D4.7 CREATIVE DESIGN AND EDUCATION AND RESEARCH

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Executive summary

Deliverable D4.7, "Creative design and education and research", presents the results of the co-design workshops organized for the Education&Research Project area.

In order to correctly read the document and the results, we do want to point out the twofold objective of the different workshop sessions. The first objective is to emphatically involve people in the DiDIY field in order to obtain the enabled elements of DiDIY which they think are fundamental according with their own experience and knowledge. The second objective is to test and improve a design process and related tools that will end up in a design toolkit.

The deliverable is structured according with the two objectives just mentioned above and that are part of an only path. Some sections give emphasis to the first and others to the second.

The Introduction presents the research model that will lead us to develop guidelines for the European Community intended to provide solutions for stimulating and engaging people in the application of DiDIY in their own professional field, in order to generate innovation and new competences. Due to its complexity, designing requires a structured and systematic approach.

Starting from the Design Tool Collection, in section 3, we designed the workshop structure and the related ad hoc tools reported in section 4. Sections 4 and 5 carefully describe the co-design approach, the designed tools, and the implementation based on their testing during workshop sessions. Section 6 presents the workshop experience. Section 7 reports the results of DiDIY&Education workshops from the point of view of the participants involved. Starting from reflections about people, key components and impacts, people identified the fundamental elements that enable DiDIY and design challenges related to education. This experimentation allows us to define a design process based on digital landscape potentialities that help to identify new opportunity in the four Project areas. The testing and implementation will last until the Project deadline and the final results will be reported in deliverables D5.5 and D6.6. In conclusion, section 8 reports some reflections which contribute to the enrichment of the results of the research on DiDIY&Education.

Revision history			
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0.1	23/12/2016	POLIMI	First draft.
0.2	26/12/2016	ABACUS	First revision.
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1.0	31/12/2016	LIUC	Approved version, submitted to the EC Participant Portal.

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1. Introduction

1.1 Action Research Model

In the present deliverable the four workshops are reported conducted within the Education&Research Project area. According to the project, one explorative workshop and one generative – in two different countries – have been organized. Italy and Spain were chosen as significant countries for the number of FabLab, makerspaces, etc and DiDIY initiative as well as for the development policies adopted at national level.

As a transversal task to the four project areas, we decided to implement a research model, based on design and creativity, which could be declined in each one of the project areas. The choice of the co-design is dictated by the desire to engage people and draw input from their experience.
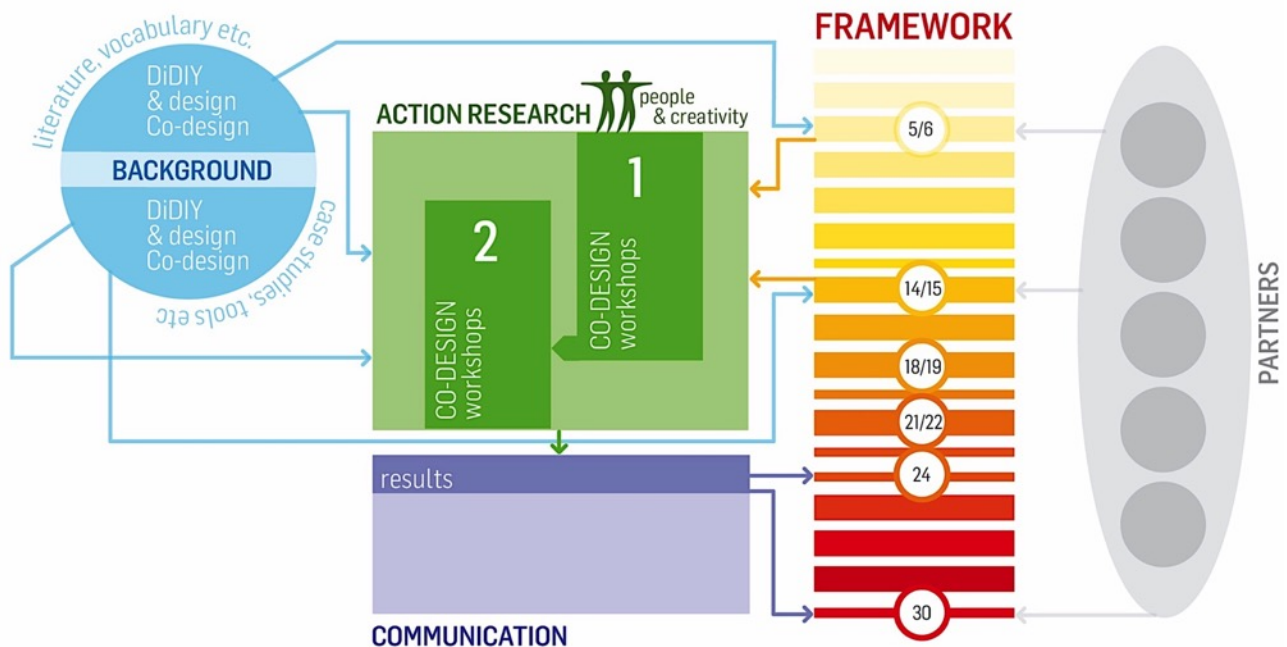
Figure 1 – Schema representing the Action Research Model.

We follow three main areas:

- the first area is the BACKGROUND RESEARCH;
- the second one is the ACTION RESEARCH, in which we will involve people;
- the last one is the communication area.

The main areas interact with the Project framework for the whole Project duration.

In particular, through the literature and case studies analysis a research space has been identified.

As is shown in the following image, we have collected existing tools and techniques in a Design Tool Collection (see Annex I). Another really important step, in order to realize the DiDIY toolkit is the designing of ad hoc tools.

In the background section of the deliverable we have included relevant information to identify our point of view about DiDIY.

The contribution is the identification of a design and creativity based model that is able to generate innovation in the project areas, through the exploration of DiDIY as a mind-set and a social practice. We can consider it as a (production) process, with a strong social connotation, where people's creativity and self-improvement through the development of new skills and knowledge are key-elements.

Figure 2 – Representation of research model steps.

1.2 Terms and acronyms

Term	Meaning
ABC	Atoms-Bits Convergence
DIY	Do It Yourself
DIYer	individual or organisation (formal or informal) that engages in DIY
DiDIY	Digital Do It Yourself
DiDIYer	DIYer that engage in DiDIY

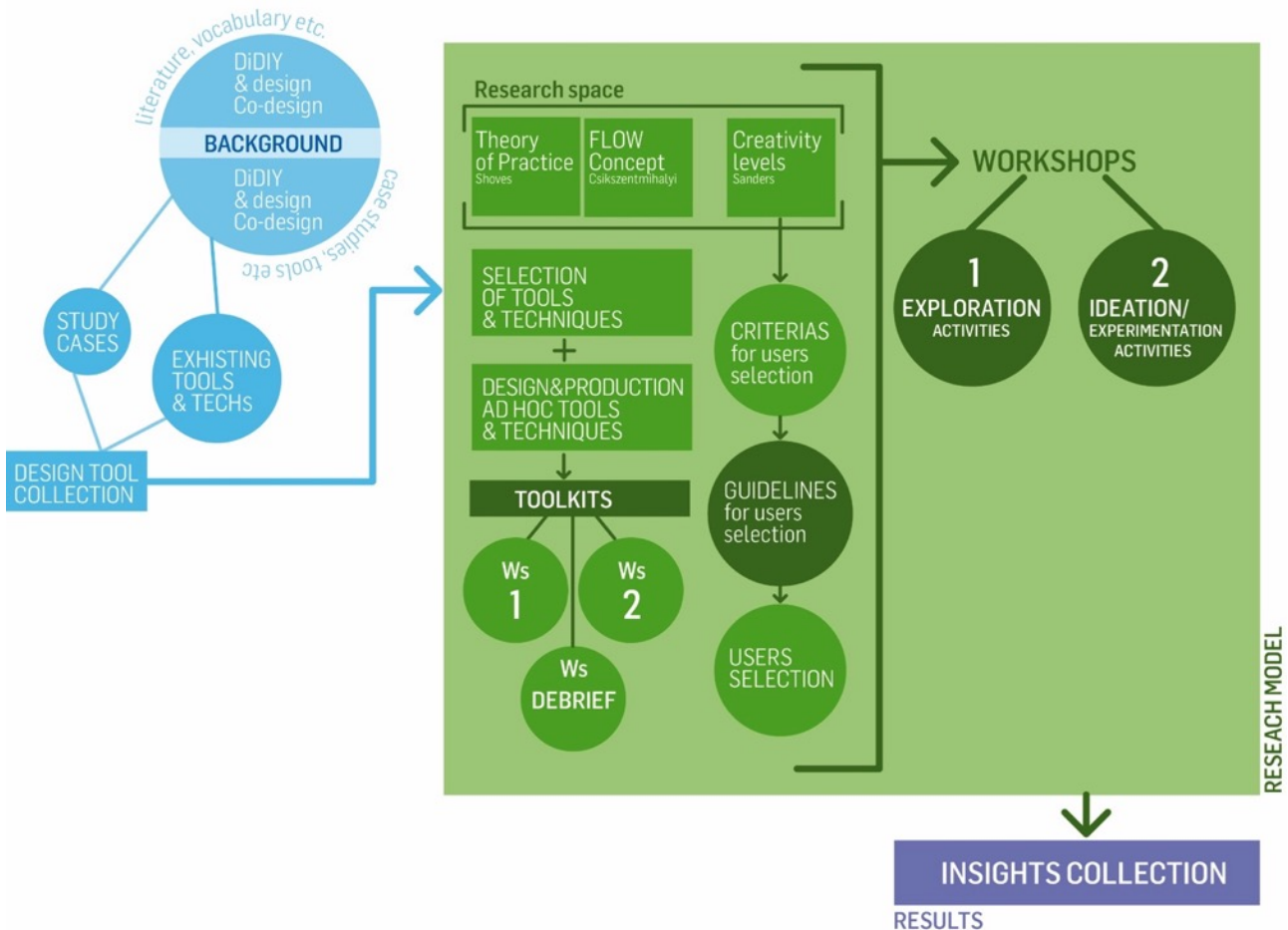| fab lab	makerspace structured according to a specific model of DIY, as proposed by the MIT's Center for Bits and Atoms
Makerspace	community-operated physical place that affords sharing of tools, resources and knowledge motivated by maker culture, revealing specific ways of creation, collaboration and learning
DiDIY co-design process	process in which users or other stakeholders are invited to actively contribute with their experience to the design process considering the fundamental elements of DiDIY
	Note 1 – Co-design builds on a tradition of user-centered design, participatory design, critical design, and ethnography. It is growing and being fertilized by many other disciplines. It is about users, or more generally, people imagining and planning with issues that are not-yet-existing and utilizing the skills that are in the core of professional design competence. Co-design is a method and a mindset characterized by the belief that all people are creative.
	Note 2 – Co-design sessions are defined as "workshops for sketching and trying out possibilities" (Binder 2010) and "temporary spaces for experimentations and collaborative learning" that are "open-ended, collaborative and creative" (Brandt, Agger Eriksen 2010). During the sessions "a set of creative techniques whose aim is to inspire the design process" (Rizzo 2010) might be used.
	Note 3 – Co-design toolkit is intended as the way that specific techniques and tools are used to unlock people's creativity helping them to work collaboratively. Each toolkit is designed to serve a specific purpose.
DiDIY design model	design and creativity based model that is able to generate innovation through the use of DiDIY
	Note – A DiDIY design model will include the development of tools that facilitate the involvement of people in the design process. It has a strong social connotation and people's creativity and self-improvement through the development of new skills and knowledge are key elements.
DiDIY platform	(1) set of hardware and/or software components, designed from scratch or deliberately assembled, to be the basis for design and/or manufacturing of a DiDIY product, or family of products
	(2) website explicitly designed to enable any combination of (co)development, manufacturing, sale, or distribution of DiDIY products or DiDIY designs, as well as mutual support among DiDIYers
	Note (to def 2) – DiDIY platforms are sometimes intended as including also the DiDIY community that interacts through the website, for example for collaborative writing of documentation.
	Example (to def 1) – The ArduPilot Mega (APM) at diydrones.com, which is "a DIY software and hardware autopilot platform usable for model planes, multicopters, unmanned ground vehicles and many other

	devices".
	Examples (to def 2) - Thingiverse.com; OpenBuilds.org.
KF	Knowledge Framework
STEM	Science, Technology, Engineering, and Mathematics

2. Background: literature review and vocabulary

The objective of this section is presenting the reflections on the factors characterising the current trend of DiDIY, envisaged as a significant phenomenon of social innovation which may foster skilling processes with ultimate effects on people empowerment through the act of making collaboratively.

2.1 Design and Digital Do It Yourself

Collaborative self-production is one of the ongoing social innovation phenomena in which people reinvent their ways of living, especially thanks to ubiquitous digital technologies, connecting people on a global scale (e.g., Internet 2.0) and bringing production closer to consumption (e.g., digital fabrication and distributed systems) (Manzini 2015).

Digital fabrication-based DIY – or simply DiDIY – is here envisaged as a creative practice through which people may increase their self-confidence and empowerment by developing new skills and knowledge. The modern concept of competence comprises not only relevant knowledge and skills, but also a range of personal qualities and the ability to perform adequately and flexibly in well-known and unknown situations. Creativity and the ability to produce ideas, knowledge and innovations is a key player. It represents the intangible substrate for innovation (Kozbelt et al. 2010).

Since the last decades of the 20th century, research in learning processes have suggested the importance of making and doing as a means to foster the acquisition of skills, especially the creative ones. Therefore, observing and understanding the dynamics of making-based activities could shed more light on how creativity unfolds and skills are acquired.

Given the skilling potential of the making trend, designer professionals face the implications, as the definition and role of trained designers is questioned. Design literature has suggested since a long time that everybody is a designer (Simon 1969; Cross 2011), and more recently that "in a world in rapid and profound transformation, we are all designers" (Manzini 2015). These theories refer to the ability and need for untrained people to create what they need even without the support of professional designers. The role of design in the era when everybody does design is therefore questioned and needs to be reshaped.

The Industrial Designer Society of America (IDSA),[1] discussed the implications of DIY for designers at the 2010 conference named 'DIY Design: threat or opportunity?' and acknowledged that, although DIY is not a totally new phenomenon, the implications of this shift for the design professions are potentially massive. The DIY resurgence is making consumers question the need for mass production, and by extension, the need for designers.

However, Manzini (2006) stresses that *"if it is true that we live in a society where 'everybody designs', designers should accept that they can no longer aspire to a monopoly on design and, at the same time, they have to be able to recognise what could be their new, and (…) important, specific role."*

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1 http://www.idsa.org.

Therefore, design is called to identify a role to play and some designers have been investigating potential areas of intervention in DiDIY practice. Béhar[2] explored "the different ways that consumers are personalizing design in efforts to assert creativity and individuality in an age of mass-production […] and how an emotional connection to objects has been resurrected in individuals and how the two realms—design and mass production—have combined to once again allow for 'Design in the Age of Individuality'". The exhibition showcased "all these new ways in which people are bringing the notion of craft into design, the notion of self-made, self-crafted, self-developed products and software. […] actually there's a new type of craft, a new type of involvement of the human and the hand in the mass-production process".

Designers' outcomes are not finished products traditionally intended and typical of the mass consumption society but solutions that enable the user and allow for adaptation, also called "enabling solution" by Manzini.

It can be inferred that "the dominant paradigm of user-as-consumer gives way to alternative framings of the user as creative appropriator, hacker, tinkerer, artist, and even co-designer or co-engineer" (Tanenbaum et al. 2013).

We propose that professional designers may contribute by facilitating the creative process of making, especially within the digital social innovation phenomenon frame, as a means to foster people empowerment. *As design researchers, we aim at contributing by developing (co)design-driven tools facilitating the identification of the skilling dynamics in place where DiDIY takes place and explore models for including them in working and educational environments.*

Future research will explore features that design professional could use to trigger novel collaboration with final users, starting from the ones proposed by Béhar and expanding them considering the different steps of the product lifecycle in which the user can be involved, from the idea generation till the extension of the end of life. Notable areas of investigation include processes of learning, acquisition of skills, and improvement of self-confidence.

These enabling solutions will imply novel forms of collaboration in which the professional designer could lead, guide, provide scaffolds, or offer a clean slate to DIY practitioners, according to their interests and creativity level (Sanders 2006).

Therefore, what is design?

Elements characterizing the approach of professional designer include:

- the design thinking;
- the abductive reasoning;
- the ability to work on multiple levels at the same time.

These three elements characterize the approach of professional designers, although they may also be adopted by or found in design amateurs. They could represent the added value that professional designer may bring when collaborating or relating with DiDIYers.

