalised. Teachers may be able to help their own luck by finding out about funding cycles, processes and deadlines within their schools and also at local, regional, national and European levels and seeking potential funding requirements at the appropriate time.

Some interviewees suggested that awareness of the possible availability of external funding contributed to inspiring the decision to build a future classroom. For example, the Turkish interviewee commented that, at the time the local FCL ambassadors in Turkey were discussing future classrooms labs, an English teacher in his school was aware of the possibility of applying for Erasmus+ funding and was considering a "project idea including teacher mobility," so they decided to combine the two projects and work together.

3.2. Drivers

In addition to inspiration arising out of a visit to, or learning about, the FCL in Brussels, the interviewees from the case-study schools described drivers which, combined with the initial inspiration, motivated their future classroom projects.

Some of the drivers were quite specific to the individual school, whilst being things which would undoubtedly have been experienced by many other schools, e.g. a poor inspection report, a general need for more innovative pedagogical approaches, concerns about specific groups of hard-to-reach or hard-to-teach students. The drivers reported were:

- An inspection which criticised the school for too much traditional teaching (too teacher-centric with little student decision making)

- Concerns about decreasing student engagement in schoolwork

- Concerns about a lack of student autonomy and problem solving

- Limited engagement by students, parents and elected officials in the life of the school

- A shortage of computer labs
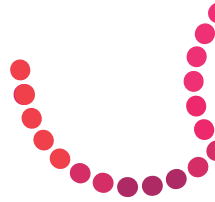
- A perceived need for a new kind of lab not just dedicated to STEM subjects

- A need to improve academic outcomes for 13 to 15-year olds from a poor neighbourhood who received little encouragement from parents and were not responding well to traditional teaching

- A desire to modernise the school, to improve teachers' and students' 21st-century skills and to embed ICT in teaching and learning across the whole school

- A need to prepare teachers for a laptop project in which they would have to teach in a different way (teacher acting more as a coach).

3.3. Aims

The interviewees described the aims of the projects they initiated to set up a future classroom. Many of these were quite similar across all schools and countries and included:

- To get teachers to try different pedagogical approaches and to take some of these back to their classrooms

- To foster more and better collaborative learning by students

- To create an innovative space designed to meet the need to develop 21st-century skills

- To create a space in which all teachers would be able to find ways to use modern technologies and experiment with different pedagogical approaches

- To enable teachers to enter a room where everything works so they can start immediately

- To make it unnecessary for teachers to spend a lot of time studying the technology; after a short introduction they should be able to start using it

- To make computers safe to use but without too many restrictions for teachers and students

- To change teachers' mindsets by providing a space where they can reflect on their current practice and be motivated to start experimenting with new methods and tools

- To demonstrate how different teaching and learning styles can be generated by reorganising the learning spaces and incorporating technology

- To increase the effectiveness of teaching by focusing on the learner rather than lessons being centred around the teacher

- To change the physical and technical environment to support and enable changes in pedagogy.

STAGE 2: FEASIBILITY AND PREPARATION

3.4. Research and visits

Teachers and school leaders who have been inspired by visiting or hearing about the FCL in Brussels often carry out further research and visits to collect more information and ideas to support decision making or planning and design processes. Research carried out by the case-study schools to inform their decision making and planning included:

- Accessing information and videos on the FCL website

- Participating in webinars, meetings, networks and online communities

- Seeking advice from FCL staff and local FCL ambassadors

- Visits to:

  - Other schools

  - Companies marketing relevant furniture, lighting, acoustic solutions and educational technologies

  - Universities.

Following an initial visit to FCL by Tim, the teacher who would later become the Lab21 Project Coordinator, his school arranged for four teachers plus the head teacher to visit the FCL and for two more teachers to attend a three-day course there. The team then visited the Flemish FCL Ambassador's school which had already built an FCL-inspired classroom, sought advice from furniture and technology companies and visited a local university that
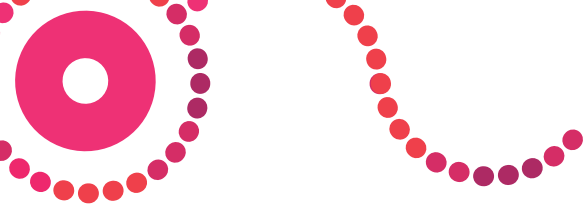
had a collaborative learning room and later built a learning lab. The university visit started an on-going relationship which includes sharing ideas and research collaboration.

Christophe, in France, did not visit the FCL in Brussels but was inspired to want a learning lab for his school by his involvement in EUN's [iTEC][6] project, which piloted and evaluated future classroom scenarios and learning activities in over 2,500 classrooms across 20 European countries and led to the setting up of the FCL. The school's learning lab team then benefited from the experiences and approaches of schools in the French FCL network, and Christophe received further inspiration and useful lessons by visiting the FCLab.fi in the teacher training school in Oulu, Finland.[7] The Finnish learning labs have a concept of zones which is similar but not identical to the zones used in Brussels and includes the five zones: Explore, Immerse, Influence, Express and Create.

Having been inspired by a visit to the FCL in Brussels to attend a workshop related to the Scientix project,[8] Carlos in Portugal sought advice from the University of Lisbon's Institute of Education, which was setting up a similar classroom. Over time the two institutions learned from and supported each other.

In Spain the team setting up the learning lab decided to start by following the steps recommended in the Future Classroom Toolkit. The Toolkit, initially developed in the iTEC project, is based on research and the experiences of many schools across Europe and was updated by the FCL Lead Ambassadors in 2018.

Can, in Turkey, was inspired when he attended a meeting of Future Classroom Local Ambassadors. He then researched possible approaches to building a learning lab and presented them to teachers and managers at his school. Members of the school's team subsequently participated in the School Education Gateway[9] Teacher Academy MOOCs, joined in webinars and discussed new teaching approaches and techniques including how these could be introduced.

In "Guidelines on Exploring and Adapting Learning Spaces in Schools" Diana Bannister recommends: "*Visit education development and technology exhibitions; for example, the annual BETT Show in London and events in other European countries have been a source of inspiration for some [schools].*"

3.5. Consulting and rallying support

If the person inspired to consider setting up a learning lab is not themselves the school's principal or head teacher, this will be the first person they will need to persuade to support the idea.

The next step is identifying, communicating with and inspiring a core group of teachers and other stakeholders, with whom the case-study interviewees initially recommend:

- Sharing information about the FCL in Brussels and local learning labs that have already been set up

- Discussing students' needs in a changing world

- Sharing ideas and experiences of new teaching practice.

Essential members of the initial core group, some or all of whom will later become the project team, are teachers, ICT coordinators and IT support staff. The interviewees also recommended consulting or at least informing students and parents.

Sometimes parents may have relevant expertise and may be willing to help with setting up the learning lab. On the other hand, some schools are located in areas where it is difficult to get parents to take an interest in the school. Some schools have found it difficult to get students to take an interest. Others suggest students are more likely to engage with the project if an innovative approach is taken. For example, in Turkey the school held an art competition with prizes which invited students to suggest designs for a learning lab, and some of the students' ideas were incorporated into the final design.

For more discussion of stakeholder engagement, see Section 3.11.

Schools are also recommended, and in some cases may be required, to consult with their local education authority. Useful advice and support may also be available from regional or national authorities, agencies or universities. See Section 3.8 for information about financial support.

3.6. Auditing space, equipment and resources

The first requirement when considering setting up a learning lab is to identify an appropriate and available space within the school to house it. Jörg Haas in Germany emphasised

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6   http://itec.eun.org/
7   fclab.fi/home-en/
8   www.scientix.eu/
9   www.schooleducationgateway.eu/

that in most schools it is necessary to work hard to obtain, and retain, a room for anything new.

