Introduction

DSI4EU aims to support the growth and scale of digital social innovation (DSI), tech for good and civic tech in Europe through a programme of policy, research and practical support.

This document, part of a series of introductory texts covering different social areas, gives an overview of the landscape, challenges and opportunities for DSI in the field of skills and learning. It also includes preliminary policy recommendations which will form the basis of our policy engagement over the coming year.

This text was written by Matías Verderau at Fab Lab Barcelona and edited by Matt Stokes and Codrina Cretu at Nesta.

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Methodology

This mapping was carried out through online research, outreach and network-building with educational initiatives around the world (mainly related to the Fab Lab network), European projects and public or government-backed education projects at the local, regional and national level in Spain. Alongside the research which led to this text, we have actively interacted and collaborated with many of the projects, including in the development and application of methodologies related to digital fabrication and social impact. Furthermore, we are coordinators of the Fab Academy; through this we have been present at many fairs, conferences, workshops and other events. All of this together has given us a broad and critical perspective of the field happening in our field.
Overview of the field

DSI4EU’s Skills and Learning cluster covers a broad scope of activity, including projects aimed at children and young people, unemployed people, people in work and disadvantaged communities. The future of education, an essential building block of today’s and tomorrow’s society, will be shaped by the transformative potential of technology.

By looking at existing activity within the field, we can delineate three main areas where DSI plays a key role today:

• Firstly, initiatives which use **technology as a tool in the classroom** to enhance learning. This is closest to the well-established, but largely commercial, edtech field. Examples include the CreaNova school and Liceu Politecnic, both in Catalonia, which use heavily digital-influenced methodologies in their teaching and learning. Although outside the classroom, UK-based Hegarty Maths has been wildly successful among students who use the platform’s videos to learn and practice maths at home for free. In Italy, taking advantage of a recent law change, Book in Progress is a teacher-led effort to produce open, collaborative, digital textbooks and learning resources which are now used by tens of schools.

• Secondly, initiatives which seek to **reduce inequality of access and outcomes** for education. This might include online mentoring for children from lower socio-economic groups (such as the TutorFair Foundation, which focuses on maths tuition in rural and coastal areas in the UK; The Access Project, which works with secondary school pupils to increase university admissions among low-income groups; and Whole Education’s Language Futures, which links students with native speakers of foreign languages), or offering free courses to help digitally excluded groups get online (such as the UK’s Good Things Foundation or Poland’s FRSI, which work to reduce digital exclusion).

• Thirdly, initiatives which support the **development of digital skills**, not just for employment purposes but also to empower individuals in a digital world.

Within our cluster activities, we focus mainly on the third type of DSI identified above - initiatives which aim to democratise access to digital and physical tools, with the aim of empowering individuals to take charge of and create impact in their own lives and communities. They simultaneously disrupt existing models and empower people to become agents of change.

DSI initiatives in this field use a range of technologies, including: online platforms like Instructables or Github; digital fabrication techniques such as 3D-printing, cutting and milling; low-cost computers such as Arduino, Raspberry Pi and micro:bit, and programme and machine design projects like Prusa3D.

There are hundreds of projects in the field, only a few of which we can name here. They include:

• Introducing **maker technologies** to young people so they can use them for good, such as: Roma Makers’ educational programme, which brings “pop-up” fablabs to schools; Makers for Inclusion, which runs making activities for disadvantaged groups in Barcelona’s Raval; Fab Lab Barcelona’s Future Learning Unit, which runs maker activities
for children under 16; and **Vailets HackLab**, a community of parents and educators which promotes the use, study and manipulation of technology both at school and at home and organises events, workshops, talks and hackathons. Several projects also exist for adults, including **Fab Academy**, a course which takes place across the 1,500 fab labs globally and is taught from MIT. The Academy is an online distributed digital course open to anyone, regardless of prior education or achievement, thus opening up possibilities for a wider range of individuals. **Waag**, in Amsterdam, also runs a series of “labs” involving the public in everything from making to biohacking, citizen sensing and heritage.