Designers can contribute to the DiDIY practice mainly bringing the three components identified above. In order to do so, the conditions for collaborations must be generated. In deliverable D2.2, it has been highlighted that *designers can contribute by designing "enabling solutions".*

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2 In 2010 the designer Yves Béhar curated the exhibition 'TechnoCRAFT: Hackers, Modders, Fabbers, Tweakers and Design in the Age of Individuality', exhibited at Yerba Buena Center For the Arts, in San Francisco (USA).

2.2 Co-design and DiDIY

DiDIY, as stated in D2.4, is a complex phenomenon where people are directly involved in the research and production of knowledge, and therefore co-design methods and approach appear ideal to us for investigating and creating knowledge. The close relationship with the final user of the co-designed solution makes this approach a powerful means for accessing and making explicit people's (also tacit) needs, desires and aspirations for the construction of new possible futures.

Co-design is a research approach which involves non-trained designers in activities, or collaborations, for the development of solutions that aim at improving their lives with the support of professional designers or, as in this case, with design researchers.

Co-design workshops, based on Human-Centred Design, are used as investigative methods where existing and *ad hoc* tools facilitate the involvement of people in the process. Furthermore, we foresee the possibility of such approach to be adapted and used as an empowerment tool by people of different DiDIY communities. Empowerment tool is here intended as something allowing people to 'take control' of their ideas in a participative and pro-active way instead of re-active one, in a system where self-improvement through the development of new skills and actionable knowledge is pivotal. In this perspective, people are considered all the way as co-design researchers and companions. The division between expert designers and the laypeople becomes blurred and so do the borders between research and practice. In order to do so, Scheldeman (2012) suggests that the designers should allow for "meaningful relation […] design should not prescribe or predict, but enable.".

Enabling may result a challenging task for professional designers and this calls for suitable toolboxes and modes of experimentation, which may not still exist. In our case, we planned to use co-design methods and tools to facilitate the skilling process and then to make use of human-centred co-design workshops for the transfer of the research model and its dynamics in the education field and the other thematic area of the DiDIY Project.

Involving people using a co-design approach gives us the opportunity to:

- have meaningful conversations with people and collect their ideas;
- elicit people's creativity thought collaborative activities and specific materials;
- be in empathy with people and understand their needs and desires;
- actively involve people in research activities and knowledge creation;
- accustom people to use sketches and prototypes as ways to express and better define their thoughts;
- promote a design approach to everyday challenges;
- enhance people's visions on possible futures.

This allow us to:

- work collaboratively to gather priorities;
- draw on evidence to decide which challenges to focus on;
- pursue promising ideas as projects;
- work with people to ensure solutions address real needs and deliver real benefits.

As previously highlighted DiDIY, has strong sharing and collaborative dimensions itself, therefore it seems adequate to consider co-design not only as a research approach, but also as a possible mindset to DiDIY practices.
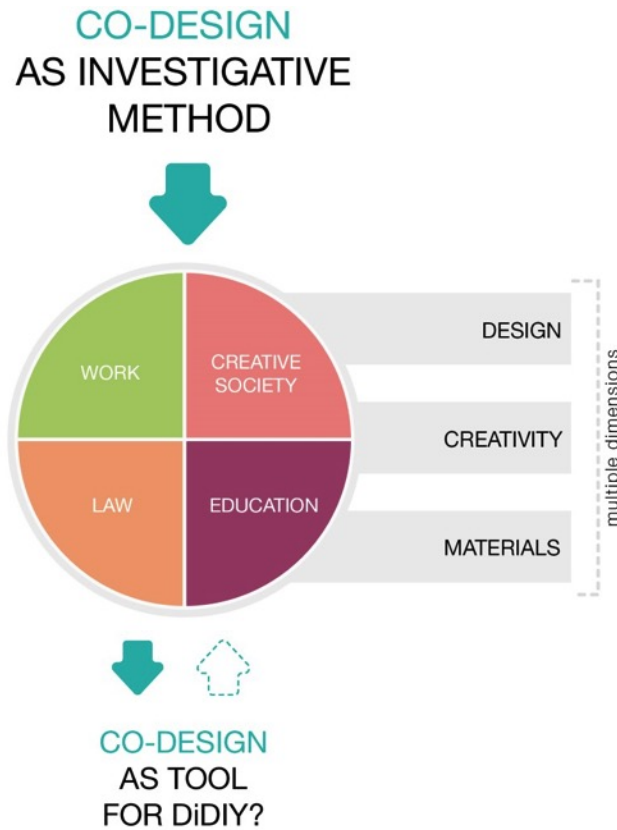
Figure 3 –The twofold aspect of Co-design for DiDIY.

2.2.1 Creativity

Creativity might be seen as a cultural, social and psychological process, rather than an invention, materialised output or product (Csikszentmihalyi 1999; Le Loarne 2005). Creativity in this sense *enables* a person, or group working as co-creators, to generate new ideas and outcomes, such as original or inventive projects at different levels. It is context-specific, requires domain-relevant skills and knowledge, and is enhanced by improvisation and motivation (Amabile 1983).

It seems necessary to divide DIYers into categories and to link them to levels of involvement or, in particular creative involvement. Sanders divides them into doers, adapters, makers and creators.

We see Sanders's categorization as the most complete and we have adapted it for the Project how follows:

DOING > The most basic level of creativity is doing. The motivation behind doing is to accomplish something through productive activity. The skill requirements for doing are generally low. The next level of creativity, adapting, is more advanced (for example changing the screen of your mobile following a step by step tutorial; making a cardboard mask following a video tutorial on YouTube).

ADAPTING > The main idea and motivation behind adapting is to make something one's own by changing it in some way. People might do this to personalize an object so that it better fits their personality or needs. The level of creativity required for adapting is higher then for doing and generally requires more advanced skills as well (for example modifying the handle of your screw driver in order to better screw your new cupboard; fix your broken umbrella adding a new handle).

MAKING > Making can be associated to a third level of creativity. The motivation behind making is to make or build something that did not exist before. There is usually some kind of guidance involved (e.g., a pattern, a recipe, or notes that describe what types of materials to use and how to put them together...). Making requires a genuine interest in the domain as well as experience (make a table starting from the idea that it should have a flat surface standing on three or four legs; make a lamp cutting a plastic bottle to make the shade).

CREATING > The most advanced level of creativity is creating. The motivation behind creating is mainly to express oneself or to innovate. Creating differs from making in that creating does not rely on predetermined pattern (invent a new device to help your paraplegic kid to eat; invent a new edible packaging for your sandwich).

2.3 Model for DiDIY dynamics

Starting from the case studies analysis we defined a model to understand how the learning process take place during making activities, what kind of competences are developed and which is the role of the different stakeholders involved. This model will be used for enabling the replication and adaptation of such dynamics into the education system and other environments related to the project.
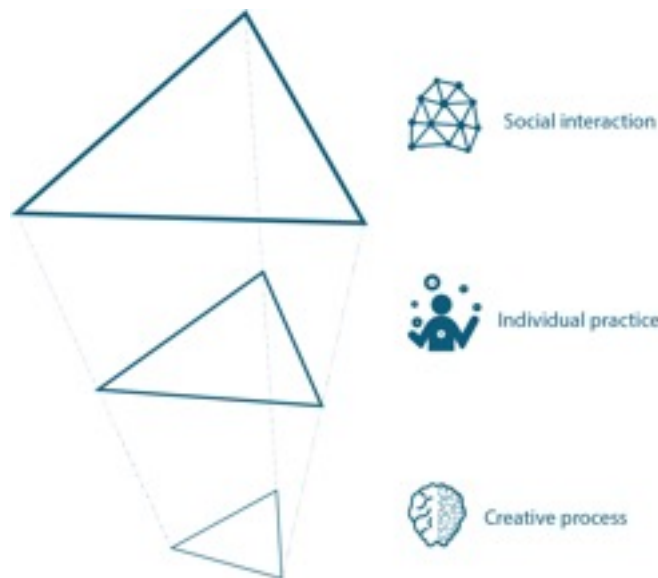

Figure 4 – Model for DiDIY dynamics.

The defined research model takes into account the interplay of DiDIY main expressions enacting on different levels also addressed above, which include:

1. DiDIY as a phenomenon of social innovation for the fundamental role of collaboration and sharing;
2. DiDIY as a practice carried out by the individual connecting materials, meanings and competences;
3. DiDIY as a creative process, developed through cognitive tasks.

On the basis of preliminary reflections on literature review, we propose that three are the main factors which influence such learning and skilling process across the three levels above:

- technology;
- motivation;
- collaboration.
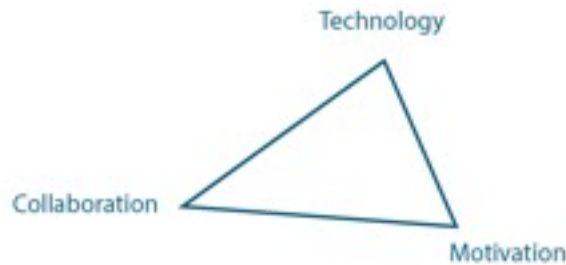
Figure 5 – Three factors which influence DiDIY learning and skilling process.

The evolution toward *digital technology* (from Materials component) facilitates both the connection of people and the accessibility to tools with appreciable results in a relatively short-term substantially. On the one hand, it is radically easier to interact with other people across geographical boundaries for collaborating and sharing knowledge. On the other hand, rapid manufacturing technology allows the creation of products even at earlier stages of the acquisition of the required technical skills, in contrast with the generally lengthy skilling process in manual crafting.

The *motivational aspects* of DIY practices widely intended (from Meaning component) are believed here crucial for sustaining the practice over time. The practitioner is supposed to persevere (or being strongly motivated) in overcoming the difficulties related to self-organization and the use of spare time on the one hand, and on the other social interactions when collaborating and participating (either for the rewarding sensation of being with the others or for social impact).

Collaboration, both with peers (i.e., other DiDIYers) and with facilitators (who are acknowledged as so by the DiDIYers) is here believed to be possibly the most significant elements characterising the latter evolution of conventional DIY towards the digital one. Collaborating is an opportunity to acquire knowledge and develop skills through other peers, to strengthen social bonds and to make an impact on a wider level than the individual one, which are less likely to happen in convention individualistic DIY.

Eventually, we aim at interpreting and translating the model for (some of) the areas of the DiDIY project (i.e., organization and work, education and research, creative societies, and legal rights and obligations), which may benefit from the skilling processes possibly taking place in the DiDIY practice.

To this purpose, we believe that the involvement of practitioners in the investigation and creation of enabling solutions is crucial. Therefore, we aim at contributing by developing (co)design-driven tools facilitating the analysis of the learning process and the identification of the skilling dynamics and generate models for including such dynamics in working and educational environments which may benefit from the skilling process enabled by DiDIY practice.

2.3.1 Key competences through DiDIY

The contemporary making attitude is considered creative, innovative, inventive, collaborative, resourceful and empowering. Makers and DiDIYers play with technology to learn about it, to figure out how things are made, how to fix them, or how to use them in a whole new way. They are non-linear thinkers, curious inventors and problem-solvers. According to Thomas Kalil, deputy director of the White House's Office of Science and Technology Policy, the maker movement really "begins with the Makers themselves — who find making, tinkering, inventing, problem solving, discovering and sharing intrinsically rewarding" (Dougherty 2010).

The potential of a digital making environment as a way for more effective learning, inside or outside school, has been increasingly sustained over the last decade for several reasons.

According to the literature, digital making activities can provide a powerful context for broadening interest and engagement of young people in STEM subjects, for example by contextualizing STEM concepts and practices in meaningful activity using maker tools (Vossoughi 2014). Connecting making with existing practices creates more powerful and equitable learning experiences (Blikstein 2013). This allow from one side the increasing of student motivation and from the other the democratization of tasks and skills previously available only to experts (Blikstein 2013). Students today grow up with digital technologies (Schön et al. 2014) and using modern digital tools connected to everyday problem is in general a way to meet their expectations and prior knowledge.

Making encourages a deep engagement with content, critical thinking, problem solving and collaboration (Peppler, Bender 2013), while considering the impact of their creations on society, ecology, and the environment (Schön et al. 2014). In a maker setting, as well as in a typical constructionism environment, a traditional teacher-centred teaching does not fit and teachers change their role becoming facilitators. In this context, teachers are asked to design a learning environment to support students in their explorations in order to make projects to share with others in the community (Bers et al. 2002). Students are active learners with a high need to explore, to discuss and to share experiences and ideas. They co-create their own knowledge by applying concept, skills and strategies supported by teachers that are seen as inspirational partners.

The openness of the setting and the creative results within this approach may lead to situations, where the students may be better as the teachers. When people are making something, the object they create is a demonstration of what they have learned to do, providing evidence of their learning and teaching others at the same time (Dougherty 2012).

In general, the skills of creating and innovating can have a broad impact on students' lifelong learning and ultimately for education and society. The current challenge is to encompass learning at all ages in both formal and informal situations with a practice that must involve a wide variety of the digital tools that form the landscape of students' future learning and work environments (Donaldson 2014).
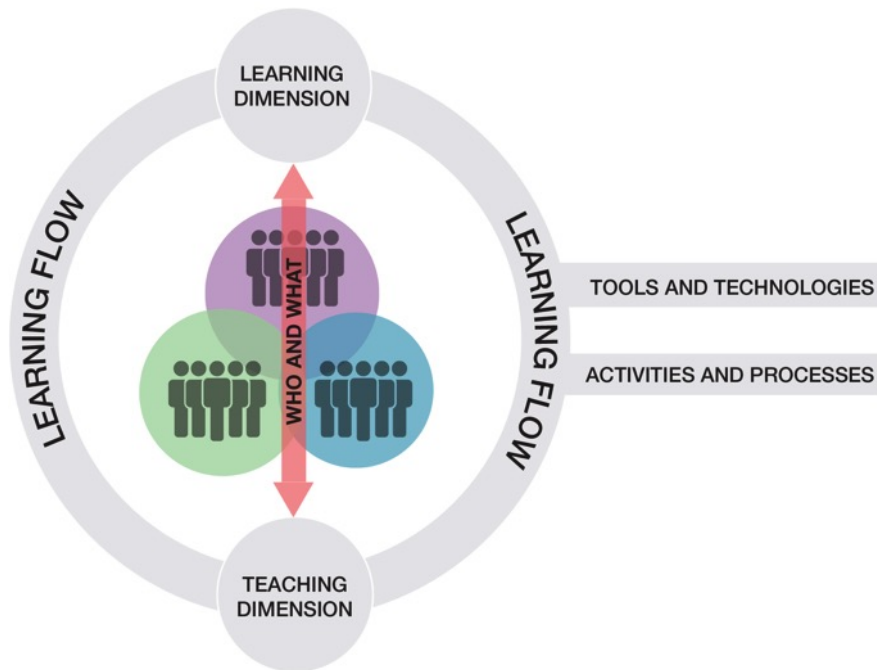
Figure 6 – The complexity of learning process in DiDIY.

3. Design Tool Collection

3.1 Existing tools and technique usable for DiDIY

This paragraph collects a series of existing tools and techniques from co-design, design thinking and more in general participatory design.

The aim of the tools collection is twofold. From one side we want to create an open database of tools, for DiDIYer, designer, facilitator, etc that are usable in the DiDIY realm during a project development. From the other side, this collection helped us to design new ad hoc tools and technique for the design of the workshop structure and tools and for the development of the final design toolkit. In section 4 there will be a reference in the various section indication which tools and technique are being used.

The design tool collection is shown as a catalogue. For each pages each tools /technique is recorded as follows:

- source;
- phase of design process in which the tool/technique is used;
- the reason why the tool/technique has been selected for the DiDIY Project;
- how the tool//technique has been included in the DiDIY workshop process.

The design collection is in Annex I.

3.2 IDEActivity toolkit and methods

In order to achieve our objective, we used IDEActivity for the workshops, i.e., a human-centred participatory methodology formerly developed by IDEActivity Center and applied in contexts where innovation is pursued (e.g., companies, institutions and organizations), using the potential of creativity and Design Thinking while co-creating with the people involved in a project.

The research conducted by the IDEActivity Center focuses on the synergy between various creativity techniques and the typical tools employed by Design. As a result of this research, a method and supporting toolkit have been developed to guide project design towards innovation. The features of this design-based methodology (Cross 2011) are: personalization and flexibility of the creativity tools; human-centered approach and co-design. These aspects enable collaborative actions aimed at identifying and solving problems through the direct involvement of users.

The IDEActivity Center has developed a method and a set of tools for design, focusing especially on the importance of creativity in achieving innovation.