Once a possible room(s) has been located, it is necessary to consider whether any building work will be necessary. One school reported needing to install larger windows and another noted that, if the learning lab is to be open for community use outside of school hours, an additional external door is required. Refurbishment work may also be necessary to upgrade the lighting, ventilation and acoustic environment.

Once it has been confirmed that a suitable space is available, the interviewees recommended carrying out an audit of furniture and equipment currently within the school that might be relocated to the learning lab and thereby save money. Several of them reported finding unused or underused equipment in classrooms, sometimes out of sight in cupboards, including interactive whiteboards, cameras and in one case a 3D printer.

Classrooms, and other areas within the school, may also contain furniture that can be renovated or adapted for use in the learning lab.

Extending the search beyond the school has been recommended as teachers have sometimes found very useful second-hand equipment offered for sale online via services such as eBay at very reasonable prices.

It is important to include in the audit a review of the existing broadband and Wi-Fi infrastructure. It may be necessary to upgrade these to ensure sufficient bandwidth and fast, reliable connectivity for all types of activities to be carried out in the learning lab and for the expected number of concurrent users of online services. Some of the case-study schools recommend installing a dedicated very high-speed broadband connection for the learning lab rather than sharing a connection with the rest of the school and thereby risking teachers and students in the lab becoming frustrated by problems like poor response times or interrupted video streaming.

The audit should include exploring whether teachers and/or parents have the skills and the time to help with tasks including remodelling the room, decorating or making furniture.

3.7.   Costs

An obvious question, which anyone will be asking, is "How much will it cost to set up a learning lab?" and it will be quickly followed by "What are the annual running costs?"

It is, of course, important for teachers or school leaders to produce an estimate which is as accurate as possible when seeking external funding and when negotiating with school boards. However, estimates for initial set up costs are likely to be unique to each school and their circumstances, as costs will vary greatly from school to school depending on many factors including:

- The size of the school

- The age of the school building

- The amount of required equipment and resources already available in the school

- The existing networking infrastructure

- The number of mobile devices already owned or used by students that can be leveraged

- The willingness and ability of school staff to help with remodelling tasks

- The technical skills of existing school staff

- The amount and type of equipment donated by industry partners.

When interviewees were asked about initial set-up costs, some were able to provide detailed information. However, most only knew about some of the costs, especially where some equipment and services were paid for directly by local education authorities (e.g. building work and networking costs in Germany). The diagram on page 15 illustrates the wide disparity between initial costs reported by the case-study schools.

In some cases, the project to build the learning lab was linked with other activities designed to increase the use of technology in the school, and the learning lab team only saw details of the costs directly associated with the learning lab. In Belgium, for example, the learning lab was able to use laptops that were purchased by a different project and therefore did not appear in the learning lab costs. The cost, to some extent, seems to be dependent upon the funding available. The school which reported a budget of 100,000 € commented that for some aspects they could probably have achieved something similar more cheaply. Other schools with small budgets or delays in receiving funding were forced to improvise and found they could save money, for example, by repurposing existing furniture or by teachers painting things themselves.

EURO 100,000	**EURO 50,000**	**EURO 28,000**	**EURO 17,000**
		EURO 15,000	**EURO 7,000**
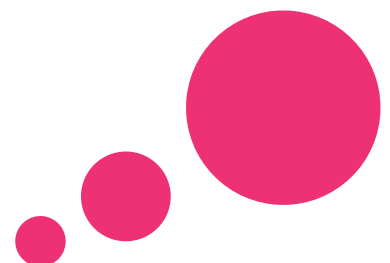
The variation in estimates of initial set-up costs for learning labs

Regarding on-going annual running costs for their learning labs, all of the interviewees anticipated that these would be modest; typically, they guessed around 1,000 € per annum. These low estimates seem to be related to a variety of assumptions, e.g. that:

- Commercial partners will maintain and when needed replace technologies they donate

- Modern consumer technologies e.g. laptops, tablets, cameras, etc. are generally very robust and very reliable

- Additional commercial sponsorship and/or project funding may be found to fund replacement and additional equipment

- Some key services will continue to be provided by the local authorities without charge.

In the case of Belgium, the interviewee reported that "*annual running costs of the learning lab are now part of the general IT budget and have not been broken down into a separate category so we don't really have running costs apart from electricity.*"

Some interviewees expressed concern about sustainability related to replacement of equipment as they believe in future there may be less funding available from public education authorities.

3.8. Obtaining funding

When a school is considering building a learning lab, one of the first tasks is to establish where the necessary money will come from. Obviously, failure to find an answer to this question will stop or delay implementation. Jörg, in Germany, told us: **"***Planning for Edu.lab took a long time due to the expected cost and initially the school felt they would not be able to achieve something like the Brussels FCL.*"** The case-study interviewees reported obtaining funding from a variety of sources: sometimes from a single source of funding and sometimes from several funders. This support included money and also donated equipment and unpaid help to prepare the new classroom.
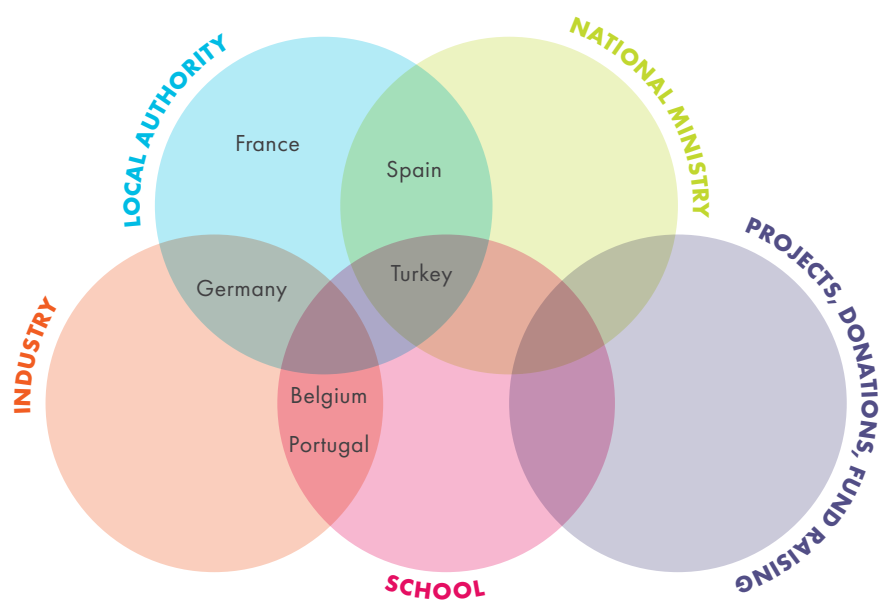
Sources of learning lab funding

INTERNAL SCHOOL FUNDING

In all cases building a learning lab will involve some cost to the school itself even if this is just a case of some staff being given permission to devote some hours to the project which would normally be spent teaching.

Tim, in Belgium, originally planned to use earnings from the school quiz, expected to be less than 2,000 €, as the modest budget for setting up the new room. However, the headmistress encouraged him to present his ideas and a bid for funding to the school board. The bid was successful and significant project funding was secured.

In Turkey it was initially decided to use the school's own resources to build the learning lab as, although the team had sought external financial support, at first they were not successful. The school started by using existing equipment available elsewhere within the school.

Several interviewees reported saving money by using equipment which was available within the school but underused and by teachers painting furniture and walls themselves.

LOCAL AND NATIONAL PUBLIC FUNDING

All the case-study schools which successfully attracted local authority funding reported that it was necessary to make some effort to persuade them or to demonstrate the ideas for the learning lab.