- **Teaching coding and programming**, either within or outside existing educational systems. These have proliferated across Europe; some of the most successful include **Code Club** in the UK, **CodingMasters** in Poland, **Code for All** in Portugal and **#SuperCoders** in Belgium, France, Italy, Poland, Romania and Spain. In some cases these target underrepresented and/or minority groups, including women (such as **23 Code Street** and **Techmums**), asylum seekers (such as **Hack Your Future** and **Refugees on Rails**) or people with disabilities (such as **Connectech**).

- **Encouraging digital social entrepreneurship** among young people, such as **Apps for Good**, which provides free courses to teachers to help secondary school students build mobile apps and IoT projects (for good), the **DOIT project** (Digital fabrication and making for social innovators), a European initiative which empowers young innovators with social entrepreneurial mindsets and provides them with the tools and skills they need to thrive, and the **Longitude Explorer Prize**, which challenges groups of young people to use technologies like GPS and open data to tackle specific social challenges.

- **Supporting projects** within the wider DSI ecosystem; in the Netherlands, for example, **makereducation.nl** runs

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**FAB ACADEMY**

Fab Academy is the largest digital fabrication campus in the world, which uses a distributed model of education to support students to make (almost) anything. The Fab Academy started in 2009 and has been doing courses every year since.

The Fab Academy spreads the principles, applications and possibilities of digital fabrication and is based on MIT’s popular rapid-prototyping course How To Make (almost) Anything taught by Prof. Neil Gershenfeld.

The Fab Academy students are globally connected, enabling the collaboration between them, and increasing the possibilities and outcomes of the program.

Fab Academy promotes collaboration as a fundamental value: students learn and work in local groups, with peers, mentors, and machines, that are globally connected by
content sharing and video conferences for interactive classes worldwide. The individual labs are supported and supervised regionally by expert nodes with more advanced capabilities, expertise, and inventories.

The Fab Academy brings digital fabrication closer to people from different backgrounds around the world. Based on collaboration as a fundamental value, Fab Academy has allowed and supported the development of all types of projects, some with technical aspirations and others with a clear impact on our societies.

The course started in 2010 with 12 Fab Labs and 30 students, in 2017 there were 73 Fab Labs with a total of 285 students learning at the Fab Academy around the world. This numbers show the exponential growth of the network and the success of the program. Fab Academy will continue sharing and disseminating this knowledge to more and more people around the world, and support the projects developed of the students through complementary programs, such as Fab Academy X, Bio Academy, Fabricademy and Fab Academy Thesis, all part of a platform called Academany, aiming ultimately to spread high level education in a distributed way.

Website: http://fabacademy.org
Twitter: @fabacademany

conferences, challenges in schools and visits to makerspaces to promote creative digital learning across the country. Maker Faires are held across Europe to engage people of all ages in digital making.

These approaches to skills and learning are increasingly being adopted into mainstream policy, practice and discourse; schools and universities are starting to accredit courses as part of their curriculum or to grant credits for the skills developed in the courses, and many traditional education institutions are beginning to adopt distributed models and digital tools and to value social impact.

It is also important to note that these initiatives are not just about teaching digital skills:

- Many of them also promote the learning of a range of cognitive and non-cognitive skills, such as creativity and collaboration, computational thinking and problem-solving.
- The majority integrate some sort of socially-oriented aspect, encouraging people to actively tackle social challenges.
- Many focus on reducing inequality by upskilling and engaging lower socio-economic groups and disadvantaged communities.

Values and strategies

DSI initiatives have well defined values and strategies, setting them apart from other sectors of the education field. These include principles such as collaboration, open access, empowerment, distributed models, peer-to-peer learning, open source technologies and community-centred programs, among others.