The Center has developed and tested its own methodology, building on different design methodologies and approaches, in particular Human-Centered Design, Co-design, Participatory Design and Design Thinking.

The IDEActivity method (Canina, Anselmi, Coccioni 2013) is designed to be a flexible tool for use in different configurations according to the specific goals to be addressed. Focused on the importance of creative thinking and learning by doing, the methodology tackles creativity with tools and approaches typical of the design environment. It aims to break pre-set patterns, stimulate the

imagination and improve the conditions in which knowledge and information are handled, communicated and retained, and ideas are produced.

This method relies on a fundamental play component, and leverages the potential of self-exposure, collaboration, teamwork, and the ability to look at things from new perspectives, both individually and with the help and influence of others. The IDEActivity methodology integrates and mixes various well-known techniques together with new ones that are often developed to meet the goals of a specific project or activity.
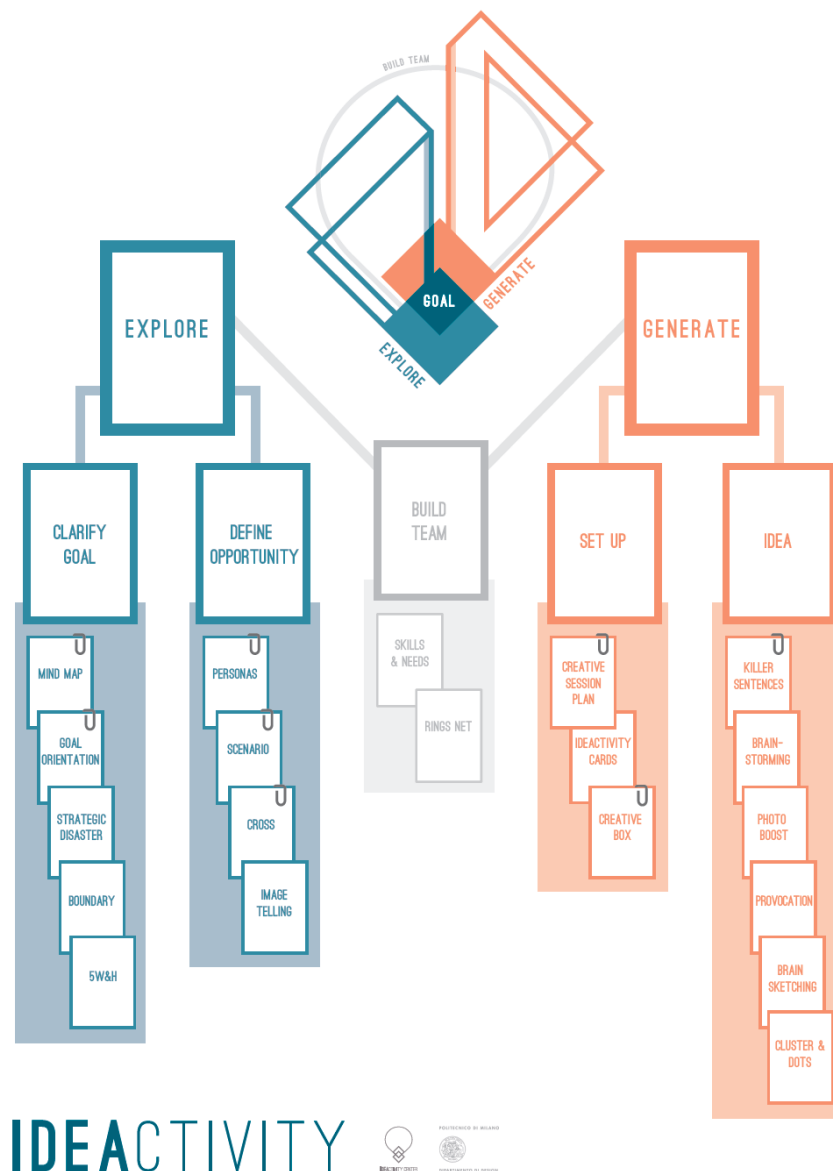
Figure 7 – The process of the IDEActivity methodology, with the three phases: Explore (in blue), Generate (in orange) and Build Team (in grey).

The key features of IDEActivity are closely linked to the visual, communicative, sensory and emotional dimensions of design. The method is designed to ensure a fluid yet rhythmic sequence of activities.

The methodology is structured on phases and integrates diverse techniques (see Figure 7).

Collected in a toolkit, the IDEActivity techniques (e.g., brainstorming, mind mapping, energizers) consist of a series of descriptive cards, necessary tools and guidelines, which enable the application of the methodology (see an example in Figure 8).

Such toolkit is used throughout the creative process and is structured on three main phases – Explore, Generate, Build team – described in the following paragraphs.

The first phase – Explore – aims at the identification of a significant objective and its possible development in relation to a given context. It is important to go beyond an impersonal analysis of the material, interpreting it with an open attitude, creating easily identifiable mental pathways and locating unexpected connections. Users are supposed to structure a common vision in relation to a problem or challenge with the actors involved in the creative process. Reciprocal understanding of needs, hopes and the aspirations is crucial, and an analytical process of information interpretation is fundamental to identify opportunities. In this phase, people are invited to analyse and organize the material by visualizing the information through diagrams, images, photos and key-words.

The second phase – Generate – aims at delivering and prototyping ideas, through creative sessions based on a series of tools designed to stimulate people creativity and generate suitable solutions in line with the given context and the objective (see Figure 8).
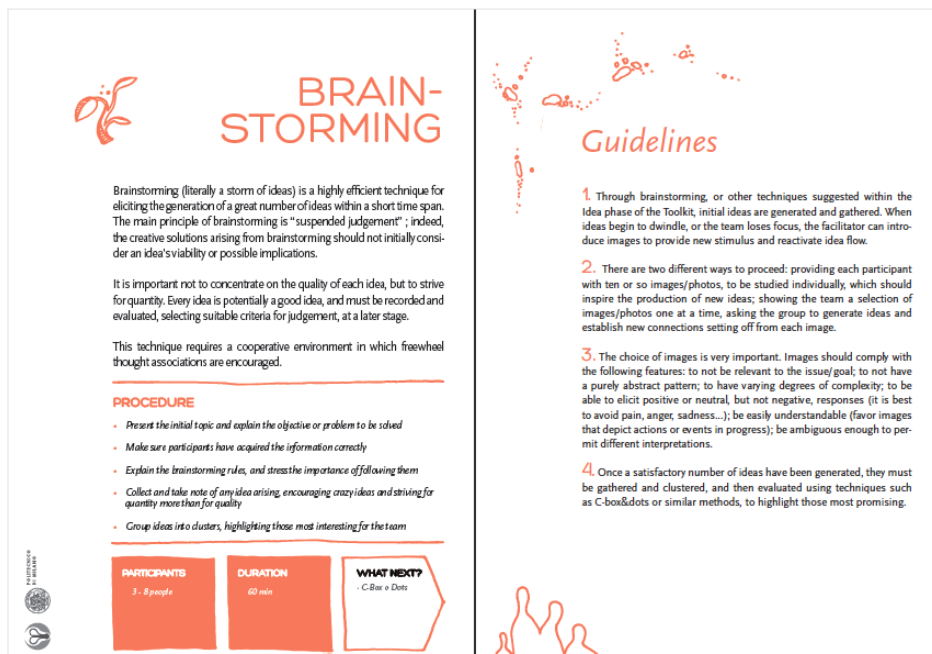
Figure 8 – 'Brainstorming', one of the IDEActivity toolkit card.

The third phase – Build Team – aims at creating a strong sense of empathy between the design team and the people involved in the project. They are introduced with the goal of facing the research phase, understanding the final users' needs and building a creative and united team. In this phase

people will learn techniques which will remove many barriers to creativity during the creative session. These three phases are adaptable in order to meet specificities and replicable in different contexts.

All phases are supported using a selection of tools belonging to the fields of Design and Creativity. Tools and techniques are categorized according to the different phases of the method and are collected in the IDEActivity Toolkit, designed to assist people in the practical application of the methodology.

The IDEActivity toolkit includes a set of cards and a range of corresponding tools used to illustrate the main steps of each phase and sub-phase of the creative and design process, and to provide guidelines for the tools required in each phase or sub-phase. The set-up phase begins by designing a set of cards to be used during the creative session.

4. The Workshops Methodology approach

4.1 Idea underlying the workshop: co-design as a tool of analysis and as a process for DiDIY

Why do we use a human-centred approach to design our workshop? Because it can help connect better with the people involved. It can transform data into actionable ideas. It can help see new opportunities. It can help increase the speed and effectiveness of creating new solutions (Ideo 2010). Why did we decide to create a toolkit for the DiDIY? *Because the people are the experts*. They are the ones who know best what the right solutions are.

The toolkit does not offer solutions. Instead, it offers techniques, methods, tips, and worksheets to guide participants through a process that gives a voice to communities and allows their desires to guide the creation and implementation of solutions. Human-centred design offers a chance to design with communities, to deeply understand the people, to dream up scores of ideas, and to create innovative new solutions rooted in people's actual needs (Ideo 2015).

To meet the objective of creating innovative solutions that engage the technological universe and are aimed at the DIY, the co-design workshop was designed by us.

In the design of these workshops, we took 4 points into consideration for the success of the process:

- *provide an easy-going environment*, where the participants are invited to relax and rethink their work or interests in relation to digital technologies, DIY mindset, collaboration and social impact;
- hold *provocative and emotional discussions* full of examples of real-life stories to facilitate understanding of what is being proposed;
- at the end of each session**,** *offer materials to enable the participants* to carry over what they have experienced and learned during the Exploratory and Generative Sessions;
- *select a facilitator* who will be able to stimulate the participants, providing new insight into the initial challenges and transforming an uncertain future into something plausible.

This has led to structure in detail not only the tools to use during the sessions, but also to define the space, identify the case studies that could make the discussion easier, accurately select the profiles of the participants and prepare the material that the participants could use in their area of work. All the elements planned will be described in detail in the following paragraphs.

Before going on to describe the planning of the workshops and the relative tools, it is fundamental to be aware that the design methods and the toolkit are not recipes, with the relative cookery book, that ensure the success of the project or service: just as slavishly following a recipe is not a guarantee for a perfect result. The process and the tools provided which will be released as guidelines in creative commons, will contribute to following a path structured in such a way as to recall the essential passages, to work efficiently, to reach the objectives without too many deviations, to communicate with the team or the experts more easily and effectively, without suffocating in the complexity of the project-building. Reflecting critically on the path, the adequate tools to be used can be chosen and this competence is refined with experience.

Another indispensable aspect is learning how to find an adequate approach for each new area. To be able to develop a project well, any tool has to be adapted to the specific situation that is being dealt with. The choice of an adequate approach depends on the objective or problem to solve, on the environment, on the facilitator, on the background and experience, etc. For each project, there will be several combinations of tools of design and creativity applicable, all with their advantages and limitations. The more methods and tools are used and checked, the better the problems of design can be approached effectively and efficiently.

The design processes can have different forms (Visser 2009), depending on the specific combination of the steps and the designer's situation (Delft Design Guide 2010).

At the level of detail, each design process is different, but if considered at a macro level, the common steps become visible. At macro level, each process starts with the analysis of the problem, and afterwards possible solutions are generated, these solutions are prototyped and evaluated and so on.

4.2 The workshop process: theoretical aspects

Assuming that there are many design processes and they have different forms, we have decided to adopt co-design because it is based on the Human-Centred Design approach. The reason this process is called "human-centred" is because it starts with the people we are designing for. The HCD process begins by examining the needs, dreams, and behaviour of the people we want to affect with our solutions.

What is a co-design workshop? It is a meeting organized in the form of a series of group activities aimed at stimulating creativity and collaboration, fostering the creation of innovative solutions. Usually the people invited to take part have a direct or indirect involvement with the solutions being developed.

We can *use it* when there is a large amount of data that can best be dealt with by an extended team, or when it is necessary to add knowledge from different specialists involved in a project. It is very useful for moments of gridlock when new insights about ideas are needed.

It possible to *apply co-design* in a creative work session where participants are invited to interact by generating ideas collaboratively. It seeks to develop dynamic activities of short duration for small groups, interspersed with presentations of the ideas generated and snack breaks. Generally, sessions are started with a simple and fast task, not necessarily related to the project, whose goal is to help break the ice and dispel shyness among participants, who are often meeting for the first time. Since each project has its own intrinsic nature and particular needs, it is up to the organizers to think of stimulating activities that will help to expedite collaboration.

This process can be fostered by *design thinking*, which is "a human-centred approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success" (Brown 2008).

So, we explored ways of fostering participants' creativity collaboratively drawing on design thinking. We first modelled a possible process reflecting how participants could develop such knowledge co-design experience (presented in section 4.3) and eventually we developed and applied a supporting toolkit (the complete version will be presented at the end of the DiDIY Project).

Our objective is to provide participants (and eventually everyone) with these tools and toolkit which will enable local groups and citizens to develop their "design thinking capability", through a structured design process substantiated with their experiences, emotions and thoughts.

At the end of our transversal task activities and workshops we will deliver a guide and a toolkit enabling people to design and innovate in the DiDIY field. The co-design workshops give us the opportunity to explore whether people can go through this design process on their own, supported by our toolkit.

Immersion

According to Dale's research (1969), the most effective methods involve experiential learning, such as hands-on or field-based practices, in particular intentional ones associated with and linked to the real world. This suggests that the active involvement of participants in the co-design process reinforces the acquisition of information and the consolidation of knowledge.

The IDEActivity Center has developed a method and a set of tools for design, focusing especially on the importance of creativity in achieving innovation. The design of these co-design activities is related to 4 key points, namely: the importance of communication, the management of physical space, the creation of a playful mood and the pace of activities.

Given the complexity and volume of information to be transmitted in a short time span, we designed a workshop drawing from both Action Learning (Davies et al. 2013) and Experience Learning with the aim of knowing and applying the innovative aspects of digital technologies of production and sharing (e.g., additive manufacturing and open platforms), in order to develop innovative ideas and projects in a collaborative way. In particular, the main objectives are: to gain confidence with the topic, identify the main typical factors of DiDIY, launch and solve a design challenge shared with the other participants by using the identified DiDIY factors. This research has identified the following key-factors: *a flexible use of space and time; the provision of adequate materials; a playful and/or game-based approach; emotional involvement of participants*.

Therefore, our fundamental objective is to offer an activity based on the concept of experiential learning of the DiDIY potentiality and the design process, designed to involve participants both emotionally and physically. Consequently, according with the idea that knowledge is continuously gained through both personal and environmental experiences (Kolb 1984), it is important from the very beginning to consider the environment as an integrating part of the experience: a vehicle for the training itinerary able to effectively support the co-design process. This means not only managing the space, but also proactively managing communication. The workshop designed by IDEActivity featured the emotional involvement of participants, a dynamic use of space, and visual representation.

Space and environment – the establishment of a parallel world

The physical and emotional involvement of participants constitutes a key element in the learning and design activities we propose (Douglas 2013). This explains our decision to incorporate music and theatricality in the learning environment. Our objective is to create a new, shared language, appropriate to the context in which co-design activities take place.

"The three factors related to the person, process, and environment interact to produce specific results. In other words, the quality of the creative product depends on the fact that people support certain processes within specific environments" (Puccio, Mance, Murdock 2011). Numerous studies have concluded that an adequate space and environment should be designed to allow for exchange, dialogue and debate, by providing a dynamic and customizable environment and flexible enough to be able to adapt to people's changing needs. It should promote an open-minded attitude and the suspension of judgement, hierarchies and business roles.

"The design of a space can support innovation and project success (…) a stressful or even depressing work environment doesn't give one the mood to think of doing things differently." (Curedale 2013).

Structuring the space and the environment with these elements in mind constitutes an essential element in planning co-design activities. For the proposed activity, the IDEActivity research team decided to design the space and the environment as an integral part of its method. The aim is to transform the design process per se into one of design process by experience.

An inspiring space is an important strategic element as it acts on multiple levels, fostering the transition between moments of attention, assignation of meaning and the pre-consolidation of information. The itinerary we proposed is a physical, experiential and emotional pathway that traced the phases of the design process through simulated web pages.

Greenbush, a pioneer in enrichment studies, says that experience determines which synapses are shed or, more importantly, which are retained. This forms the *wiring diagram* upon which subsequent development is built (Begley 1996).

During the activity we have acknowledged the importance of setting up a space that allows for a fluid but rhythmic sequence of activities where simulated web pages or physical and mental pauses are essential elements for the retention of new information, its personal re-mapping and the emergence of new ideas.