In France, the school approached the local education authority, to request funding for their learning lab project; and some funding was provided by Aisne, the French department where the school is located. The school had to develop a well-defined and costed proposal and then to wait for this to be approved. Christophe notes that "*the support of the FCL network proved essential at this stage.*" However, is was a slow process and it took two years to receive the funding.

In Turkey, after the school had completed a collaborative design exercise and produced a 3D model of their planned learning lab, it was easier to demonstrate what they were trying to achieve. As a result, "*when the local authority visited and saw the model, they wanted to be involved and they invited the national Ministry of Education to help with funding too.*"

In Spain the school started the planning, design and building of the learning lab themselves and then received financial support from the Ministry of Education and Culture of the city, in collaboration with the national Ministry of Education and Vocational Training (MEFP). This enabled them to include more technology and new furniture in the learning lab.

The Portuguese school was successful in attracting some funding from their National Ministry of Education but 75% of the funding they needed came from commercial company sponsorship.

In Germany, the local education authority paid for the building work and the ICT networks that needed to be installed, whilst commercial companies provided the equipment needed for the learning lab.

INDUSTRY PARTNERS' FUNDING

Industry partners are, in most cases, an important source of funding for school learning labs. This includes either direct funding via sponsorship or funding in-kind by providing equipment and services free of charge, or at reduced cost, to the school.

Carlos, in Portugal, said it took a long time to secure the sponsorship the school needed and he emphasised that "*it is most important to find the right person in any company you hope to work with. If you just send an email, it goes into the garbage. You need to make personal contact with the right person, and this takes time, research and perseverance.*" However, he found that "*most companies involved in education are very willing to cooperate in building these kinds of spaces*", especially if school learning labs can attract interest from the media and therefore help to publicise industry partners' brands and enhance the image of their companies. Carlos also observed: "*We have students who, if they get used to a company's products at school, may be their customers in the future.*"

Can, in Turkey, hopes to attract commercial sponsorship and project funding to help with replacement and additional equipment. If enough funding can be obtained, the school plans to open a new learning lab next year. He sees a mutual benefit for the companies and the school as the companies can showcase their equipment and solutions and help the school to keep up with the latest trends in educational technology.

European Schoolnet provides a code of practice on working with industry which may be useful to schools (see page 4).

STAGE 3: TEAM-BUILDING AND PLANNING

3.9. Building a project team

The interviewees were asked for three key messages they would like delivered to other schools planning to set up a learning lab. One of the messages from Francisco (Fran) Gómez in Spain was "*Once you have generated expectations in the educational community and explained the project, a team of truly interested people needs to be formed to make it happen.*"

In Turkey, Can had the original idea but got initial support from an English teacher who was looking for an Erasmus+ project idea. They then recruited a science teacher and the ICT coordinator to form a project team which led the planning and implementation of the learning lab. Can

advises: "*You need a team of staff who are enthusiastic and can think outside the box*" and "*the relationship between the project team and the funding authorities is key.*"

Christophe in France found that "*knowing he could rely on a stable team, who were willing to work in a team to achieve their goal, was inspiring as well as enabling.*"

Tim's team in Belgium consisted of four teachers who were given some non-teaching time to implement the project. Helpfully, the headmistress was also very much part of the team. She participated in some of the visits, and progress and reporting were faster as she already knew what was happening and contributed to the thinking.

Small project teams can work closely together and be very effective. However, if you are lucky enough to recruit a large number of enthusiastic teachers, you could follow the previous guidelines' advice and "*identify one small group for each issue*" the team needs to address and then "*bring them together to discuss their findings*" to inform planning[10].

3.10. Working with IT staff and ICT teachers

The support of school-based IT staff or ICT teachers is at least extremely helpful, in many cases essential, and unconvinced IT/ICT colleagues can cause problems or even prevent a learning lab from being set up.

Can in Turkey describes the ICT coordinator in their team as "*the strongest part of our project*" and his previous experience of setting up the school's computer lab was very helpful. Fran in Spain was also lucky; he reported that "*fortunately from the beginning the ICT coordinator demonstrated his willingness to collaborate with the implementation of the learning lab.*"

Tim in Belgium reported that "*the school's IT coordinator was part of the core implementation team*" and is now "*an active user of the learning lab who provides technical support for problems teachers cannot solve.*" Tim recalled: "*I didn't need to convince him, he was as much interested and inspired after he visited Brussels as I was.*"

However, Carlos in Portugal found he needed to convince IT and administrative staff and, even though the principal had asked them to support the learning lab, they did not really believe in the learning lab idea or that student-centred methods could be effective. Carlos commented: "*It was hard to get their support. However, two ICT teachers were very helpful and over a few years some other staff changed their minds, but others did not.*"

10   http://files.eun.org/fcl/Learning_spaces_guidelines_Final.pdf, Section 5.1. Setting up a Future Classroom Lab.

In Germany Jörg and his team showed IT and administrative staff pictures and information about the FCL in Brussels and emphasised that there was nothing like it in Germany, so their school would be the first. Jörg suggests that sometimes people are more likely to support projects which offer them the kudos of being trailblazers.

3.11. Stakeholder involvement

Guidance for schools related to transformation projects always advises attempting to involve all stakeholders. In EUN's "Guidelines on Exploring and Adapting Learning Spaces in Schools", under the heading "Discussion, Dialogue and Planning for Change", is advised: "*School leaders need to recognise the importance of on-going consultation, discussion, dialogue and planning for change with teachers, students, parents and other stakeholders. This helps the school to determine clear reasons for the change and gives opportunities to ensure that others understand the potential benefits. It will be necessary to involve all teaching and support staff if changes are going to affect the whole school. Changes can take time and it is important to communicate and share evolving plans with teachers, students, parents and other stakeholders.*"

The six case study schools varied in the types and number of stakeholders they involved in planning their learning labs and the extent of their involvement. In some cases, engaging some stakeholders was more difficult than the learning lab planning teams had hoped.

Can at the Turkish school observed: "*It is important that we unite stakeholders around a journey of transformation. If people don't agree, the school will be an unhappy place; it helps to keep them involved.*"

TEACHERS

All six schools involved some teachers in planning and building their learning labs and in some cases all the school's teachers were involved in planning.

Jörg in Germany commented: "*In every school some teachers are open to digital transformation and it is important to find them and to get them to help in convincing the others. If you are alone, you will stay alone.*"

In France, there was a delay of two years before the school received approval for funding from the local authorities and Christophe recalls that during this time "*the teachers rolled up their sleeves and invested some of their time outside of their normal working hours*" to start preparation for the learning lab including clearing a space, finding and recycling furnishings and looking for very economical solutions.

In Portugal, Carlos reported that "*Teachers were the main local stakeholders involved in the planning process.*"

In Spain, teachers were involved in the planning process and later design, and are continuing to design innovative pedagogical activities.

In Turkey, ideas for the learning lab were collected in two meetings of all the teachers and these resulted in changes to the room's lighting and seating. The music teacher created learning scenarios and songs for lessons in the learning lab and science teachers focused on creating STEM learning scenarios.

STUDENTS

Jörg in Germany found convincing students to be "*quite easy*" and during the planning stage the students helped a lot.

In contrast, Tim in Belgium recalled: "*We had a romantic idea about involving them [students] but perhaps the idea seemed too abstract in the beginning. We tried to have a meeting to involve the students but none of them turned up.*" His advice to other schools is to select a few students and involve them more proactively at a later stage.

In France, Christophe reported that planning for the school's learning lab was "*informed by the students' wishes and then by the teachers' goals*"; however, "*this utopian part has been confronted with financial reality*" and the outcome addresses these wishes and goals as far as is possible with the funding available.