Community

Successful DSI projects are rooted in communities. Fab Labs, for example, are available as a community resource, open access for individuals and a heavy focus on educational programs. Fab Labs are as much a space for meeting and community-building as they are for the fabrication itself. They do not discriminate on age or background - many in fact focus especially on minority and disadvantaged groups - and they are often set up in established community spaces, for example by bringing maker technologies into public libraries.
TECHNOVATION

The Technovation challenge is an international competition in which girls between the ages of 10 and 18, from more than 100 countries, participate. Technovation offers girls around the world the opportunity to learn the skills they need to emerge as entrepreneurs and technology leaders. Each year the girls are invited to identify a problem in their community and to solve it. The girls work in teams to build a mobile application and a business plan to launch this application.

Technovation is a program run by Iridescent, a non-profit educational association that prepares engineers to provide cutting-edge STEM training to disadvantaged girls, boys and their families. Associations such as the Peace Corps and UNESCO support this initiative, which has collaborators such as Google, Verizon, IBM and Walmart, among others.

Technovation’s curriculum takes students through 4 stages of launching a mobile app startup, inspired by the principles of design thinking:

- Ideation: Identify a problem;
- Technology: Develop a mobile app solution;
- Entrepreneurship: Build a business plan to launch the app;
- Pitch: Bring the business to market.

Technovation has a profound impact on students and mentors. A five year look-back survey of alumni showed that while most students had little or no experience with computer science before Technovation, their experience with Technovation had a powerful effect. After participating in Technovation, participants were more interested in:

- Computer Science (78%);
- Entrepreneurship (70%);
- Business Leadership (67%).

Additionally, after participating in Technovation:

- 26% of alumni in college major in CS. This is 65x the national rate of 0.4% of first-year female college students majoring in CS;
- 58% of alumni enroll in subsequent Computer Science courses.

The first edition of the competition was held in 2010 in San Francisco. In 2015, the documentary CodeGirl, directed by filmmaker Lesley Chilcott, was released, featuring some of the stories of the more than 5,000 young people from more than 60 countries who took part in that year’s edition.

Twitter: @technovation
Website: technovationchallenge.org/

Distributed models

Many platforms and initiatives are based on a distributed educational model: students learn in local working groups, with peers, mentors, and machines. These elements are in turn connected globally by content and video sharing and interactive classes. A good example of a distributed model is the Fab Foundation’s platform, which has spread across the world since its establishment in the US. The platform creates standards-aligned digital fabrication curricula for STEM education that reflects open-source values and enables teachers to build and share lesson plans openly.
Open source
Most of the designs and projects created by students are open-source and accessible to anyone for further development, creating a large and diverse repository of projects and solutions to social challenges. An interesting example of the use of open-source technologies with social impact is the European GAIA (Green Awareness In Action) project, which aims to promote positive behavioural changes within communities regarding energy and environmental awareness. Its activities consist of the gamification of real time, IoT-enhanced energy consumption in schools located in Italy, Greece and Sweden.

Accessibility and affordability
Within this field of DSI, most classes, tutorials and files are open and free to access. In general students enrolled in the projects only pay for common infrastructure, and local and global services; the Open University’s successful MOOC platform, OpenLearn, is completely free. While makerspaces and fab labs tend to make as many programmes as possible free or low-cost, although, as discussed below, this value can lead to challenges around sustainability and scale.

Challenges
DSI has the potential to change education for the better - to build a fairer society, to include the excluded, to empower citizens to be agents of change, to equip individuals with the skills they need for the coming decades. Unfortunately, this potential has not yet been realised. In our analysis we have identified two main challenges for DSI in the field of skills and learning.

Funding
Funding is, perhaps unsurprisingly, one of the greatest challenges for DSI initiatives in the skills and learning cluster. This is the case both for starting new initiatives and for sustaining, growing and scaling initiatives. Many traditional models, such as charging access, advertising and data monetisation, are anathema to DSI’s values, while austerity across Europe has significantly reduced the funds available from local and national governments and publicly-funded schools.