The means to achieve this objective is involving participants in a/the simulated DiDIY Open Platform. This is supposed to enable people launching the challenges that a community can help to address or accomplish. The workshops intend to explore how can we help people clarifying the objective to achieve and launching a challenge that is clear to the community.

The playful approach – group dynamics and the creativity highway

In order to foster a group of people and enable them to become a well-established and cohesive creative team they must become familiar with their surroundings and with all the components of their team. In this context, the transfer of know-how should be accompanied by short activities designed to facilitate the generation of a favourable creative climate, which encourages team spirit and the sharing of objectives.

For this reason, the use of icebreaker and energizer activities intended to overcome the initial resistance and preconceptions of participants (possible barriers to teamwork) is particularly useful in creative sessions.

The initial activity Create your Avatar embeds a relevant component of playfulness and is able to raise attention levels and create a positive environment or climate. Many theories and studies in the fields of psychology and pedagogy have identified a particular moment in the game as useful for

learning; Schaller (1861) identified games as providing a time of rest and recreation, Gross attributed to games the ability to stimulate capabilities that are present within the human essence, at the instinctive-intuitive level, while for Huizinga (1938) playing was a basic human trait, placed at the origin of culture and social organization.

Both in co-design and training activities ice-breaker, energizer and other playful activities are used by the IDEActivity research team to consolidate the team and create a positive climate. These techniques are intended to strengthen or produce meaningful relationships within the group, involving corporeality as a means of expression and communication and as a stimulus to open-mindedness and *lateral thinking.*

Play is being used as a workout space for the group because of its manifestation in the form of imaginative simulation and an opportunity to understand information in a more immediate and profound manner.

The underlying messages, explained at the end of these activities, provide each participant with insights into the dynamics occurring within the group and in the mental and creative processes triggered during activities, leading participants to develop greater self and group awareness.

Visual thinking – a powerful tool for organizing and retaining information

The learning process requires the active participation of the subject (Mayer 2000). The brain selects what information is relevant and then organizes this data in a mental representation, integrating it with prior knowledge to produce a single model.

Visual and verbal information, with their own distinctive characteristics, are key elements in the workshop. This is a multimedia-based process as it requires both systems. In his theory of multimedia representations, Schnotz (2001) discriminates between external representations (images and texts) and internal representations (mental images or models).

In processing a text, the brain firstly elaborates a mental representation of its superficial structure. Secondly, it outlines a propositional representation of its semantic content and finally, it elaborates a mental model of the subject. These processes are guided both by the sensory information perceived and by our prior knowledge.

Diversely, in processing an image, we firstly perceive, elaborate, and create a visual representation of it, which is subsequently reinterpreted semantically (giving the image a meaning); finally, we construct a mental model of the subject.

Adhering to one of the principles in Mayer's guidelines, which states that learning increases when words are associated with images – as the resulting integrated mental model is richer in information to be accessed at a later stage – we established Visual Thinking as our third key element in the training activity. Visual Thinking is the tool through which concepts, information and ideas are translated into images, words and/or the intervening connections, so as to transmit them in a manner that simplifies and improves the comprehension and internalisation of their contents.

Despite the various differences in interpretation, experts agree that image generation, construction and combination are fundamental elements within the creative process.

The data we have seen and reported thus far demonstrates:

- the importance of creating, manipulating and combining mental images within the creative process;

- the fundamental role played by visualization, particularly when stimulated, in both creative discovery and problem solving, even in every-day life scenarios.

4.3 The workshop design and organization

In this section we will explore the structure of the workshops following the phases of the process of co-design, making a brief summary of it, identifying the tools of reference and describing in detail the tools we have designed ad hoc to help the participants tackle a phase.

Any kind of design challenge you've got, you'll move through three main phases: *Immersion*, *Ideation, and Prototyping*.

In general, the first stage of the process aims to get closer to the social and cultural context of the project. This stage, called Immersion, is broken down into two parts: Preliminary Immersion and In-Depth Immersion. Preliminary Immersion seeks an initial understanding of the context. In-Depth Immersion aims to identify the needs of the people involved in the DiDIY, and the opportunities that are likely to arise from an understanding of their experience regarding the issue under scrutiny. This "plunge into context" frequently generates a mass of information so vast that it becomes hard to identify the opportunities and prospective challenges to be overcome. Consequently, a stage of Analysis and Synthesis ensues, which seeks to organize the data visually so as to indicate patterns that will help to provide an understanding of the whole and identify opportunities and challenges.

In this third stage, the aim is to generate innovative ideas through collaborative activities to stimulate creativity. Generally, the tools for synthesis developed in the Analysis stage are used as a means for generating solutions geared towards the context of the issue under scrutiny.

The ideas generated are then selected – on the basis of different criteria – for validation in the Prototyping stage.

This phase, the last one used during the workshop, helps to make ideas tangible, so as to provide continuous learning and eventual validation of the solution.

For the workshop, we proposed a simplified yet exhaustive version of the creative design process, focusing on three different phases that were spatially represented as online pages along the itinerary:

1. discovery DiDIY (Analysis or Clarify Goal phase, within the Explore area);
2. challenge, to define potential opportunities (Synthesis or Define opportunity phase, within the Explore area);
3. generating ideas to come up with new solutions (Idea phase, within the Generate area);
4. prototyping ideas to implement a concept (Implementation Phase, within the Generate area).

Each phase was linked to one (or more) card(s) from the Design Tools Collection and presented with an Activity card. Both are preparatory tools fostering both the design process and the involvement/stimulation of participants.

It should be noted, therefore, that the design stages touched upon here are highly versatile and non-linear. It is an iterative process as shown by the IDEActivity figure. We also decided to schematize the phases simply in order to help comprehension.
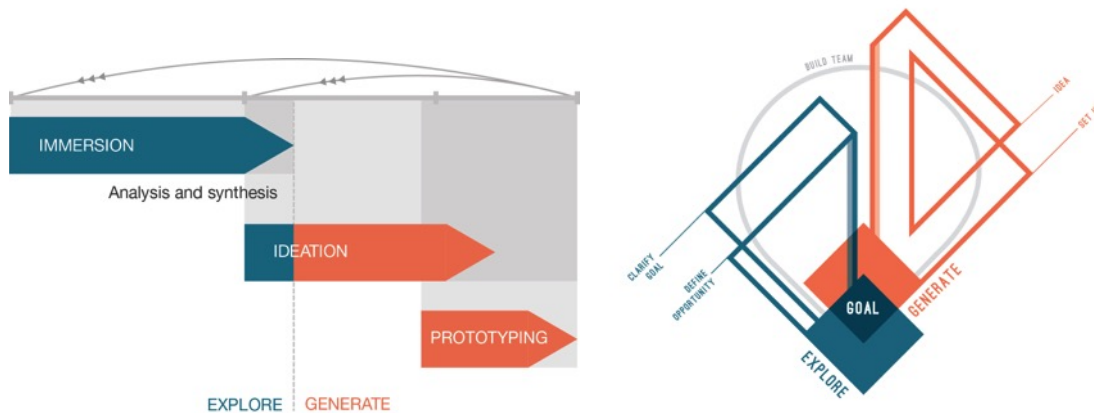
Figure 9 – Schema representing stages of the design process (left) in relation to the Explore and Generate phases of IDEActivity method (right).

Each of the main phases of the creative design process has two stages: divergent and convergent. In other words, each phase starts with a 'problem' definition, followed by a divergent phase which includes the 'creation' or 'widening' of a field of possibilities which includes collecting and generating facts, problem statements, and ideas, without criticism. Then resultant solutions are clustered and categorized, followed by a convergent phase in which there is a narrowing of choices based on criteria of what is useful and relevant (see Figure 9).

During the divergent phase of the creativity process, a large number of alternatives are identified.

At this stage the most important rule is: 'quality is quantity' to generate as much information and as many new ideas as possible. Free association plays an important role during this stage. In addition, the rule of not judging ideas is essential. When confronted with new ideas or concepts it is important that participants take a constructive stance.

Done properly, many ideas and a great deal of information will have been generated and collected during the divergent phase. The sheer number of new options will make it hard to select the best ones. For that purpose, an additional stage of 'cleaning up' and acquiring an overview of the options generated is useful before moving on to evaluation and selection. In this phase ideas are grouped together based on commonalities.

In the converging phase, all the ideas have the benefit of the doubt (the value of the idea may not be apparent at first), but one should also make decisions and work towards the stated objective. The alternatives chosen are then evaluated and selected.

The four phases of the creative design process each demand a different attitude from the participants.

There are elements continually used in our workshop, for example, to build deep empathy with the people, we always work with them in an engaging environment. To maintain creativity and energy, we always work in teams. To keep our thinking generative, sharp, and because it helps us work things through, we always make tangible prototypes of our ideas. And because we rarely get it right the first time, we always share what we've made, and iterate based on the feedback we get.

4.3.1 Set up

Before a creative session is conducted, it should be thought out and structured, considering the goal to be achieved, the available team and the location in which the sessions will be carried out: the techniques to be employed should be selected or designed accordingly.

It is necessary to set off from a clearly defined topic. We firstly think of what should be achieved with the session. We decided:

- teams should preferably be made up of four to six people;
- to plan the sessions to last an hour at the most for each activity, guaranteeing high levels of concentration and energy throughout the session. Duration of the whole workshop session is 5 hours;
- involving people who do not usually work within the same field can help generate new perspectives (see paragraph 4.3.2);
- to choose an environment that is not too restricted, allowing enough room for participants to move freely, and make sure there is plenty of free wall-space (see section 4.4, paragraph "Engaging environment");
- to provide tools to capture ideas. We prepare materials such as post-its, felt tip pens, paper and snacks;
- to establish the calendar of the workshops.

Design Tools Collection

see *Set Up – IDEActivity*

4.3.2 The participants

"Human-centred design isn't just about talking to a lot of people it's about talking to the right people" (Ideo 2010).

Working in multidisciplinary teams and brainstorming with other workshop participants having different backgrounds can help us to see how we can use digital technology in new ways to design new social applications and practices. Multidisciplinary teams are important for successful creativity sessions because it provides diversity enabling the build-up of new associations and interactions. In a group, the free flow of ideas can be stimulated by including open-minded group members from different disciplines who are not afraid of asking 'stupid' questions (Tassoul 2010).

When participants and designers work together in accordance with this design philosophy, both take on multiple roles throughout the design process. The designer starts out as a collector, taking information and insight from the environment of the participant, and creating an understanding of and empathy for their stories. In the next phase, the designer and the participant both take on the roles of maker and expert, materializing ideas, making and exploring early solutions. The participant is the expert on their own experience, and the designer is the trained disruptive force. Both their signatures are valuable in the process.

Finally, the designer takes on the role of interpreter, using these new insights to evaluate and enhance the result still further.

The participants all have specific areas of knowledge, but they share broad interests in DiDIY. By being open to new developments, the team absorbs external knowledge, finds new questions, and shares new, outside knowledge within the team. Attitude is crucial: the desire to learn, the will to explore your own boundaries, to listen to your intuition, and to deal creatively with new knowledge (Waag 2011).

In relation to these considerations, the choice was not to send a general invitation on the communication channels available but to select the participants according to their specific role, their desire to explore the potential of the new technologies and the desire to exchange and discuss with other experts.

The participants who were sent a personal invitation were identified and selected on the basis of well-defined profiles. For each workshop, the aim was to involve experts in the field of digital making together with professionals from the four areas investigated in the workshops in order to form multidisciplinary worktables with skills linked to the themes of the project.

For example for the education workshop, we wanted to create a group with mixed skills: experts in digital technology and experts in education, who nevertheless had a strong interest in both areas.

Although the choice required a considerable organizational effort, we deem it is crucial to be able to observe the phenomenon of education from different points of view. The experts we decide to select and who took part in the workshop on DiDIY&Education were: primary and secondary school teachers, high school and university professors, makers interested in education, educators that run educational programs outside schools using digital making (inside museums or Fablabs), professionals in different departments of the school system. We tried to involve people that already apply digital technologies at school, that use alternative educational methods, or who are interested in the topics.

Design Tools Collection

see *Build Team – IDEActivity*

see *Build a Team and Recruiting Tools – IDEO*

4.3.3 The facilitators

Collaboration and consensus are essential ways of working. Simple in concept but not so easy to achieve, creating an environment where groups can be productive and effective in achieving their goals is a facilitator's primary role.

Facilitate means "to make easy." As a facilitator, the job is to make the meeting easier for the participants. His or her main task is to help the team or group increase its effectiveness by improving its processes. A facilitator *manages the method* of the meeting, rather than the content. Facilitators are concerned with *how decisions are made* rather than what decisions are reached.

We can identify a few facilitation challenges (Facilitators Toolkit):

- continually focusing on and attending to the group;
- being comfortable with ambiguity and information overload;
- processing misperceptions and emotional reactions;
- focusing exclusively on process rather than content;

- helping the group develop so they can ultimately work without facilitation.

Co-design workshops can be greatly enhanced by involving an expert facilitator to guide the session as the IDEActivity team. Indeed, the facilitator should guide the session and not let his or her own opinions interfere with the expression of other peoples' opinions. It is very helpful if the facilitator has a good general knowledge of the subject and of the tools being used (Tassoul 2010).

The facilitator should manage the conflict. It can be healthy in a group. It shows that members are taking ownership and sharing their ideas honestly. However, there are times when healthy conflict escalates and ceases to be constructive. Since emotions resulting from conflict tend to intensify over time, it is important to address the conflict as soon as it begins to become unhealthy.

The facilitator has to keep track of time and allow everyone who wishes to express an opinion at both the individual and group level. Teamwork is fun: it can be inspiring and stimulating, it motivates you to give your best and there are others who can support you and from whom you can learn. But it doesn't always work that well: teamwork can also be very demanding if you have different perspectives, and it can be frustrating and unfair if you have to sacrifice good ideas for an unhappy compromise or not everyone is really contributing. Teams can be less effective than an individual and they can develop very unproductive dynamics. These dynamics can appear especially when the people do not know one another as in this case, therefore the facilitators have to be ready to change strategy at the time when they appear. For this reason, before and after every workshop, we have planned a time of sharing. Planning also goes through working out a couple of reserve techniques and of team-building depending on the difficulties we encounter.

The number of facilitators involved each time in the 16 planned workshops are decided according to the number of people taking part in the session. The idea is to have one per group of 6-8 people. As the tasks are transversal in order to integrate the results of the research work done by the other groups, all the partners are invited to take part, in particular those in charge of the area which is being investigated in the specific workshop.

As facilitators, we keep and manage the time of the planned activities. We need extra supporters taking pictures and recording each workshop, to be transcribed eventually. These people could also manage the welcome and registration desk.

4.4 Explorative workshops

To explore means being open to new opportunities and gaining inspiration to generate innovative ideas. This phase allows the creation of a groundwork from which a significant and potentially viable goal can be defined. A point of view is established with regard to a specific topic/issue, taking scientific material and structured research into consideration, but also considering the target user and market.

By graphically visualising information through images, photographs and key words, the material can be analysed and organized, creating easily identifiable mental pathways and locating unexpected connections. It is important to go beyond an impersonal analysis of the material, interpreting it with an open attitude.

The tools used during this phase are aimed at:

- understanding the context;
- finding problems and opportunities.

The specific objectives of the exploratory workshops are:

- identifying the fundamental factors underlying DiDIY to be taken into consideration for the solution of a challenge so that it becomes a winning idea in the context of DiDIY;
- a collection of project-building challenges for each specific area launched by the participants and therefore based in their direct experience in each of the areas;
- diffusion among the participants of knowledge of the phenomenon of DiDIY through the analysis of case studies, so that they can enter into empathy with the context.

The outputs of the exploratory workshops are the inputs for the generative ones that deal with solving a project challenge, selected from those that emerged in the exploratory workshop, integrated with the fundamental factors identified.

In order to reach these objectives, the participants are guided through a structured pathway made up of various activities to perform using methods and tools typical of co-design planned ad hoc. As can be perfectly hypothesized, the flow of the workshop, the activities and the tools, tested in the workshop sessions, will undergo a process of refinement and continuous improvement. The modifications which will be made each time will be generated by the observations of the research team in the workshop phase and from the feedback from the participants. A first work of verification and perfecting is always carried out through the experimentation at the pilot workshop.

This paragraph describes the initial planning of the flow of activities of the exploratory workshop and the relative tools, the evolution from the pilot workshop and the last version tested are included in the paragraph on the experiences.

The image below shows an overview of the whole flow of the workshop, from the initial Welcome to the last activity of the final Debrief. The flow of activities is divided into three main sections "Discovery DiDIY", "Fundamental factors" and "Upload your Challenge" which correspond to the three main objectives which we want to reach:

- to explore DiDIY to enter into empathy with the context;
- to identify the fundamental factors of DiDIYto be transferred into the design of an idea;
- to launch specific challenges in the four areas of the Project.