In Turkey, students were actively involved in planning from the beginning via an art competition focused on classroom designs with the entries submitted informing development of the plans for the school's learning lab. Now the learning lab is open the team continue to involve students, and parents, in their plans and activities via social media and the local news.

PARENTS

Some schools are very successful in engaging parents in school projects and activities but the degree of success is dependent upon the nature and culture of the school's catchment area.

Carlos found it was very difficult to involve parents in their school's area in planning as parents' participation in their children's schooling was generally very low with, typically, only 2% of parents attending parents' evenings. At end of the year he tried again by inviting some parents to visit the learning lab to see how it was used but these were only about 1% of the parents.

On the other hand, in Jörg's area of Germany, he found it quite easy to involve parents and, in Turkey, parents attended a meeting held in the learning lab and made suggestions about its development and use.

3.12. Recruiting partners

It is unusual for a school to set up a learning lab completely on their own. There are usually partners who provide one or more of:

- Advice
- Assistance from expert staff
- Money
- Furniture
- Technologies
- Solutions
- Training
- Technical support.

LOCAL AND NATIONAL EDUCATION AUTHORITY PARTNERS

In some cases, local and or national education authorities have provided financial and technical support for schools setting up learning labs and in some countries such developments require their permission.

In Portugal the Ministry of Education (MoE) had to know about and approve the school's plans and they provided logistical support. The school sought to engage them more closely by offering the MoE the use of the learning lab for workshops and meetings. The school also had a written agreement with the MoE which helped to formalise the project and therefore helped to convince potential commercial sponsors to support it.

In Turkey face-to-face meetings with the national authorities have been used to spread information and share news about the school's learning lab. Information has also been shared with teachers from many other schools interested in setting up future classrooms who attended a national meeting organised by the Turkish MoE.

INDUSTRY PARTNERS

The interviewees reported that attracting industry partners can be hard work and advised that it can help to approach local companies and to leverage personal relationships in order to connect with people who can help. However, some schools have successfully built relationships with large foreign companies.

Jörg, in Germany, said he wrote more than 200 emails to companies seeking help, materials and financial support; "*the companies who answered were helpful but only ten*

answered, of which five were a great help." Interestingly, these were foreign companies not connected to the school previously and some of them have now been working with the school for years. Eventually the school recruited 12 companies and other organisations as partners.

The Belgian case-study school recruited two commercial partners by exploiting personal contacts and local knowledge. In the case of Ocular, a company with experience of interactive learning in museums, the fact that the president of the school board knew the CEO of Ocular was very helpful. The company gave free advice in the early stages and reduced prices later. This saved the school money but also benefited Ocular, as selling to schools was a new market for them. The other company, Barco, who have their headquarters very close to the school, were also keen to move into the schools' market and therefore provided their services at a reduced cost.

European Schoolnet provides a code of practice on working with industry that may be useful to schools (see page 4).

UNIVERSITY PARTNERS

Some of the schools have formed valuable partnerships with local universities in which the university and the school have helped each other by:

- Sharing their ideas and experiences of setting up learning labs (Belgium)

- Collaborating to research the impact of the learning labs (Belgium, Germany and Portugal)

- University architecture students contributing to the design, and providing technical support for the construction, of the learning lab (Turkey).

3.13. Writing a plan

Any significant new development in a school requires a clear plan which can be shared with partners and stakeholders and managed to ensure key aims and objectives are achieved. Individual schools need to create their own plan for their particular context as defined by factors including:

- Their aims and objectives

- The type, size and age of the school building

- The existing technical infrastructure in the school

- The socio-economic profile of the catchment area where the school is based

- The number and age of the school students

- The extent to which they already use technology to support teaching and learning

- The type of furniture, technologies and/or systems that industry partners can donate.

Some case-study schools made specific suggestions for things to remember when drawing up the plan:

- Make an investment plan for purchasing equipment over 3 or 4 years but make a start with equipment and furniture already available around the school;

- Build a physical model, or a 3D visualisation, that can be shared with potential funders and partners to help them visualise what you are trying to achieve;

- Plan how use of the learning lab will be booked or timetabled;

- Plan how technical support for the equipment in the learning lab will be provided;

- Plan how teachers will be supported in the use of the learning lab and in the use of ICT for teaching and learning.

It is also advisable to create a Risk Plan which anticipates possible problems, sets out who will be responsible for resolving them and indicates the actions to be taken.

3.14. Developing the initial learning lab design

Although all the case-study schools were inspired by visiting or learning about the FCL in Brussels, the designs they developed for their own learning labs were all different. The processes followed to produce these designs varied from school to school dependent upon a number of factors including:

- The drivers which motivated the school

- The extent of teachers' and students' involvement

- The availability of advice, equipment and assistance from partners

- The funding available

- The size and nature of the space available.

It can be very helpful to involve stakeholders in developing the initial design for the learning lab This may include:

- Working groups of teachers brainstorming how the learning lab could be structured and used for their subjects

- Collecting students' ideas via project work or a competition

- Explaining your aims to commercial partners and seeking their design ideas

- Involving a local university.

Christophe in France advises that the project team then compare the idealistic plans of students and teachers with available resources to achieve a realistic project plan.

The blueprint for the Lab21 in Belgium was the result of a process in which the school team shared their ideas with industry partner Ocular, describing and providing drawings to demonstrate what they thought their learning lab should look like and providing detailed information about the FCL in Brussels. Ocular's designers then developed a design which was in some ways surprising whilst achieving the aims of the school.

The French school's team followed a collective design process, considering ideas and experience of learning labs and other innovative learning spaces already developed in Europe. The output from this process was a 3D representation of the space which was then used for presentations within the school and to external stakeholders and potential sponsors.

In Germany the original idea was to create a more modern computer lab which would be more flexible and where students could do different things like project work and making things. At first it was going to be modelled quite closely on the FCL in Brussels, including the six learning zones. However, when this plan was presented to the teachers, they felt this would be complicated with classes of 30 students as it would be difficult to manage so many students doing completely different things. Therefore, the school decided to implement different learning scenarios or user cases in the learning lab instead of having fixed zones.

The Portuguese school's initial aim was essentially to clone the FCL in Brussels. They began by setting up one room including five different coloured learning zones (Create, Develop, Investigate, Exchange and Present). Then later they added the pink Interact zone outside the main room with round tables, an interactive whiteboard and a computer assisted lighting system optimal for working, which was provided by a sponsoring illumination company.

The school in Spain had very few resources in the beginning and so they decided to create the zones used in the FCL in Brussels in a classroom using traditional furniture and the
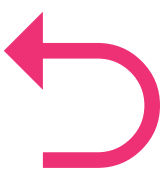
limited technologies available. The teachers then designed innovative pedagogical activities to use in the classroom. Later, when the school had obtained funding from the local and national education authorities, they were able to incorporate more technology and new furniture.

The initial design for the Turkish case-study school's learning lab was developed using ideas from two meetings of all the teachers and from the students, via an art competition. Parents also made some suggestions. Some of the students' designs did not include any technology. One idea, which was incorporated into the final design, was a drama stage on which students can make improvisations, present their work in different ways and generally improve their presentation skills. Fortunately, the space available for the learning lab was large and provided enough room to install the stage. Two university architecture students helped develop the design and provided technical support for the construction of the learning lab.

STAGE 4: IMPLEMENTATION AND START-UP

3.15.   Learning zones

All of the six schools, having been inspired by the FCL in Brussels, initially planned to implement the six learning zones found there (see Section 2.3).

Later, however, some schools either varied or, in one case, abandoned the learning zones idea.