However, there are many approaches that organisations have successfully adopted to ensure the longevity and sustainability of their initiatives. Given high interest in the field of education, some projects - such as Apps for Good, Raspberry Pi, micro:bit Foundation and the Fab Foundation - receive funding from corporates. Others receive funding from public institutions such as the EU or local governments. San Sebastian’s Hirikilabs, a makerspace in the Tabakalera cultural centre, was originally funded as part of the city’s European Capital of Culture status in 2016, and Barcelona’s Ateneus de fabricació are funded by the city government. A significant number of projects are either wholly- or partly-funded by donations and staffed by volunteers, including some of the largest initiatives like CoderDojo, Code Club and Turing Lab. Some projects charge for access, even if small amounts, or operate “freemium” models where people can pay for extra services or materials.

Regarding making in particular, access to equipment can be a prohibitive factor. One interesting method of tackling this is Pop Up Labs, which allow these prohibitive technologies to be distributed to all communities - especially remote and rural ones - and distributing their cost. Others have worked to bring down the cost of equipment itself; Prusa3D, for example, offers lower-cost 3D-printers which can be assembled by individuals, while RepRap is an open design 3D-printer which can print its own components, and therefore be replicated.
Acceptance and adoption

Although there is growing openness towards, and acceptance of, new digital approaches within traditional learning and education, DSI initiatives are still largely seen as an ‘alternative education’ model. This means a high proportion of policymakers, educators and parents are reluctant to adopt these approaches, whether as the basis of or a complement to traditional curricula. Debates within the field of education often centre around dichotomies of “traditional” and “progressive” education, which can act as a barrier to collaboration and innovation on both sides of the divide. Furthermore, as relatively new concepts there is little systematic evidence of the impact of DSI approaches within education, especially in the long term, and there are few widely-recognised accreditations or qualifications in the field.

The main challenge of these initiatives is to not be perceived as an alternative to current models of education, but as a set of tools that provide support to develop skills and increase the social impact of education.

Nevertheless, there have been steps forward in recent years; Code Club UK, for example, is now present in almost 7,000 schools, over a quarter of all UK schools. It should be noted, though, that these are extra-curricular activities usually started by a keen teacher or parents, rather than a feature of the education system as a whole. Regarding recognition and accreditation, there have also been some successes; Fixperts’ framework, for example, is taught in over 30 universities and forms part of formal qualifications in the English school system.

**FIXED**

FixEd aims to inspire creative, ingenious and generous problem-solvers and equip them with the skills they need for the 21st century, by supporting educators and organisations around the world to engage and motivate learners through learning programmes for schools and universities.

Founded by Daniel Charny, an industrial designer and university professor who was frustrated by students’ lack of understanding of materials, processes and people, and Dee Halligan, a cultural strategist, FixEd’s main programme is Fixperts, a learning programme that challenges young people to use their imagination and skills to create ingenious solutions to everyday problems for a real person. In the process they develop a host of valuable transferable skills from prototyping to collaboration.

Fixperts offers a range of teaching resources and formats to suit schools and universities, from hour-long workshops, to a term-long project, relevant to any creative design, engineering and STEM/STEAM studies. It is now run in over 30 universities worldwide and is recognised within the mainstream English education system. Over the course of the programme, Fixperts make films documenting their work; there are now over 400 films which have been viewed over 500,000 times.

The Fixperts course is based around six key areas: learning to solve problems; building social connections; connecting imagination with skills; award-winning, classroom-ready teaching resources; effectiveness across design, engineering, STEM and STEAM; and creating new formats and options in response to changing needs.

Alongside the Fixperts course, FixEd carries out a number of wider activities. It has recently started FixCamp, a summer activity camp in London supported by the Royal Academy of Engineering, which aims to reach 200 students over Summer 2018. FixEd also carries out a range of research and thought leadership activities, including an active blog, sharing insights and influencing policymakers.

**Website:** fixing.education

**Twitter:** @fixing_ed
Emerging policy recommendations

Recognition by the public sector and support from policymakers in the form of advocacy, funding and stewardship are essential first steps to help DSI in this field to grow. Below we discuss some emerging proposals and ideas.

Recognition and ecosystem-building

Policymakers at the local or national level (depending on education systems’ structures) should advocate for DSI as an integral element of educational structures, and make the social, economic and cultural case for its adoption. They should support the creation of an ecosystem of projects and other stakeholders by funding, or developing, networks of support and sharing of knowledge and best-practice.