Each section is made up of activities that are shown in the table together with the relative tools designed and the times.
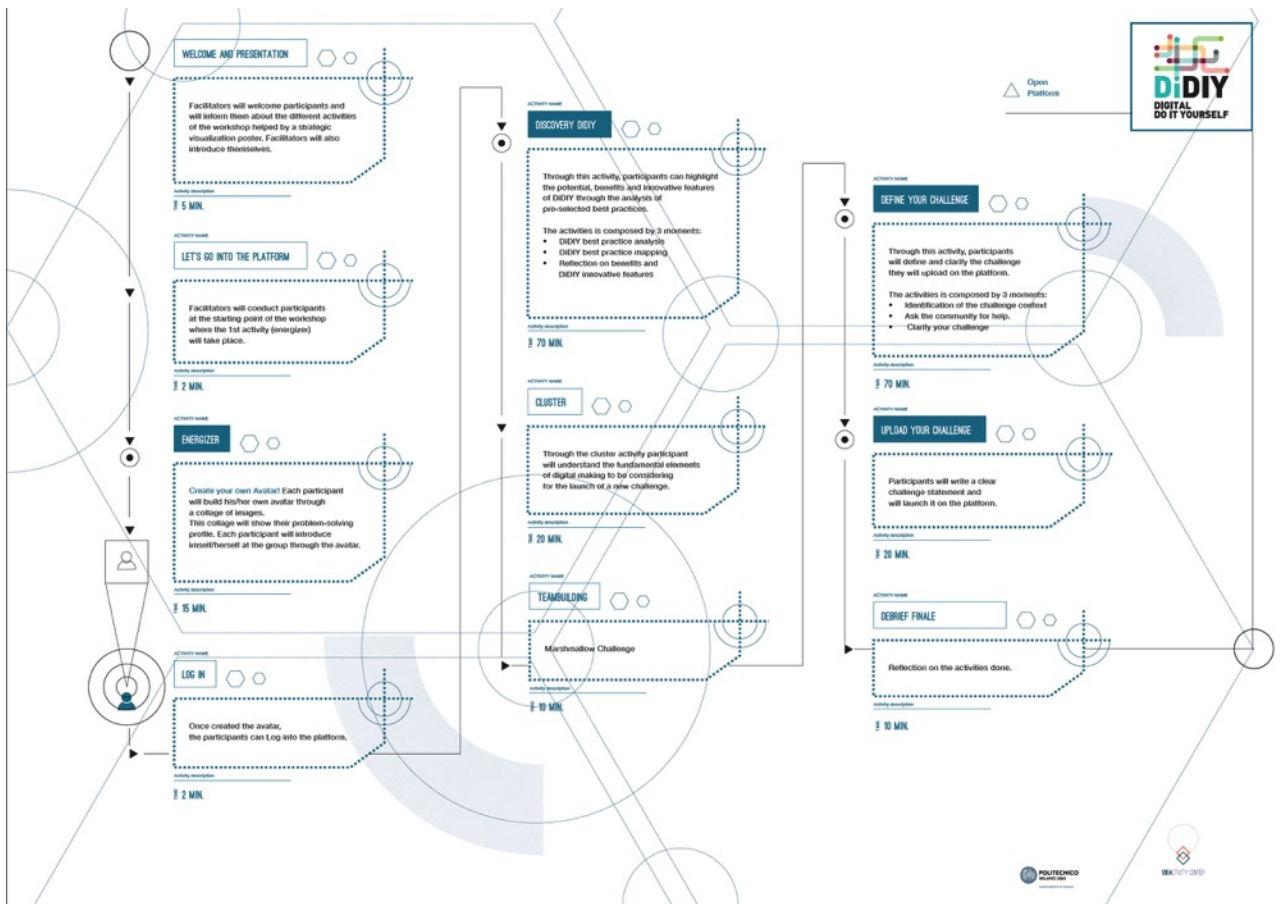
Figure 10 – Overview of the whole flow of the workshop.

Welcome and presentation

The workshop starts with a brief explanation to introduce the European DiDIY project and the partners, as well as the objectives and the activities under way. The explanation of the workshop through Strategic Visualization allows sharing the objective of our workshop activities and the design process followed.

This technique allows the groups to work with complexity through working out simple processes and allows the facilitators to decide what is most suitable for the different phases, following the pathway of the participants. Strategic Visualization shows the schedule of the day and the tasks connected with each step: what to do in each activity, how much time will be devoted to each one,

the tools and the materials to use. The poster, on the wall, creates a point of reference during the workshop and tries to make all the participants autonomous in understanding the slow at any time of the day.
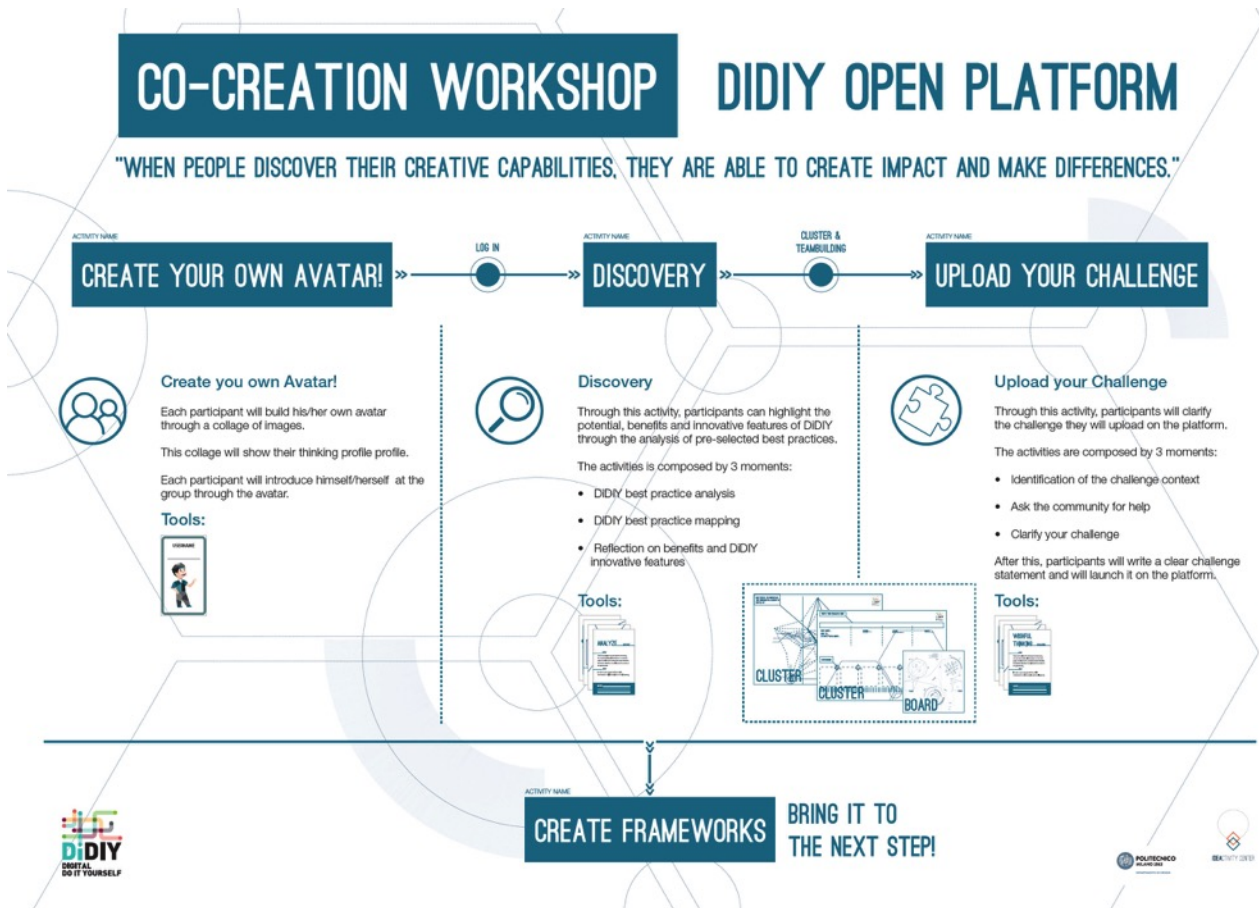
Figure 11 – The Strategic Visualization poster, with dimensions 70 x 100 cm, shows the activities of the co-design session, with the tools to use, the times and the objectives to be reached.

Let's go into the platform

For the opening activity, we designed a very simple yet highly effective energizer. We start with an energizer, which is an activity intended to motivate and give energy to participants. They are asked to describe their main abilities related to the development of a project (e.g., I'm good at generating ideas, or analysing problems, prototyping concepts, etc).

The energizer will transform them in avatars who will navigate the tangible version of the virtual platform, starting from the "homepage".

Create your Avatar

The Avatar is created by making a collage of ten images which reflect the Foursight profile of the participants. This profile indicates the level of preference for each of the four mental processes that are necessary for innovation. Innovation requires the use of creative thought, a mixture of intuition, imagination, analysis and action. Each of the four preferences – Clarification, Ideation, Development and Implementation – has its strengths and its potential weaknesses. In particular, FourSight reveals the types of thought towards which a person, a work team or an organization feel naturally attracted and the types of thought that tend to be avoided or under-used. We have developed a simplification of the test, which is usually carried out by answering about thirty questions, through images which could be associated with the characteristics of four profiles (for example a clarifier likes to go into depth, understand the details, has a methodical approach to problem-solving unlike the ideator who enjoys being wide-ranging with his/her imagination, finds satisfaction in thinking in abstract terms and privileges an intuitive approach to innovation, etc).

By giving a coloured edge to each image, according to the predominant colour of the images selected, the profile of each participant is identified. The activity ends with the presentation of each of them through their profile avatar and the Log In to the platform, marked by a sound.

There is a brief explanation that each person has an inclination with respect to the phases of the project in the posters which are distributed in the room.

The profile avatar is also used for the division into groups which is also made according to the profession.

The final kit of materials used for the Create your avatar activity is also shown here (see Figure 12):

- adhesive images divided by profile with a coloured edge;
- Avatar figure with user name;
- poster with description of Foursight profiles.

Figure 12 – "Create your Avatar" activity kit.

Engaging Environment: simulated DiDIY Platform

The activity, built on the concept of an experiential path, is designed to be emotionally and physically engaging. The environment has to be considered as an integral part of the experience that supports the workshop process. This means not only managing the space, but also organizing communication and the rhythm of the workshop experience proactively.

The activity's main objective is to demonstrate how, through a human-centred approach, the co-design process – whose language is based on different forms of communication, and which makes use of specific tools that are integrated into the creative process- represents a high added value and an essential element in achieving innovation in DiDIY.
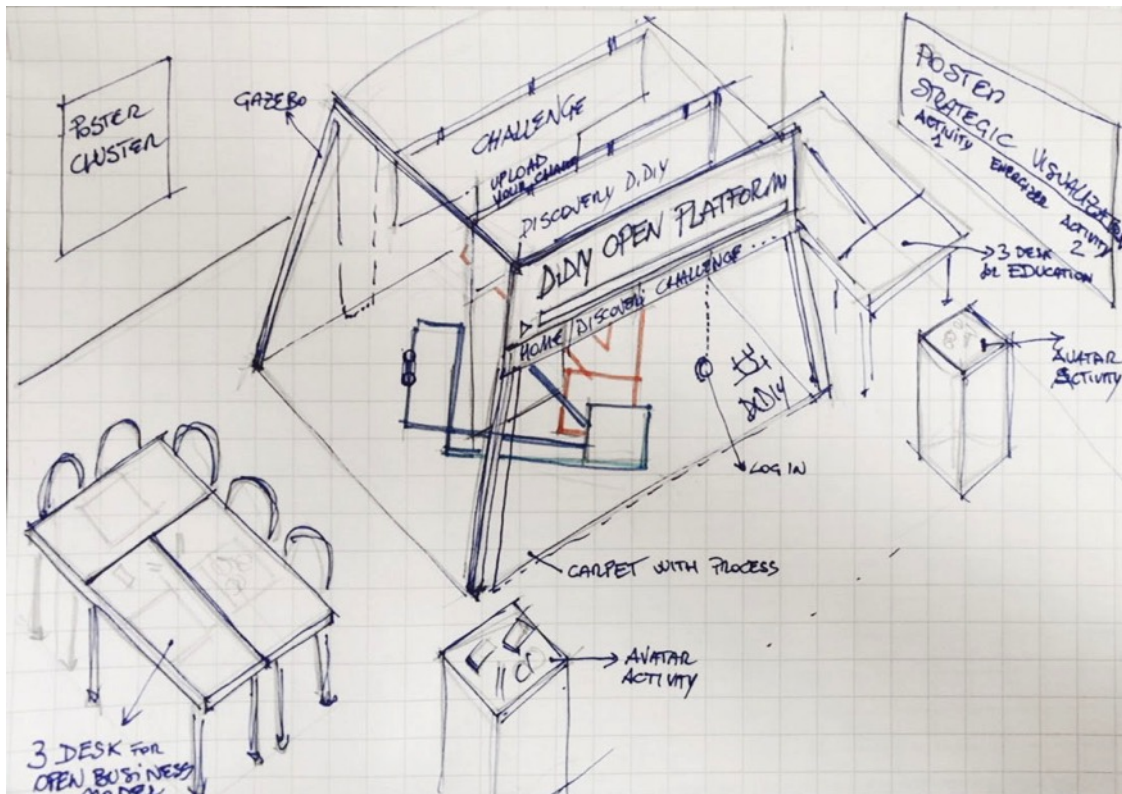
Figure 13 – Design Sketch of DiDIY platform.

Figure 14 – Physical installation of DiDIY platform.

The environment is expressly created as a sort of parallel world in which the participants are invited to enter as spectators and as leading players: a foreign and peculiar setting to be explored and become comfortable in. The itinerary proposed is a physical, experiential and emotional pathway that traces the phases of the design process through simulated web pages in the DiDIY Online Platform, in which participants are invited to take part in increasingly involving activities.

The entire experiential pathway started with the three-dimensional rendering of the IDEActivity method, with its division into two principal phases: Explore and Generate. A 3x3 m image is placed on the floor which represents the method, and three web pages in correspondence of the steps show the points of the pathway: Homepage, DiDIY Discovery and Upload your challenge (see Figure 14). Participants could walk among the webpages that are projected in the specific area of the path in which they are involved. This approach allowed participants to mentally construct a comprehensive three-dimensional image of the process, depicted as a path, and to visualize the creative techniques and tools pertaining to each phase of both the Explore and the Generate areas.

The work tables are also set up with: Post-Its and coloured felt tip pens, small games that help keep a creative atmosphere during the activity (tops, bells, etc) and snacks to give energy during the moments when tension flags.

The rules of the day (see Annex II) are also hung on the wall in the space, so that participants can keep the right mindset.

The climate that is generated during the session is one of the factors that guarantee its success. The right mindset that can deal with the activities proposed during the workshop therefore has to be generated. Approaching the co-design session, one should be as open-minded as possible and try to avoid criticism of the ideas that are generated because this can cut off potentially useful ideas. A positive attitude is the strong foundation of a successful creativity session. The following rules can facilitate the creativity process:

- group members should be able to express themselves freely and openly without censorship and should operate with appropriate respect towards others;
- there should be no judging of people (Tassoul 2010).

4.4.1 Discovery DiDIY
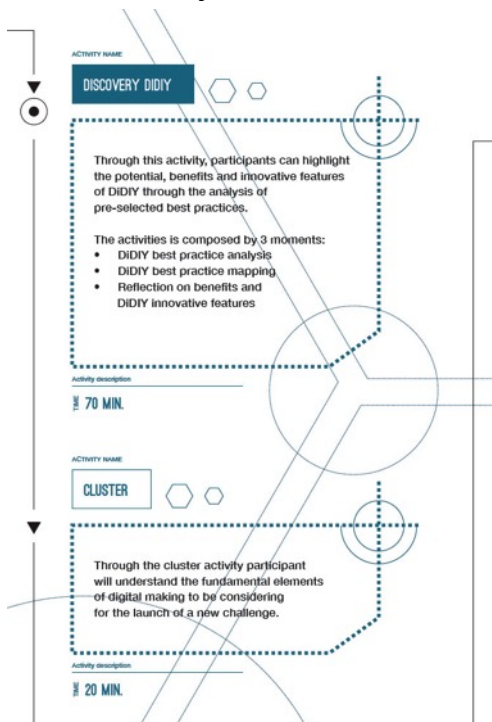
There is no better way to understand the context of DiDIY than by immersing participants in that context. Discovery DiDIY has the essential objective of allowing participants to explore the phenomenon of DiDIY, to make it known and to create an empathy with the context. This divergent phase is fundamental, not only for those who do not know the phenomenon, but also for those who, already experts, want to analyse the context from different points of view. This makes the start of a creative flow among the participants easier. Knowledge is fundamental especially in the subsequent phases of the workshop.