The learning lab in the French school has the six learning zones. In the Belgian learning lab, in addition to the six learning zones they also have special collaboration pods designed by their industry partner Ocular.

The Portuguese school's learning lab was initially set up with five of the learning zones (Create, Develop, Investigate, Exchange and Present) in one room and later the sixth zone, Interact, was added outside the main room.

The Spanish school began by implementing all six learning zones currently in the Brussels FCL. However, recently the school has merged the Develop and Investigate zones, following the example of the Classroom of the Future at the Professional Development and Technology Institute (INTEF).[11] They now plan to build a new library which will include the six learning zones and the school also plans to build a new learning lab.

In the Turkish learning lab, the school team created all six learning zones and then found that several teachers wanted to set up additional flexible learning spaces for their subjects. These included the music teacher who wanted to set up an area as a music room and the physical education teachers who wanted to make a special area for their activities.

The German school initially intended to implement all the FCL learning zones. However, when Jörg shared his ideas with colleagues they expressed the feeling that all the different zones would be complicated to implement in their school with classes of 30. Therefore, it was decided that, as an alternative to learning zones, they would have many different ways of setting up the learning lab to enable its use with different learning scenarios or use cases.

The original design of the six learning zones in the FCL in Brussels was never intended to be prescriptive. The intention with the zones was more to challenge teachers and school leaders who visited the FCL and to encourage them to give more thought to how the specific organisation of technology and furniture within different learning spaces can support a variety of innovative pedagogical approaches. It is quite normal, therefore, that the case-study schools which have developed their own learning lab have adapted the learning zone concept to meet their own local context and requirements.

3.16.   The physical space, furniture, sound and lighting

The first step for schools starting to prepare the physical space for a learning lab is to identify a suitable room or rooms. Carlos in Portugal advises using a large room at least 8x6 metres. The Turkish team were lucky enough to obtain a very large room, the size of two standard classrooms, which gave them space for all their equipment plus a drama stage which had been suggested by students.

Some remodelling of the room/s may be necessary. In Belgium a new wall was built, some noise cancelling curtains hung and the lighting was changed to make the Create and Present zones more like a studio. In France a small kitchen was installed as part of the design, the lighting was renovated and much of the preparation work was done by the teachers themselves, including painting the room. In Turkey the old classrooms to be turned into the learning lab had small windows, so these were enlarged to allow more daylight in. Carlos in Portugal suggests that if the room is on the ground floor it may be necessary to increase security as the room will contain valuable equipment.

The room or rooms will need to be redecorated; in most cases this has included using colours and logos to identify the learning zones within the space. Carlos says early investment should be made to ensure the room is attractive and comfortable – including the floor and the chairs. Flexible seating and other furniture are an important feature of learning labs. The French team bought rolling furniture on castors similar to that found in the FCL in Brussels. In Portugal, to furnish the sixth learning zone, the team took tables and chairs from a stock room and painted them themselves.

The Belgium school's learning lab included special collaboration pods designed by an industry partner. Tim noted that "*when pupils work together in the pods they have a feeling of privacy and are not easily distracted by what happens around them even though the pods are not fully enclosed. The students in the pods do not distract other students in the areas around them as they might if merely seated at adjoining tables.*"

Noise is a potential issue in a learning lab. Some schools, e.g. in Belgium, found that the tiles already installed on the ceiling were quite good acoustically. The German team found there was a minor problem with noise but special blinds were used to decrease this and it was decided that users could live with a bit of noise as it was important to prioritise spending on technology. In Portugal the floors in the two rooms are sound absorbent, which avoids almost all potential noise problems.

Good lighting is important in a learning lab. When the Portuguese school's sixth zone was built, a sponsoring illumination company provided lighting that is constant, computer-assisted and optimal for working. The Turkish school found different types of lighting are needed in different zones and areas, e.g. spotlights help in the chroma key, "green screen" area. They have also introduced some plants to create better air quality in the learning lab and it is planned that, in future, students will grow and take care of plants including flowers and herbs that they can use.

3.17. Technologies

Implementing the learning lab plan will include installing technologies, which may include new, relocated and/ or donated technologies and, if necessary, upgrading broadband and Wi-Fi infrastructure.

The technologies found in the case-study schools' learning labs are listed below but not all schools have all of these. The amount of technology, and the specific technologies, available in school learning labs vary according to:

- The amount of funding available to equip the learning lab

- The type and amount of technology provided by industry partners

- Technologies available within the school that can be moved into the learning lab

- The extent to which students' personal devices can be used for learning (e.g. whether the school has a Bring Your Own Device (BYOD) policy)

- Technologies available due to other technology-enhanced learning projects in the school

- The objectives and interests of school leaders and teachers.

The ingenuity and generosity of teachers is also a factor. For example, in Germany a tablet cart and two 3D printers were purchased cheaply on eBay, and in Turkey the ICT coordinator personally donated a 3D printer to the school.

THE TECHNOLOGIES IN THE CASE-STUDY SCHOOLS

- Interactive white boards
- Electronic flipchart
- Learning response systems
- Interactive touchscreens with screen mirroring
- Tablets
- Laptops and notebook computers
- An interactive table computer
- Mobile devices
- E-book readers
- GoPro cameras
- Lego robotic kits
- mBot robots
- Calliope mini microcontrollers
- Arduino boards
- Raspberry Pi Mini-PCs
- Drones
- Science lab
- Microscopes
- Data loggers
- HD video camera and chromakey with greenscreen and lighting
- Digital audio equipment
- Interactive projectors
- High-performance CAD computers
- Multimedia computer with 3D scanner
- High-performance Virtual Reality (VR) computer with Oculus Rift VR glasses
- 3D monitor
- 3D printers
- 3D scanning
- Colour laser printer
- Animation, logo, poster, cartoon and video editing software

- Multifunctional teacher workplace with projector and DVD player.

In the Turkish learning lab there are no robotics kits. Instead, students and teachers make all the parts for robots using the 3D printer and other materials, e.g. wood.

In Portugal, whilst planning the learning lab, the school noticed that nearly all the students, including those from poorer families, have mobile phones and/or tablets. Therefore, the school has tried to integrate the use of these into the learning lab and to show the teachers and the students that they can be used for learning.

Some of the schools recommend the learning lab has its own, dedicated, very high-speed broadband connection separate from rest of the school. Carlos in Portugal explained that experience suggests sharing the school Wi-Fi would *"greatly increase the probability of failure"* due to teachers and students' frustration with slow Wi-Fi.

The German school has a "self-healing" system. Jörg explained that *"it is the school policy to allow students to use and experiment with everything in the learning lab as they wish"* but they believe *"it is important that everything always looks the same when teachers and classes come in."* To ensure this, one of the school's commercial partners has implemented and supports a self-healing system for the learning lab which restores everything to just as it was before any changes were made or before any crashes. The German school was fortunate in having a commercial partner with the specialist knowledge and tools to supply this system.

3.18. Technical support and technology related challenges

The case-study schools were asked about technical support for the learning labs they have set up. There were different arrangements for this in the schools:

- Technical support for problems teachers cannot solve is provided by the school's IT coordinator (Belgium)

- Equipment maintenance and technical support is provided by the school's ICT teachers (Portugal)

- The ICT coordinator is responsible for training and configuration of the devices (Spain)

- An external company provides technical support (Spain)

- Technical support for technologies and systems donated by commercial partners is provided by those partners (Belgium and Germany)

- The city provides technical support for the IT networks in all schools in the area (Germany).