Furthermore, there is growing recognition that education should have a more social slant, encouraging young people to become more responsible, active and involved citizens. This fits closely with growing recognition of the need for social awareness in other fields, such as responsible research and innovation (RRI) and CSR. Education policymakers should make creating socially-aware and -active citizens a necessary part of educational curricula. Alongside this, policymakers should encourage and facilitate the creation and recognition of certification for DSI-related courses, so that people feel confident to invest in them.

Provision of more funding alternatives

We have already made a lot of progress in terms of financing for DSI initiatives and projects around Europe, but we need to develop a wider set of funding options for different kinds of programs, with different structures and objectives, but also facing the needs in each stage of the projects.

One of the first elements, which is related to the previous point, is to expand the criteria by which projects are selected. This allows access to funds to a larger number of initiatives and projects that can be a real contribution but do not have the necessary structure to apply for those funds.

The development of financing should be strengthened by considering the real needs of each stage of a project, allocating resources for the creation of initiatives, but also for stability, continuity and growth, allocating funds to the operation, administration and investment.

The creation of new projects is very important, but the sustainability of the existing ones is equally or even more relevant - far too many projects fail to live up to their potential after the first two or three years.

Another recommendation is related to the roles of the different institutions that grant funds or prizes. These institutions must work in coordination and create synergies. Instead of competing or considering political objectives (or political marketing), efficiency should be prioritised taking into account the roles and relationships of each institution to maximise the impact of funds on education.

It is even important to consider, structure (and value) of the delivery and disposition of other resources, such as communication, coordination, physical resources and contact networks as part of an integral support and not only related to money.

Today there are funds and awards at European, governmental and local level
for these types of projects. For example, in Barcelona the City Council has some autonomy over education, promoting programs that consider the use of digital technologies, or contests to finance this type of initiative, like Cibernàrium or the Ateneus de Fabricació. At the autonomous community level, the Generalitat de Catalunya promotes infrastructure for education in general, for example integrating digital manufacturing tools in some schools like the Escola del Treball. At the national level, the education ministry that defines the general lines of education in Spain, and all this under the standards of the European Union that has its own guidelines regarding education. However, the next step in this area is to create sustainable and long-term financing routes that are outside of research and exploration. The challenge is how to access common means of financing for sustainability and scale.

BARCELONA OPEN DATA CHALLENGE

The Barcelona Open Data Challenge is a pilot competition ran by Barcelona City Council aimed at promoting the use of open data published in the Open Data BCN portal.

The competition is a project-based learning initiative aimed at secondary school students aged 15 and 16. Through the analysis of their environment, using the data published on the portal and with assistance from their teacher, students are tasked to design improvement proposals to encourage the City Council to think differently about the city.

Students are encouraged to make analyses, cross-check data and make use of the more than 420 datasets available in the municipal catalogue, that contain information on topics such as housing, population, trees, public transport, bicycle lanes, accidents or incidents reported by citizens.

The competition consists of six phases distributed throughout the school year (from October to May), during which time teachers attend various workshops and receive training in Open Data, data analysis, video editing and design and participate in co-creation workshops. The training is aimed at enabling teachers to transfer the skills and knowledge they acquire onto their students.

The phases are:

- **Phase 0**: Registration.
- **Phase 1**: Analysis of the environment and defining the project.
- **Phase 2**: Analysis of the open data related to the project and development of the action plan.
- **Phase 3**: Preparation of the presentation of the projects.
- **Phase 4**: Final public event with the presentation of the final projects.
- **Phase 5**: Evaluation.

In the end, each centre choses a project they feel represents them in for the final public event. The winning project is chosen by a jury selected from the City Council. The finalists present their proposals publicly and are evaluated by City Council staff.

**Twitter**: @BCN_digital

**Website**: [http://opendata-ajuntament.barcelona.cat/ca/repte](http://opendata-ajuntament.barcelona.cat/ca/repte)
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