This first activity guides participants through a process of identifying DiDIY potential and benefits by exploring and interpreting a best practice (e.g., FabAcademy or Open Source Ecology). They will conclude this activity by choosing the benefits/potential that they'd like to bring with them to the next stage. The participants are led in their exploration of the case through the use of activity cards, which show the task to be performed and a gameboard with specific aid cards, with which each group analyses the case.

The exploratory iterations start by an in-depth analysis of a specific DiDIY project, presented as a case study in a detailed brochure with its main details: objectives, participants, resources, main values, results, etc. The paper version could be complemented with web browsing of the project's site using a tablet, which for example helps understand the project better by watching some of its videos.

The activity is performed at each table by choosing one of the case studies prepared by the team of researchers and starting with the analysis through sharing information, experience and knowledge. The connections between some aspects of the case and personal and professional experience written on Post-its and shared on the gameboard lead to enriching the contents. For each group there is a facilitator who works as a lead co-designer. Sometimes just by explaining the steps, eliciting and

clarifying when needed, that is, acting as a facilitator. In other occasions pointing to given results, re-interpreting or even focusing on specific ideas from conclusions of the group. That balance between letting people do and discuss vs. influencing by focusing on some of the outcomes is a very interesting one in relation to the main goals.

The involvement of the participants and therefore their active sharing is guaranteed by the introduction of cards which stimulate reflections on subjects that are always different.

The divergent phase of analysis is concluded with a convergent phase of clustering using the technological star.

| (70 minutes' tot) .... 20 .... 25 .... 25 | **DISCOVERY DiDIY** | OBJECTIVE: Through this activity, participants can highlight the potential, benefits and innovative features of DiDIY through the analysis of pre-selected best practices. The activity has 3 steps: ....
 * DiDIY best practice ANALYSIS
 Participants have to read and analyse the best practice brochure and then write the project objective in the centre of the gameboard. ....
 * DiDIY best practice MAPPING
 Give the activity card MAPPING and explain the activity.
 Participants identify the key people, technologies and elements in the best practice with the help cards. ....
 * Reflection on benefits and DiDIY innovative features
 Give the IMPACT activity card and explain the activity.
 Participants reflect on the results and benefits generated by the best practice. They write on post-its and put them on the board.
 Facilitators guide this activity. | **.....................**
 Activity Card 1
 Gameboard
 Game Card
 ....
 Activity Card 2

 ....
 Activity Card 3
 Activity CARD |
| 25 | **CLUSTER** | OBJECTIVE: Through the cluster activity participants will understand the fundamental elements of digital making to be considered for the launch of a new challenge.

 Give the SHARE & NEGOTIATE activity card and explain the activity.
 Participants cluster the impacts previously identified with the help of facilitators. | **Activity Card 4**
 Tech flower poster |

Table 1. Workshop agenda

Each tool is described in detail as follows.

Tools

Case Studies

Preliminary Immersion consists of Exploratory Research and Desk Research. When the co-design workshop begins, some of the participants are not familiar with the subject. Everything begins with

strategic alignment of participants. For this phase, we have decided to proceed by creating a support to quickly help the participants understand the essential aspects of the case study. We have decided to use mood boards for this.

Panels or mood boards are useful for understanding the meaning of each concept. The images help to understand processes for interpreting the memories, meanings and beliefs that comprise people's cognitive process, and consequently, their decision-making process.

The selection of the case studies is made on the basis of the previous research we, and the partners, carried out. The criteria with which they have been selected has nothing to do with how good the case is but with the significance with respect to the three levels defined in the model. They therefore have to have a marked social aspect, an evidence element of collaboration and a motivational factor that can be identified through analysis.

Four cases have been chosen that could reflect these three levels offered in the four areas of the DiDIY project. We decided to start with four, FabAcademy, Open Source Ecology, Public Lab and Instructables, but with a view to the future, the format will be released with the toolkit with which the people interested can implement the number of case studies.
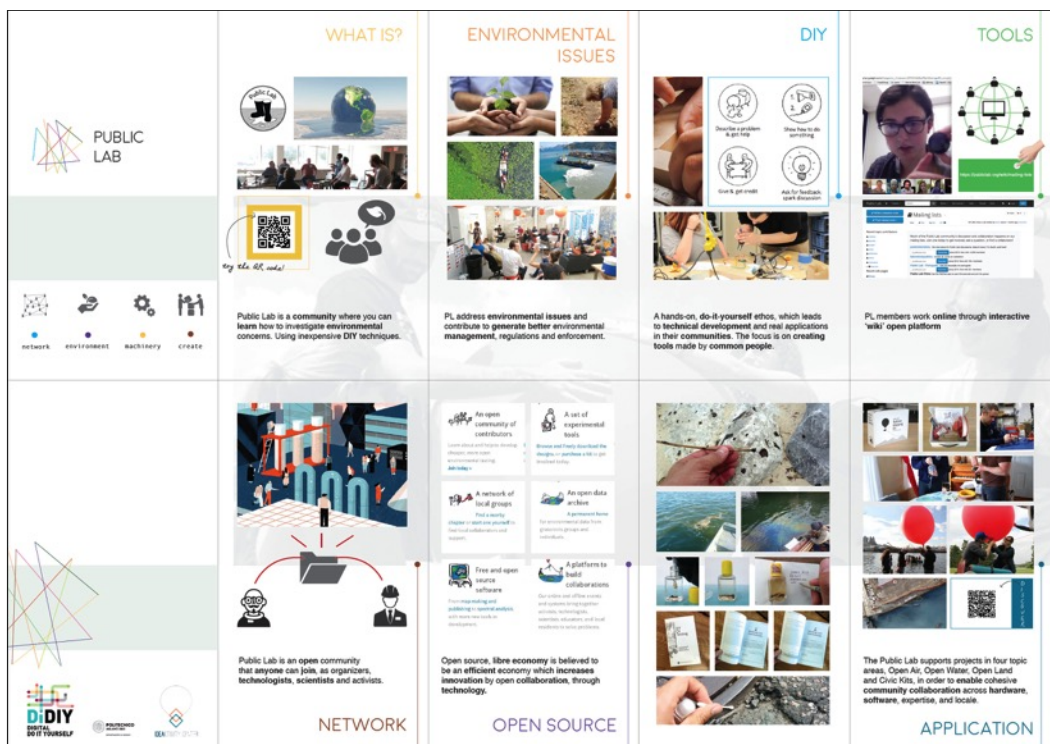
Figure 15 – Front side of the "Public Lab" case study. Poster 70x100 cm.

Figure 16 – Back side "Public Lab" case study with details.

The Best practices are shown on posters measuring 70x100 cm folded like wallets. On the front there is the main information divided by subject, on the back the in-depth information. The information has been presented using images, text and clinks to multimedia content (website and video) through a QR code.

Activity cards

Another way to communicate with the participants is the use of our activity cards, which provided participants with the only available guidelines for each activity. This technique is included in the toolkit developed by the IDEActivity Center.

Discovery DiDIY is made up of various activities which are progressively introduced through the activity cards. The activity cards have been created to be consulted directly by the members of the group and show *how* and *why* the activity has to be performed. These cards pace the rhythm of the workshop giving a sense of dynamism to the session (see section of evolution of tools activity cards). All the activity cards have on the front an evocative image whilst on the back they have the name of the activity, a brief explanation of How it takes place and Why it is important.

Activity card 1 – Analyse
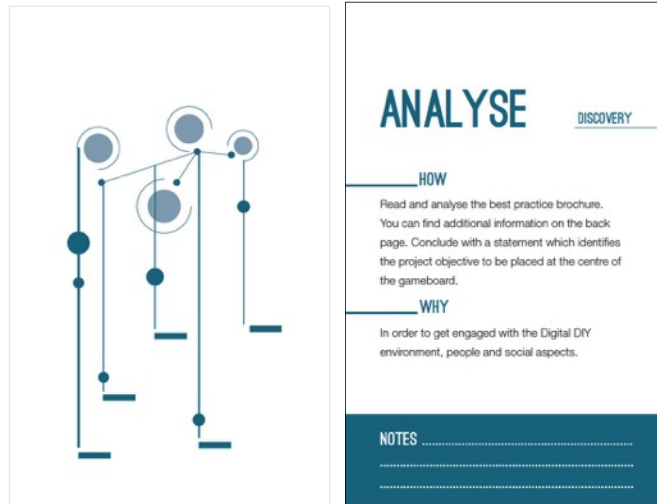
Figure 17 – Activity card *Analyse* in Discovery.

How   Read and analyse the best practice brochure. You can find additional information on the back page. Conclude with a statement which identifies the project objective to be placed at the centre of the gameboard.

Why   In order to get engaged with the DiDIY environment, involved people and social aspects.

Activity card 2 – Mapping
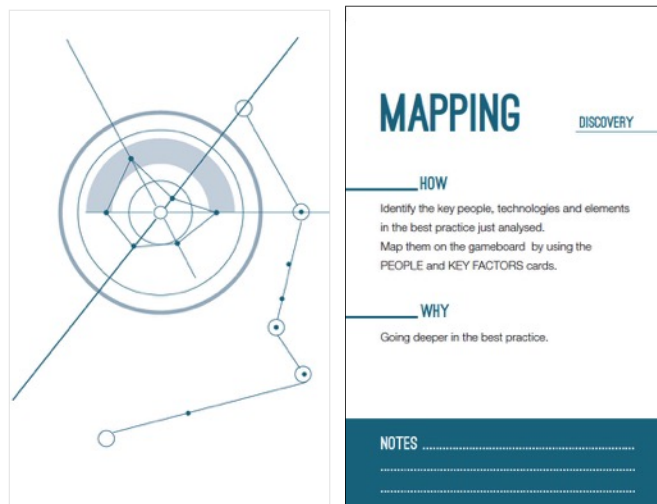
Figure 18 – Activity card *Mapping* in Discovery.

How   Identify the key people, technologies and elements in the best practice and map them according to the instructions on the board and on the specific cards.

Why   Going deeper into the best practice.

Activity card 3 – Reflect
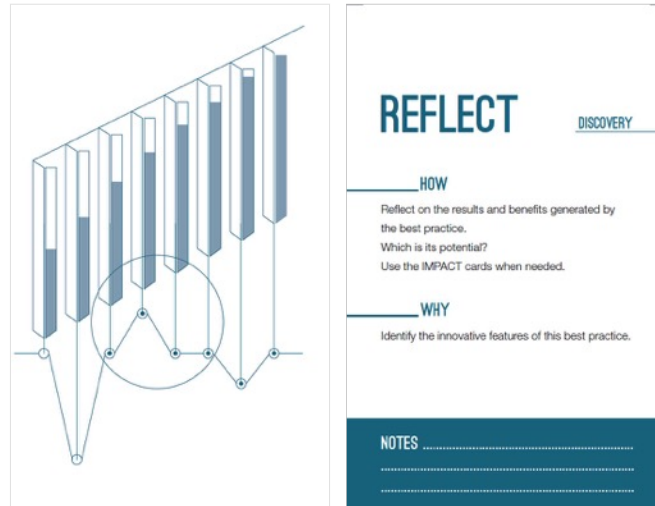
Figure 19 – Activity card: *Reflect* in Discovery.

How   Reflect on the results and benefits generated by the best practice. What is its potential? Use the help cards when needed.

Why   Identify the innovative features of this best practice

Activity card 4 – Share and negotiate

Figure 20 – Activity card: *Share and negotiate* in Discovery.

How   Share the impacts previously identified with the other activity participants and agree on 3 to 5 possible clusters.

Why   Help the people in the comprehension of the fundamental elements of digital making to be considered for the launch of a new challenge.

Gameboard

In seeking to develop innovative solutions for DiDIY, the first phase of co-creation session is transformed into a game to stir up ideas. Gamification is the use of game thinking and game mechanics in several contexts with the objective of improving participation and generating engagement and commitment from potential users. Gamification is applied as an alternative to traditional approaches, especially to encourage people to adopt certain types of behaviour, to get to know new technologies and to speed up their learning and training processes. Therefore, the act of playing has a meaning beyond entertainment. It presents its importance as a cultural element when: the game is more than a physiological phenomenon or a psychological reflection (MJV 2015).

In general, the application of gamification indicates situations that involve creation or adaptation of the user's experience to a particular product, service or process; the intention to awake positive emotions, explore personal skills or engage virtual or physical rewards to complete tasks.

According to Yu-kai Chou[3], probably the most respected gamification guru nowadays, the biggest contribution this methodology can offer to society is human-centred design, rather than design focused on function....

Applying a successful gamification strategy is directly related to understanding the context where the user is inserted, and what their extrinsic (incited by the external environment) and intrinsic (self-motivated) expectations and constraints are.

That exploration phase consists of locating on a gameboard three types of information about the project: people, key enabling factors and main impacts. Guided by a set of cards with questions about more specific aspects of the project, participants place relevant concepts on Post-its on those three areas while discussing them. The gameboard is a support, which the participants have at their disposal, to complete and enrich using the Post-its. The cards linked to the individual areas and the Help cards are placed in the specific spaces on the gameboard.

As a starting point of the analysis, the participants have to identify a shared objective. The three levels of interpreting the phenomenon shown on the gameboard at the side of the section on Impacts, deriving from literature (see section on model of research) ought to facilitate reflection.

The gameboard in the form of a poster measuring 60x60 cm represents the support that facilitates the analysis of the cases and which collects all the reflections of the participants.

It is divided into three areas; people, key factors and impacts, united at the centre of the objective area to be used as shown on the activity card *Analyse*. The board has spaces to put the cards relative to each area. The board is inspired by the toolkit issued by Waag in creative commons.

For the workshops in the exploratory series in Milan, the gameboard was stuck on to a Poliplat support.

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3 Source: yukaichou.com.
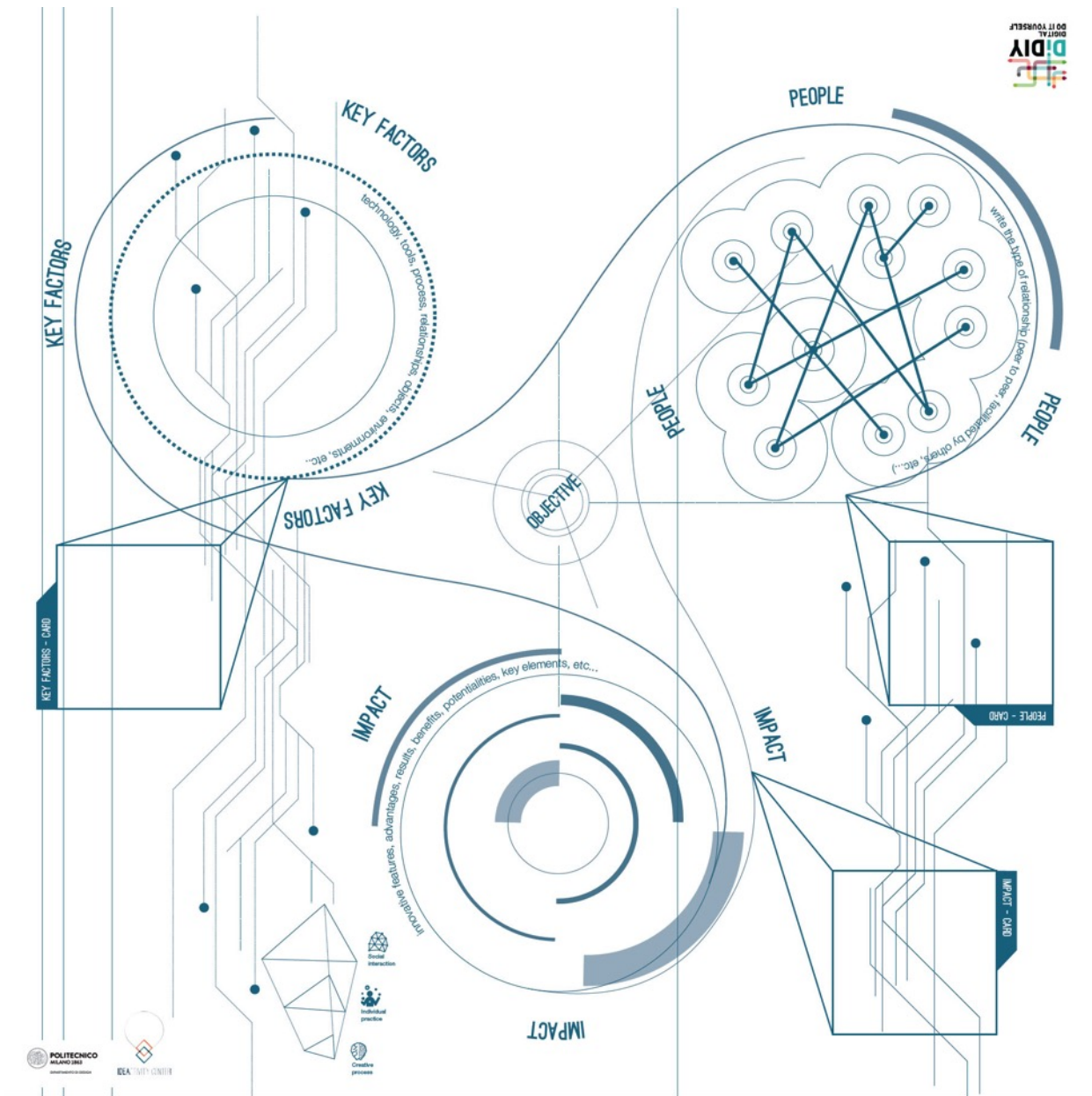
Figure 21 – Gameboard visual layout.