Perhaps surprisingly, in general, the schools did not seem to consider the provision of technical support to be a big problem. They all already had support arrangements in place for their schools' networks and for commonly used technologies. This support was provided by staff within the school or at city or local area level, or by external organisations, or a combination of these. For more unusual technologies or solutions donated by or purchased from industry partners, these partners usually provided training and technical support.

Setting up a learning lab usually means more technologies in use and more users of them and, therefore, the workload of the staff responsible for technical support may increase. However, there seemed to be a view in some schools that the reliability and user-friendliness of some of the consumer technologies used (e.g. tablets, laptops and mobile phones) helps to reduce the amount of technical support needed. In some schools the expectation was that the more technically competent teachers would be able to sort out some problems by themselves, whilst others would need some assistance from colleagues, the school's ICT teachers or ICT coordinators.

Clearly the level of technical support that setting up learning labs will require, depends on their particular context, competence and experience and the technologies used. It may be that schools that have already set up their own learning labs tend to be those that have already achieved a good level of ICT competence.

Where more support is typically required, it is to help teachers in using technologies and integrating their use into their teaching. Christophe in France commented on the need for more help with this and more time to provide it.

The interviewees had a few comments on the technological challenges. These included challenges resulting simply from more teachers becoming involved in the use of technology. This results in more pressure on bandwidth, more need to support those with limited technical knowledge, and increased maintenance of equipment which is more heavily used by more people. Fran in Spain observed that some of these challenges *"are overcome by the teachers working as a team, with those who have more knowledge of ICT and teaching with technology supporting less experienced colleagues."*

Tim in Belgium noted that the challenges his school experienced were *"more to do with available time for*

training and lesson development than with technical issues." He observed that "*the Create zone is not used very much. This is probably because using video and audio production tools is a big step for many teachers and they need more training to be confident enough to incorporate the tools into their teaching.*" Also, "*we have VR glasses but we haven't found time to develop many lessons around these yet although there are some nice apps we could use.*"

3.19. Convincing the teachers

Any innovation in a school will only be successful if sufficient teachers are convinced it is a good idea and worth them finding time in their busy working lives to engage with it. Once convinced, some teachers will become advocates whose enthusiasm will help to convince others. On the other hand, if you fail to "sell" a new idea to teachers, they will not change their practice.

In Belgium, Tim reported mixed reactions from teachers to building the learning lab: some were glad that something new was happening whilst some others were not interested. He recalled no strong opposition from teachers, although he suspected that some of them "*may have thought the money could have been better spent or that the hours of work could have been dedicated to 'more important' tasks.*" Tim noted: "*it takes a long time and we will never get every teacher on board but we keep trying... some teachers are afraid of the technology and of losing control.*"

In France Christophe convinced other teachers to support the idea of the learning lab by showing them the benefits he had achieved using new approaches with students in his own classroom. Resistance from teachers to the changes proposed was not a major problem. Some of them needed more time to change their practices but all of the teachers joined in the project to some extent.

Jörg in Germany found: "*It is important to all the teachers to be kept updated about what is going on in advance.*"

Carlos in Portugal observed: "*The pencil metaphor describes very well what happened with teachers in my school. In our school 10 to 15 % of teachers thought the learning lab was a good idea, 20 to 30% thought it was a very bad idea and would achieve no good results at all and others were waiting to see what happened.*" The pencil metaphor[12] was developed by Lindy Orwin and is based on a familiar Technology Adoption Curve first drawn by researchers in the 1950s.[13]

Carlos reports that, after 4 years, half of his school's teachers use the lab, but the other half still do not. He concludes that

"*changing of the minds of the teachers is very hard and takes a long time.*"

In Spain Fran convinced other staff in his school that the learning lab was a good idea by explaining the pedagogical foundation of the project. He reports that none of the teachers has resisted implementing the project. However, some have had difficulties in modifying or adapting their methodologies to be compatible with the principles of the learning lab.

Some teachers in Turkey thought it would not be possible to run lessons in the learning lab as classrooms are usually crowded and they thought it would be too noisy. The team discussed this with teachers and convinced them there would be less noise if students are busy and really engaged in their work. The argument was: if students are passive learners, they get bored and start to talk but in the learning lab groups of students are allowed to talk about their project and therefore talk less about other things.

3.20. Professional development and support for teachers

There is no one-size-fits all model for training and CPD of teachers. Schools take different approaches to CPD related to the introduction and use of learning labs depending on:

- National and local norms regarding teachers' CPD

- The culture of the school regarding CPD, generally and related to technology

- Any involvement of the school and its teachers in transnational projects involving technology enhanced teaching, CPD and knowledge sharing

- The existing level of ICT competence of teachers

- The previous experience of teachers in teaching with technology

- The level of teachers' involvement in the design and building of the learning lab.

In the case-study schools in Belgium and France there were no conventional training courses for teachers. In Belgium the implementation team demonstrated the learning lab technologies to a group of early adopter volunteer teachers and explained the idea of learning zones to them. Later the learning lab plans were presented to the full staff meeting and "TeachMeets" were organised.

12   https://www.teachthought.com/technology/pencil-metaphor-how-teachers-respond-to-education-technology/

13   https://en.wikipedia.org/wiki/Technology_adoption_life_cycle

A TeachMeet is an organised but informal meeting for teachers to share good practice, practical innovations and personal insights related to teaching. Participants volunteer to demonstrate good practice they have developed or delivered or to discuss or demonstrate a product that enhances classroom practice.

Co-creation sessions were also organised for the Belgian teachers working with teacher trainers and researchers and the teachers were supported when they gave their first lesson in the learning lab.

In France, the teachers involved in setting up the Tip-e learning lab learned on the job and then shared ideas and good practice with their colleagues.

The school in Spain has an on-going training project for teachers located in the learning lab, which is coordinated by a teacher, the ICT manager and the school director. They advise other schools that it is important for teachers' CPD to take place in the learning lab.

In Portugal, when the learning lab was first set up, all the teachers in the school had a 10-hour workshop which included developing Learning Stories, and learning how to implement these, as well as training in the use of different technologies and apps. Some of the training in the use of specific technologies was led by the commercial partners who provided the technology. The school has also used and learned from the Learning Stories developed by the iTEC project.

Training is a key function of the Portuguese learning lab and between 2014 and 2018 more than 300 teachers took part in workshops there.

In Germany, following the pilot in which four teachers used the learning lab and tested everything, five or six one-hour training sessions for teachers were held. These sessions where used to show teachers what was in the learning lab, how to use the equipment and how to work in the lab, including sharing the project team's ideas about different approaches to teaching and learning. In the near future training in the use of specific approaches and technologies is planned, including sessions on creating more innovative media, how to make a video in the lab and how to use a CAD system.

In Turkey initial training and on-going training was arranged for all the school's teachers and for teachers from other local schools who had expressed an interest in changing their teaching methods.

There were three training events with 60 teachers including sessions on flipped classrooms, 21st-century skills, learning labs, digital education solutions, e-learning courses, the EUN Academy and Turkish online resources. Also three seminars were arranged. In one of these, teachers took the roles of students to test lesson ideas, practice scenarios, and try greenbox use and use of the furniture and technologies in the learning lab.

Turkish teachers who were not very confident about using the learning lab or the technologies were involved in small projects at first during which they received advice and support from the ICT coordinator. During the summer break, two weeks of teachers' events are planned in collaboration with other schools in which teachers will both provide and receive training, with the school's learning lab team sharing their experiences of using the learning lab and the learning zones.

A WhatsApp group has been created for the learning lab teachers, which, Can says, "*allows them to share ideas at all times of day and night, even at midnight!*"

## 3.21. Starting to use the learning lab and piloting learning scenarios

Some schools have chosen to pilot use of their learning lab with a small group of teachers and their students. This can be a good way of trying out ideas and new technologies, and finding problems that need to be resolved, with less pressure than there will be when the lab is fully operational. Other case-study schools decided to make the learning lab open to all from the beginning.