Gameboard cards

A Card Sort is a quick and easy way to spark conversation about what matters most to people. By putting different cards, each with a word or single image or questions, in someone's hands and then asking them to reflect or answer the question, you'll gain huge insight into what really counts. You can also use the Card Sort exercise to start a deeper conversation about what a person values and why. All the cards measure 9x9 cm.

Card People
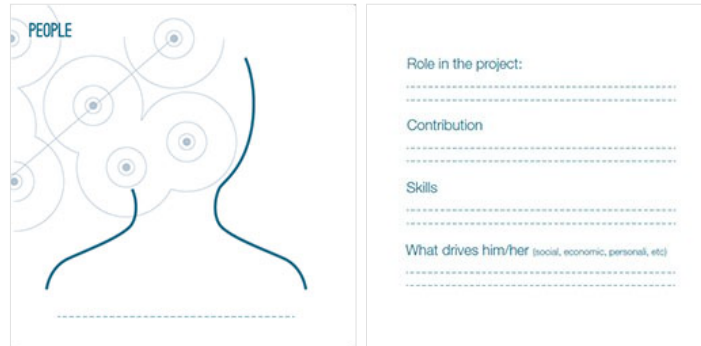
Figure 22 – Card People, front and back side.

Front: Silhouette of a person with a space to show who they represent.

Back: The participants, through questions, have to indicate the role of the people, the contribute they make and what motivates them. The cards are to be filled in on the front and on the back.
- What is the role in this best practice?
- What contribution is offered?
- Skills
- What drives him/her to contribute? (social, economic, personal reasons, etc)

Key factor cards

The pack contains two types of cards:

1. the cards on technologies have pictures and the description on the front and the questions to be answered on the back;
2. the key factor cards which have question on the back. Both have the function of stimulating discussion and reflection.

Figure 23 – Key factors card – type 1. Front side.

Front: Electronic components

They are used as DiDIY products or technologies. They include actions and reactions in and to the products. They include programming software (microcontrollers (Arduino/Genuino), Raspberry PI, sensors, actuators, etc).

Front: Sharing technologies

They enable relationships between distant people, including the communication of information/knowledge and sharing ideas and designs.

Front: Production technologies

They enable the creation of objects and products. (3D printing, laser-cutting, CNC machines, 3D scanner,…)

Figure 24 – Key factors card – type 1. Back side to fill in.

Back: What do these tools allow doing? What is innovative in the use of such technologies in this project? To what extent are you familiar with them?

Figure 25 – Key factors card – type 2. Front and back side.

This type of cards have an icon on the front which recalls the meaning of the questions that are on the back.

Back 1.   Identify which tools, format and processes are needed for the project realization. How they are innovative?

Back 2.   Think about the network in this project. Does it enable innovation? How?

Back 3.   Identify the motivation of the involved people. How can other people be motivated to participate in the project?

Back 4.   Which skills and competences are needed for the project? Why? Technical, experience, cognitive, creative, behavioural, etc.

Back 5.   Reflect on the possibility of using physical and/or digital environment where you can meet expert and passionate.

Impact cards

The cards have keywords (which in part repeat the key factors) with the prefix New, while there is a series of questions on the back.

IMPACT

NEW ENVIRONMENT

Which impacts may be generated by the context or the environment in this project?

IMPACT

NEW SOCIAL EFFECTS

In this project the digital making activities are oriented to:

- social inclusion
- skills empowerment
- verify abstract ideas
- knowledge sharing
- skills democratization
- create personal ideas supported by experts
- customize products

IMPACT

NEW WAYS OF THINKING

Do you think that this project could stimulate creativity?
Why and how?
Individual or community level?

IMPACT

NEW VISION

Do you think that this project may be considered as innovative?Why?

Do you think that the innovative aspects are generated by the specific factors or by their interaction?
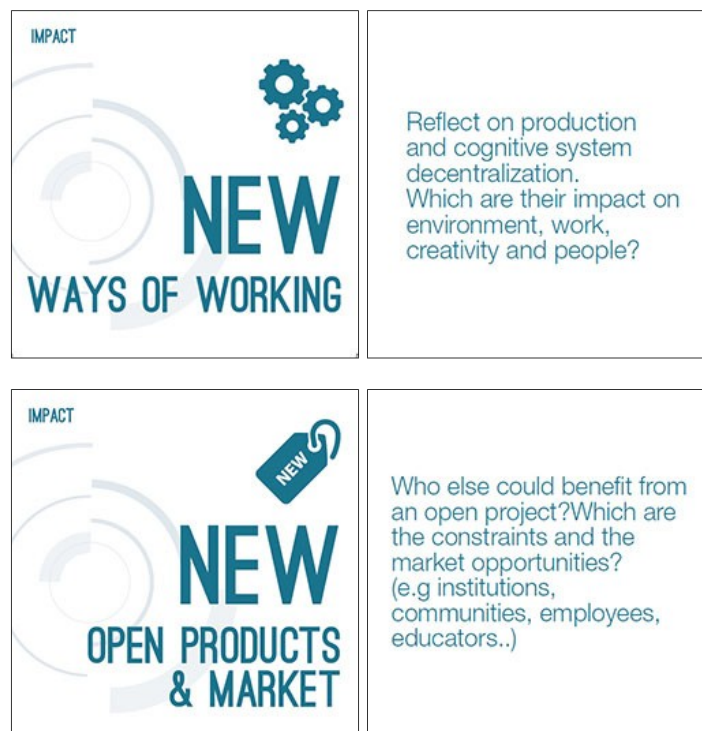
Figure 26 – Impact card. Front and back side.

NEW SKILLS – Which type of knowledge or skill is developed in the interactions between environment, person, objects and technologies? (for example: Problem solving, Critical thinking, Creativity, Collaboration, Communication, technical knowledge, manual skills, creativity)

NEW RELATIONSHIP – What are the different geographical scales of interaction of the people involved and what are the benefits of interacting at those levels?

NEW ENVIRONMENT – Which impacts are generated by the context or the physical place where the project takes place?

NEW SOCIAL EFFECTS – In this project, the digital making activity is more oriented towards...

Social inclusion, Increasing competences, Physically verifying abstract ideas, Sharing knowledge, Democratizing competences, Implementing personal ideas with the help of experts, Personalizing products according to one's needs.

NEW WAYS OF THINKING – Do you think that this project can stimulate talent and creativity? Why and how? Individual or in a group?

NEW VISION – Do you think that this project can be considered innovative? Why? Are the innovative aspects determined by the whole or the singularity of the key factors?

NEW WAYS OF WORKING – What are the impacts and repercussions of the decentralization of productive and cognitive systems on the environment, in work, on creativity and on people?

NEW OPEN PRODUCTS & MARKET – Who else could benefit from an open project, with which legal constraints and new market opportunities (institutions, community, companies, workers, educators, etc)

Fundamental elements

A critical piece of the synthesis phase is understanding the insights that will drive the design out of the huge body of gathered information.

In the Inspiration phase the team gathered tons of information. Here's how to share it with the team and put it to use. After the divergent phase of analysing the case study, which took place in separate groups, there is now a convergent activity of collaborative clustering called "Share & Negotiate". The objective is to group together the reflections that have emerged by similar aspects in order to identify the elements that can be considered underlying DiDIY.

From the analysis that has just been made, each work table identifies its fundamental factors to subsequently compare with those identified by the other groups.

From the comparison the *fundamental factors common* to the various groups are identified. Some of the different factors are kept on selection by the group.

The result of this phase is precisely the collection of a series of factors which then, analysed by the research group and worked out allow creating the tool useful for planning in the generative series (see sections 7.1, 7.2, 7.3).

This activity is greatly conditioned by the profiles of the participants. The analysis of the case from the point of view of a teacher brings to light reflections closely linked with the world of education which consequently bring out specific factors for the area of education.

Tools

Technological star poster

The tool designed for this phase if the poster measuring 100x70 cm with the representation of a star. This activity has to take pale collaboratively as each session of the workshop has to produce from 3 to 5 factors shared by all the participants, Each factor, placed on a point of the star, has to be accompanied by a name and a description.

A star has been chosen to express visually the concept that the fundamental elements of DiDIY are not new per se but as they are part of a set which only cohesive can lead to innovation. Only the presence in a project of all the elements determines innovation.
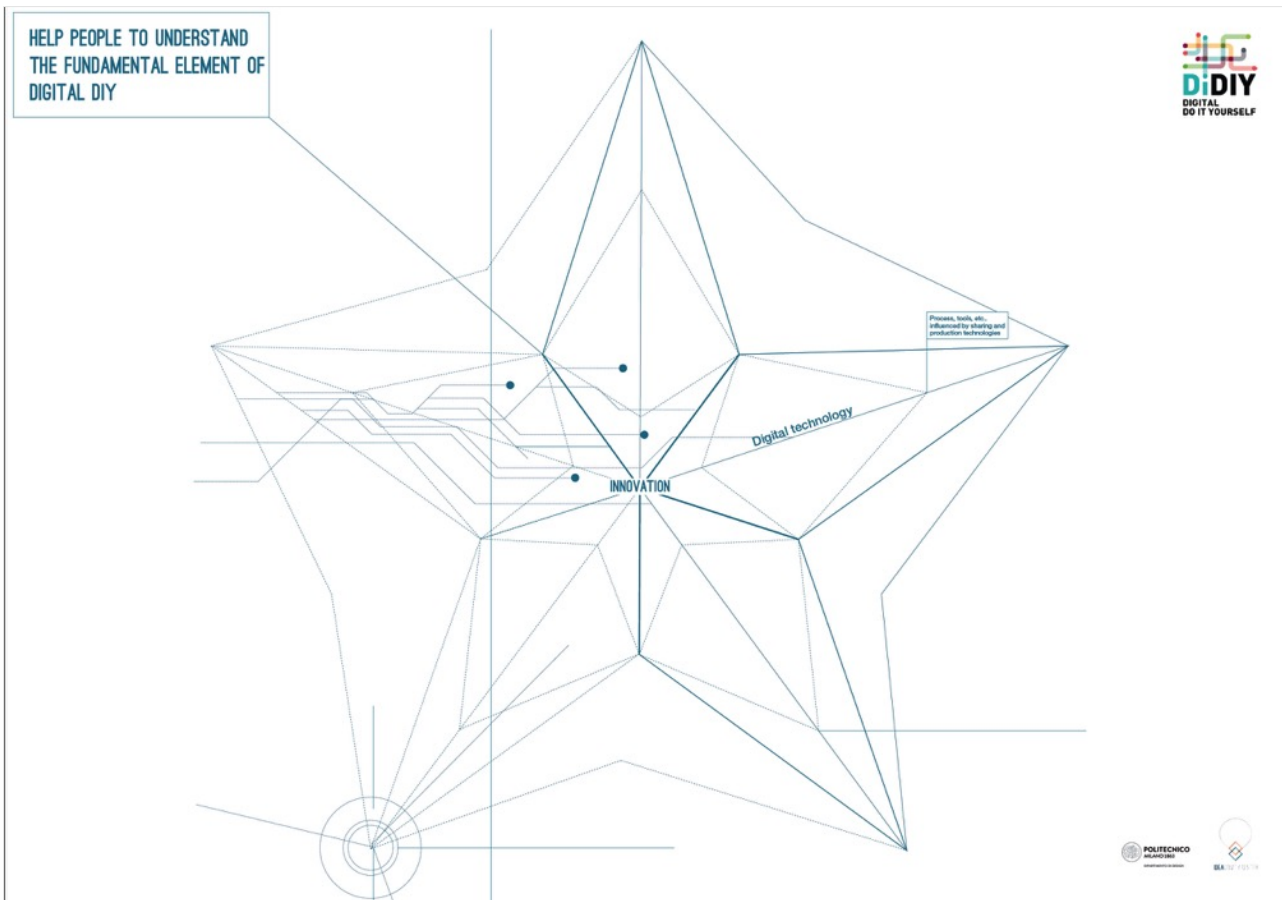
Figure 27 – Technological star poster. Dimensions: 70x100 cm.

4.4.2 Challenge

The second stage of the experience is the 'web page of the challenge launch'. Here participants work collaboratively to formulate a clear statement for the 'challenge', supported by our tools (e.g., sharing "inspiring stories"). The outcome is the "challenge statement" which will be addressed in the generative workshop, to be held in the near future, with the same participants.

The definition of the problem and its formulation have a great impact on the results of the creative session. If the problem is not accurately defined, the results generated could be irrelevant for the project. Guidelines for defining a problem include:

A. Formulate the objective of the session of creativity in a single phase, defining the focus of the project concisely and clearly. Often a problem has various sub-problems that have to be dealt with separately.

B. Keep a real and tangible focus. If the problem is too abstract, the results will be superficial or invalid.

C. Always start the phrase with "How to". The words who, what, where, when and why invite collecting data. In order to stimulate the generation of ideas, it is better to start with How.

Generating a possible challenge starts from a phase of inspiration through a picture gallery and using the Wishful thinking cards. The participants then translate the desire into a challenge first by

posting all the information they have on the subject and subsequently through clarification using the gameboard tool again. This helps in formulating a more accurate challenge which will be told through a storyboard and rewritten correctly using the "How might we…?" technique.

The activity has three steps:

- Identification of the challenge context – through choosing some evocative pictures, each participant will have to write the challenge down on a piece of paper.

- Post all information about the challenge – include all the information, the experience, the cases that the group known on a piece of paper that looks like a blog web page.

- Clarify your challenge – the groups will have to work on clarifying the challenge, specifying: Who will benefit from solving the challenge? Who are the other players involved? Why is it important? helped by the gameboard.

| 70 | **CHALLENGE** | OBJECTIVE: Through this activity, participants will define and clarify the challenge they will upload on the platform. The activity has 3 steps:
....
Identification of the challenge context
Give the WISHFUL THINKING activity card and explain the activity.
Participants take gallery, mind map by FKI and identify a shared challenge to work on.
....
Post all the information about the challenge
Give the POST WHAT YOU KNOW activity card and explain the activity. Post everything you know about the design challenge on the blog platform with the help of community and facilitators.
....
Clarify your challenge
Give the CLARIFY GOAL activity card and explain the activity. Participants divide the challenge into subtopics (environment, people, process ...) following cards on the gameboard | **Activity card 1**
Gameboard
Game Card

Activity card 2
Card "wouldn't be nice if"

Activity card 3
Poster "Blog"

Activity card 4
Poster Challenge |

Table 2 – Workshop agenda – Challenge.

Tools

Activity cards

As for the previous activity, all the cards have on the front an evocative image while on the back they have the name of the activity, a brief explanation of How it takes place and Why it is important.

Activity card 1 – Wishful thinking
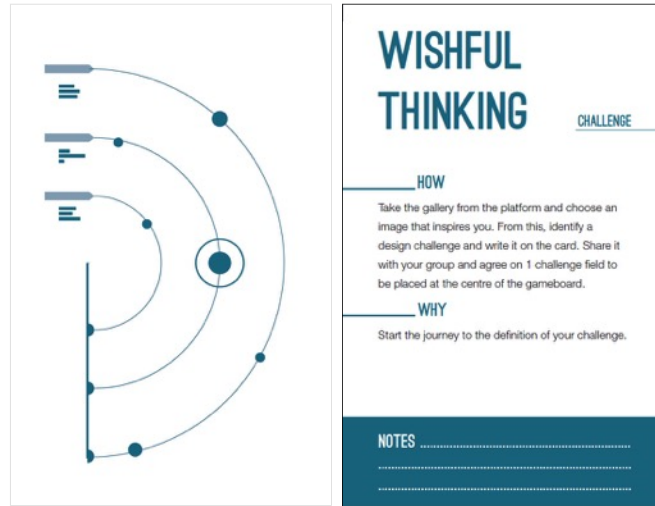
Figure 28 – Activity card: *Wishful thinking* in Challenge.