Teachers who are early users of the learning lab will be developing innovative future classroom scenarios and specific learning activities based on these which can be used within the new space with the technologies that are available. In some schools, work on future classroom scenarios started in early meetings of the project team and/or during the planning phase.

As teachers start to use the new learning lab, they will pilot the learning scenarios/activities with the students and evaluate their effectiveness. In some cases, teachers identify elements of new learning scenarios that can be taken back to their more traditional classrooms.

Many teachers using a new learning lab will also continue, for some time, to need training as well as support and advice from ICT coordinators or other more ICT-literate teachers.

Once the learning lab is in use, schools are likely to identify modifications and additional investments that will be needed and which should be incorporated into on-going development plans.
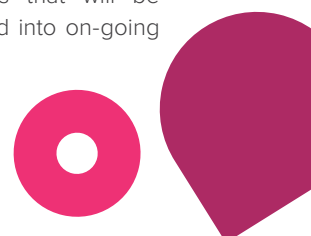
4. How the case-study learning labs are being used in 2019

The Belgian learning lab is used for stimulating self-directed, independent and collaborative active learning by students aged between 12 and 18. It is also used for informal meetings of pupils and teachers as well as for experiments, educational research (e.g. by university students), professional development, networking activities, meetings and discussions. The school leaders see the learning lab as a key part of teachers' professional development.

In France the learning lab is available to all teachers and this was an important element of the original plan. The way the classroom has been used by teachers and students has changed over time. New practices are tested regularly and then adopted or not depending on how effective and practical teachers believe them to be. The approach of groups of students working on projects together was introduced gradually as this was something many teachers were not used to.

In Germany, although these are early days, Jörg has noticed teachers are using the space more flexibly and some of his ideas about approaching teaching differently are already happening. There are some signs that teachers are collaborating more, and this will be encouraged at the annual teachers' conference. A "buddy" system has been proposed in which a teacher works with a pre-service teacher buddy when using the lab. The school feels this could be a very effective collaboration as trainees have more time to plan.

In Portugal the learning lab is available to all teachers, teaching all subjects and age groups. The teachers who have been using the lab most grow more confident with the technologies and methodologies the more they use them. Although this group has not grown as much as Carlos had originally hoped, the teachers have had to collaborate more, as "*when students had questions about new applications the teachers had to ask their colleagues for advice.*" However, Carlos reports that "*the change in the students has been the difference between day and night*" and that after starting to use the lab they approach school in a different way.

In Spain the learning lab is used on a scheduled basis. All the classes attend the learning lab once a week. In each case approximately half the class goes to the adjoining classroom, which is the Interact Zone, to carry out activities with teachers. The other half of the class stays in the main learning lab area to carry out other types of activities e.g. research, robotics, etc.

In Turkey the learning lab has been available to all the teachers from the beginning and they all use it, including the special education teachers. Can observes: "*We have great technologies that the students, not just the teachers, use actively. We teach the students how to use the technology and give them chances to make small projects and to make mistakes. They make better projects than the teachers.*"

Some teachers are integrating imaginative technology supported elements into their practice e.g. a science teacher used a detailed photograph of a cell and with green screen technology in the Create area she was able to seem to be inside the cell indicating and describing all the parts to her students.

Can describes how "*students can share in this type of experience in other subjects, e.g. history, they can use it to 'become' a character in an appropriate location. The students can use their imaginations and the 3D printer to create many different things. They can also express themselves and be creative on the stage or use robotics and sensors.*"

The individual case studies are available on the FCL website: fcl.eun.org/guidelines

5. The benefits and impact of learning labs

5.1. Benefits observed

Since they set up and started using their learning labs, benefits observed by the case-study schools include:

- Teachers are using the space more flexibly and are starting to approach teaching differently.

- Teachers who have tried different technologies and pedagogic approaches in the learning lab are designing lessons and starting their own projects making more use of technology.

- Some teachers are using more enquiry learning, project learning and group learning.

- Teachers are working with different apps and in different ways in their own classrooms.

- More collaborative learning.

- The learning lab provides a space in which to develop students' competences.

- Improved student motivation and engagement with learning.

- Students are more active in the learning process.

- Students can work collaboratively and multi-disciplinarily and use their imaginations.

- In traditional classrooms the outputs are very limited but in the learning lab students can create different works and outputs, both digital and non-digital.

- Improvements in students' multiple intelligences.

- Improved engagement with students' families.

- Increased collaboration between teachers.

- A buddy system pairing teachers with student teachers when working in the learning lab.

- Opportunities for the school to get involved in other projects with industry partners with whom they form partnerships to build the learning lab.

- Publicity about the learning lab and the support already received from others has encouraged more commercial companies to want to become involved as partners.

- Sponsors wishing to publicise their involvement with the learning lab raise the profile of the school.

5.2. The impact of learning labs

In some of the case-study schools some formal research has begun to collect evidence of the impact of the learning lab. In all the schools some impact has been informally observed by the school leaders or teachers involved.

Two university research projects are being carried out in Lab21 in Belgium and other learning labs, further exploring the possibilities, the effects of the use of technology in the classroom and the best ways to support teachers to integrate technology into their practice. Results are not yet available.

In France, the school is not currently carrying out or collaborating in research into the impact of their learning lab. However, Christophe is an FCL Ambassador, which involves sharing information with other ambassadors and may include involvement in projects later.

In Germany, as the Edu.lab has not been operational very long, it is too early for reliable evidence of impact to be available. However, the school carried out a pre-test with teachers before they started to use the lab and, in summer 2019, the results of comparing this with post-use data will be available for the first evaluation. Moreover, the local university will soon start some research to evaluate the impact of Edu.lab. However, the research team has already noticed that experiences in the learning lab have had some impact on the installation of technologies elsewhere in the school. As a result, the school has decided not to install an interactive white board in every classroom but to install a teacher's station where they link up their laptop in all classrooms.

In Portugal the school is working with a university partner, including cooperating with the author of a doctoral thesis focused on the school and other learning labs. The research includes ten lessons taught in the learning lab, and in traditional classrooms for comparison, with three or four cameras used to study the teachers and students throughout the lessons. The results will be available in 2020. Meanwhile Carlos has found that "*the two classes in*

the pilot improved their results, not by a lot, but it is a start" and "*there has now been a very high impact on the way the teachers using the learning lab are working and using the resources*"; and "*in their regular classes, even where they are still using rows of tables, teachers have changed their methodology and the tools used with the students*."

In Spain no research looking for evidence of impact has started yet, but the school intends to plan this when following the final steps in the FCL Toolkit. Meanwhile Fran notes that *"small changes are evident but change is a gradual process"* but *"interest in incorporating ICT into teaching and learning processes has been generated"* and "*improved collaboration between teachers has happened especially due to the need to design scenarios and pedagogical activities for use in the learning lab*."

In Turkey the learning lab is quite new, and the school is not currently carrying out or collaborating in impact research. However, it is piloting some national projects which may contribute to relevant research. The team has informally observed significant benefits related to student engagement and learning which are reflected in benefits observed.

As research findings become available from schools where learning labs have been set up and their impact evaluated, these will be published on the FCL website.

5.3. Lessons learned by the case-study schools

The following lessons learned were reported by the case-study schools:

- "You need to consider everything including, figuratively and a bit literally, tearing down the school walls."

- "There is a lot to learn, from finding ways to obtain equipment to learning how best to use it, and this should not be underestimated."

- "The relationship between the project team and the authorities is key."

- "It is very important to get to the right person in the companies you hope to partner with."

- "You need a team of staff who are enthusiastic and can think outside the box."

- "It is necessary to develop methodologies that incorporate ICT."

- "You need to talk to lots of people, internally and especially externally."

- "Building a learning lab opens up opportunities for collaboration. Teachers tend to be confined to the school building but there is so much to learn outside – collaborate with other schools."

- "It is very difficult to change teachers' mindsets, so it is a very slow process and you cannot change teaching if you do not change the way you access the students."

- "It is hard to convince teachers it is possible to do things differently, e.g. introduce project or enquiry learning, and still have students ready for the exams in time."

- "Unfortunately, some teachers build a wall, as they do not see themselves working in the learning lab environment. Such teachers are not always the older teachers, some are very young and just starting out in their careers. It is not a matter of age. Confidence in using technology is needed and many teachers don't like it when students see that they do not have this."

- "It is very important that teachers are convinced of the necessity for the learning lab, believe in the project and face the challenge with enthusiasm and willingness to change."

- "We have found it takes longer to prepare lessons for the learning lab than for the traditional classroom. This is the reason some technically competent teachers may not use the learning lab."

- "When teachers see other teachers using equipment and approaches that work for their subject and their students, they realise how important the learning lab is."

- "The students are very eager to use the learning lab and they keep asking when is the next lesson in there."

- "We must dare to try new ideas and changes to teaching practices even if it seems impossible at first due to cost. From the first positive feedback, everyone follows."

- "The only bad result has been lack of time to work on other school priorities."

- "It is a lot of work, there were many hours when I thought it would never happen but eventually it is here."

6. Learning labs – The way forward

We hope you have enjoyed these guidelines and found them useful and inspiring. European Schoolnet also provides a number of other **services and related initiatives to help schools** develop innovative learning spaces for their students and staff. Please note though that European Schoolnet is not able to provide funding for any learning lab initiatives.

FUTURE CLASSROOM LAB AMBASSADORS

Currently Ministries of Education in 16 countries have appointed Future Classroom Lead Ambassadors who support the implementation of the FCL concept by providing training and advice to schools. Several countries also have an expanding network of FCL Local Ambassadors who support the Lead Ambassadors, particularly in countries where schools have been inspired by the FCL to develop their own versions of learning labs that are adapted to the local context. We suggest that you find out what kind of activities the Ambassadors are organising at national or local level (this varies from country to country). The Lead Ambassadors and their contact details can be found here: fcl.eun.org/fcl-ambassadors

NETWORK OF LEARNING LABS

Following the spontaneous emergence of several learning labs across Europe, European Schoolnet created a network to link different learning labs and related initiatives together. It is an open network and welcomes different learning labs to join and exchange together on different issues like learning lab management, cooperation with commercial partners and industry, teacher training activities, etc. All the learning labs are independent initiatives, often inspired by the original FCL, but by no means identical with the original FCL. In fact, all learning labs are different since they have been created and adapted to the local context and to provide for local needs. However, the main ideas of the FCL are present in most cases. All learning labs and innovative learning spaces that meet the basic criteria (explained on the website), are welcome to join the network. The labs are described on the FCL website: fcl.eun.org/fcl-network-labs

PROFESSIONAL DEVELOPMENT COURSES AND WEBINARS

Supporting the professional development of teachers is an integral part of a learning lab's rationale. The FCL in Brussels offers workshops and courses that help teachers to design and deliver lessons in flexible learning environments, supported by technology. The on-site courses take place at FCL in Brussels. For the course fees, schools use different funding mechanisms including funding from the European Union Erasmus+ Programme's Key Action 1.. Read more here: fcl.eun.org/courses

A number of webinars and online courses are also organised on a regular basis. All those interested are welcome to take part in free and open online training events for teachers and school leaders including webinars and online courses. To stay up to date on the future events, please follow the FCL website, social media and newsletter.

FCL RESEARCH PROGRAMME

Developing a solid FCL research programme is one of the key objectives of the FCL team in 2019 and 2020. To this end, European Schoolnet has been gathering available evidence from research that helps to define the conceptual framework for the programme. Whatever the specific research questions to be addressed, the alignment between the curriculum, teacher practice and the space will be the backbone of the research approach. Evidence from research indeed suggests that efforts to understand the impact of physical space on teaching and learning should systematically take into account teachers' competence in using the space to best support specific practices. It also reveals the importance of school leadership attitude and capacity to provide the necessary diversity of learning spaces and the flexibility in school time organisation.

Some of the evidence already available suggests many possible questions that research programme about learning spaces could address, particularly related to participatory design issues. Just to mention a few of these questions: How can we encourage teachers to make best use a learning space? How does the space support teacher collaboration? How does the space work for learners with special needs? How can we align space with different technologies? How can we organize the space to implement 'augmented' learning? How can we sustain a culture of change at school level aligning curriculum, pedagogy (including assessment) and the space organisation?

The FCL research programme will be announced in 2020 and will be the result of a co-construction process with the FCL partners. To reflect the diversity of interest at country level, it will develop around two axes. The first one will focus on the impact of using FCL type of space in teacher training (initial and continuous) on teaching practice when participants are back in their own classrooms and schools. The second one will focus on the impact at student level and might address questions like the relationship between space and student engagement in learning, motivation or wellbeing. Follow the development of the research programme here: fcl.eun.org/research.

**"Generate expectations in the educational community and form a team of truly interested people to make it happen."
*(Tip from a case study school)***

NOVIGADO PROJECT

More activities linked with innovative pedagogy and learning spaces/labs will be organised within a new Erasmus+ funded project called Novigado, where European Schoolnet is one of the consortium members. The project which will run from December 2019 to May 2022 will provide schools and educators with more opportunities to come together as a community, find and share resources, and take part in professional development activities. More information at fcl.eun.org/novigado

ACKNOWLEDGEMENTS
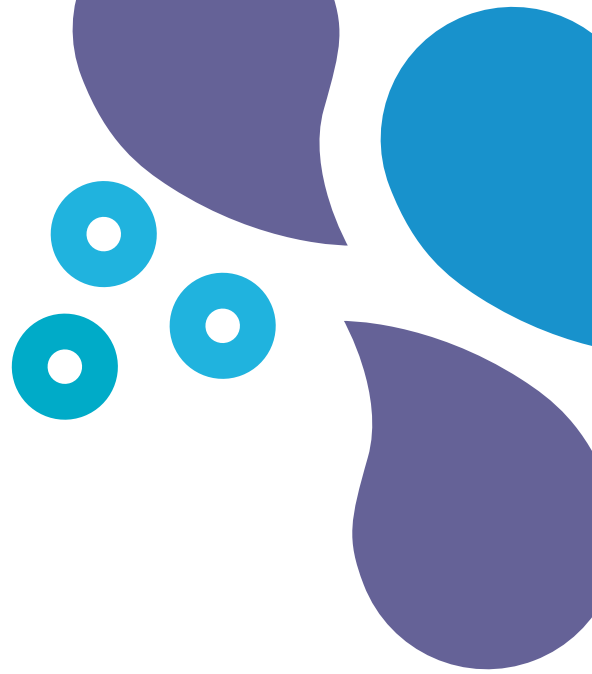
Future Classroom Lab
by European Schoolnet

Building Learning Labs and Innovative Learning Spaces

The guidelines have been created by European Schoolnet and supported by members of its Interactive Classroom Working Group (ICWG). Eight Ministries of Education are involved (Belgium (Flanders), Czech Republic, Ireland, Italy, Luxembourg, Portugal, Switzerland, Turkey).

Read more at fcl.eun.org/icwg

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