How   Take the gallery from the platform and choose an image that inspires you. Starting from this pic you have to identify an interesting field for the design challenge (write it on the card). Share with the group, select the most interesting and put it in the gameboard.

Why   Begin your journey to the definition of your challenge.

Activity card 2 – Post what you know
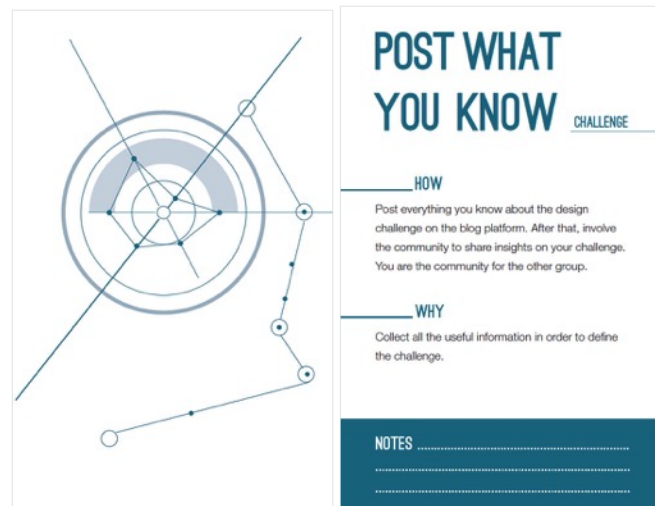
Figure 29 – Activity card: *Post what you know* in Challenge.

How   Post everything you know about the objective on the blog platform. First try to do so individually, then with the community.

Why   Collect all the useful information to define the challenge.

Activity card 3 – Clarify goal

Figure 30 – Activity card: *Clarify goal* in Challenge.

How   Simplify the goal into subtopics (environment, people, process, etc) following the info present on the gameboard cards. Finally, integrate your analysis with the help of the community.

Why   To clarify the challenge goal and define the future opportunities. If you systematically subdivide the challenge you simplify understanding it.

Activity card 4 – Writing Challenge Statement
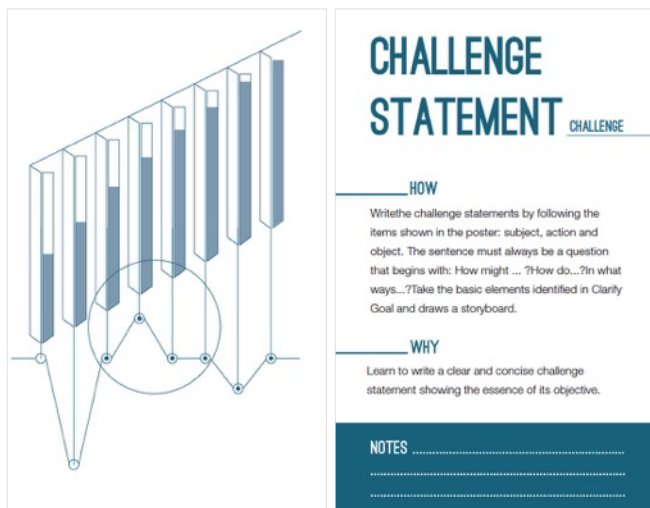
Figure 31 – Activity card: *Writing challenge statement* in Challenge.

How   Write clearly and concisely the challenge statements by following the items shown on the poster: subject, action and object. The sentence must always be a question that begins

with: How can...?, How do I...? In what ways can you...? To help take the basic elements identified in Goal Clarify and draw a Storyboard.

Why   Learn to write a clear and concise challenge statement showing the essence of its objective.

Wishful thinking card and gallery

The integration of a picture gallery with the Wishful thinking tool increases its effectiveness.

Figure 32 – Image gallery.
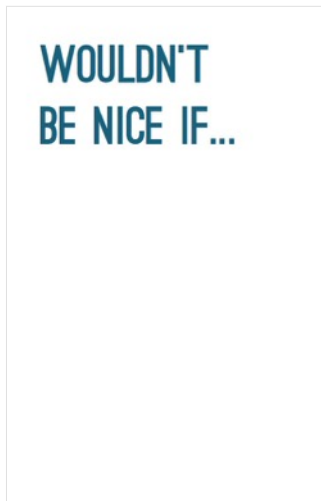
Figure 33 – "Wouldn't be nice if" card.

Write *Wouldn't be nice if ...* On a card, leaving space to let people complete the sentences.

Blog Poster
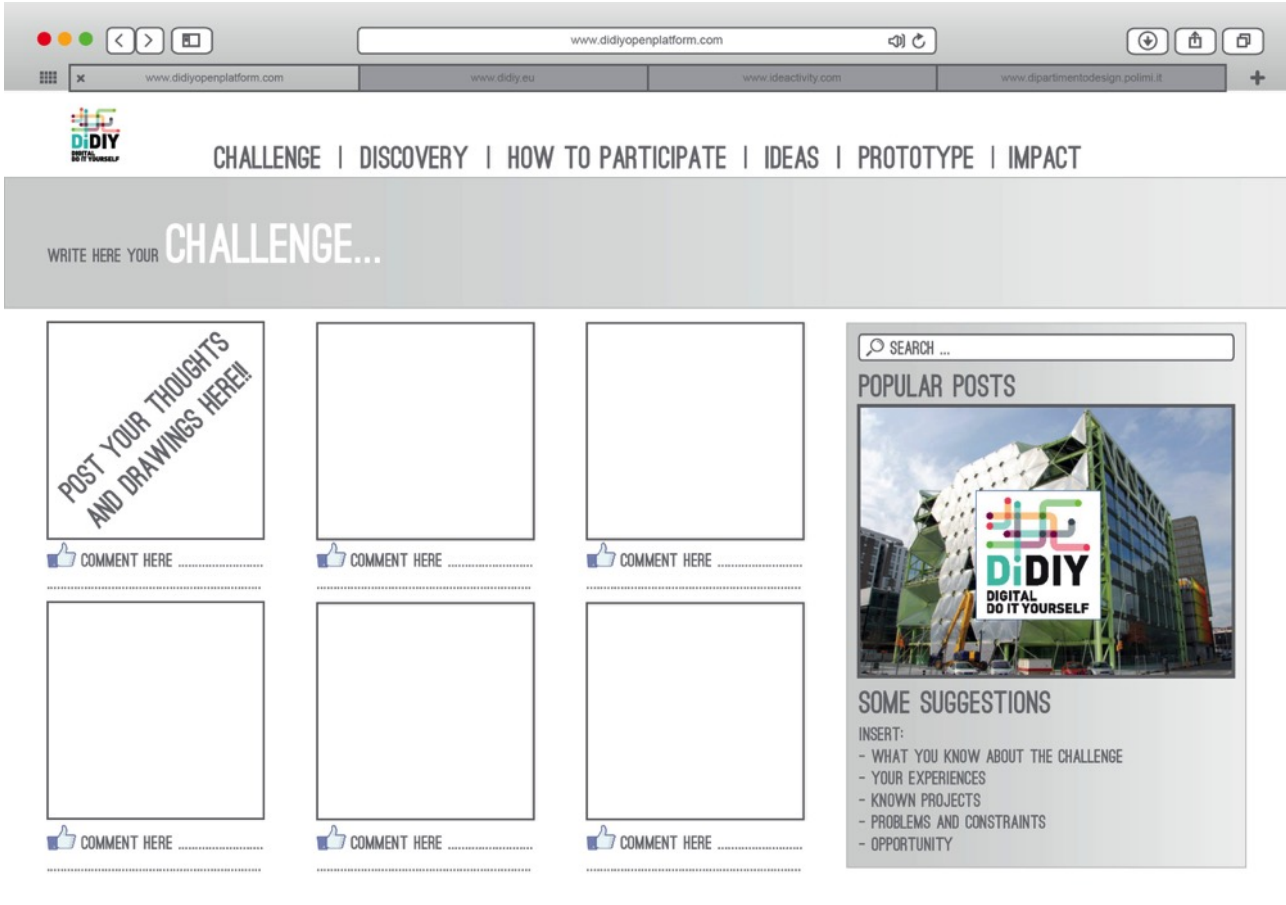
Figure 34 – Blog poster tool.

The poster of A2 dimensions has the layout of a blog, using the graphic of banners as though it were a web page. It represents a virtual noticeboard with spaces where each participant can write what they know about that challenge. At the top there is a special space to write by hand the challenge (where there is the blog grid in the picture).

There are blank boxes where people can write or stick Post-its. Under each box there are the symbol for *like* and a small space for *comments*.

On the right-hand side phrases are included to help the group.

Insert: What you know about the context; Your experiences; projects known; problems and restraints; Opportunities; etc.

Gameboard and Gameboard Cards

For this step of clarification, we decided to use both the board and the cards already used in Discovery. Many of the cards are the same as in the previous phase. Only the cards that have undergone variations are described below.

People cards
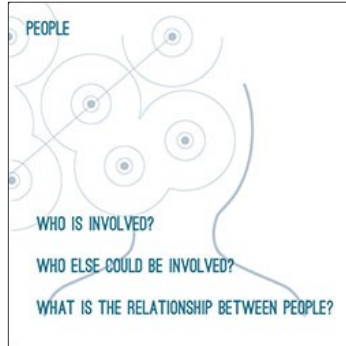
Figure 35 –F People card added for Challenge activities.

The same PEOPLE card with silhouettes bit with the following questions:
- *Who is involved in the problem?*
- *Who else could be interested?*
- *What are the interactions between the different people?*

Challenge statement poster
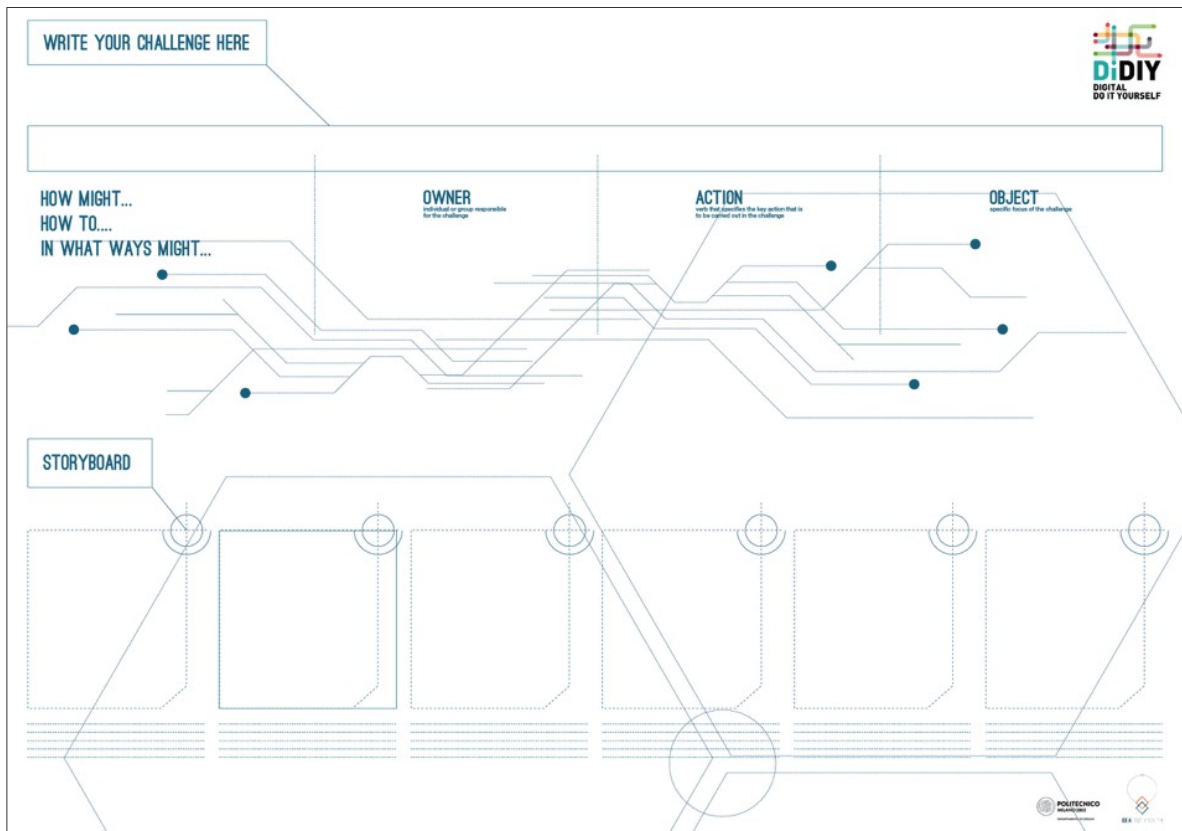
Figure 36 – Challenge statement poster. Dimensions: 70 x 100 cm.

The next step in the synthesis process is to Create Insight Statements, succinct sentences that will point the way forward. Insight statements are incredibly valuable as they'll help you frame How Might We questions and give shape and form to subsequent Brainstorms. It's not always easy to create them, and it will probably take some work editing them down to the three to five main insights that will help you drive toward solutions.

The passage from the Wishful thinking statement to a challenge statement is really difficult for those who are not designers; it is the task of the facilitators to correctly follow its development.

4.5 Generative workshop

The goal of this phase is to generate innovative ideas pertaining to the theme identified during EXPLORE. Conceptual design effectively begins once the problems have been analysed, and the opportunities defined.

The idea generation phase usually begins with creative sessions conducted by the team with regard to the theme to be investigated. This activity is carried out with support from different tools, used to stimulate creativity and generate suitable solutions consistent with the context and the goals to be achieved.

The tools used during this phase are aimed at:

- generating numerous ideas
- selecting ideas
- visualizing ideas

The goal is to generate many new solutions for the problem to be solved or the objective to be achieved. This activity has a twofold value, aiding the team both in generating ideas and in identifying which are the most interesting and hold the most potential. Using specific tools, the ideas generated during the session are captured, clustered, selected and perfected.

The participating team is pivotal in the session's positive outcome. Teams with experts in multiple fields have a much higher potential for generating ideas that encapsulate many different perspectives.

After collecting the issues identified by participants we suggested a final co-design activity. Each group is provided with a series of raw materials, with which they produced "rough prototypes" to tangibly visualize the issues identified previously through the Upload your challenge, and test the validity of the solutions suggested.

The use of tangible resources (string, cardboard, Styrofoam, scotch tape, etc) enable the involvement of participants on multiple levels and through multiple sensory perception. By manipulating and assembling materials to visualize ideas three-dimensionally, as is custom within the design process, the participants are able to assess the quality of their idea and immediately ascertain its success with the group. The workshop flow posed a creative challenge, giving way to constant reinterpretation throughout the prototyping activity in order to continually re-establish priorities and achieve a collective product.

The activity enables the groups to achieve a significantly higher quantity and quality of prototyped solutions in relation to the allotted time span.

The specific objective of the *generative workshop* is to create and construct a well-defined concept that includes the fundamental factors and which meets the challenge launched in an innovative way.

It starts from sharing knowledge and personal experience on the subject of the specific challenge selected, to then go on to building a shared scenario and the generation of ideas. Each group has 50 minutes for the generation of ideas, according to the data collected and previously shared. It then goes on to the clustering phase which makes similar ideas or ones that can be grouped together by characteristics be selected, structuring the idea, which is then implemented with the fundamental factors which resulted from all the exploratory workshops scheduled in the 4 areas investigated by the European project (education, work, legal system and creative companies).

The participants are guided by the facilitators and use methods and tools designed ad hoc which are typical of co-design and design thinking.

It is important to write down thoughts and considerations on the challenge that is being outlined, setting off from a broad perspective and gradually getting into more and more detail. It is also effective to keep visual memorandums (old sketches, photographs...) as reminders of the mental connections made throughout the evolution of the "clarify goal" process.

The production of the prototype is a tangible manifestation accessible to everyone. As a final phase, the participants are asked to present the concept, with a prototype.

The session ends, like the previous one, with a final debrief on which the feedback and the participants' sensations are collected.

Tools

Frame the Design Challenge

Figure 37 – Challenge worksheet.

Properly framing the design challenge is critical to the success. It's important to start with the question: What is the problem we're trying to solve?

To deal with the challenging step we decided to create a template to send to the participants a few days before the workshop session, complete with the challenge statement selected by the exploratory workshops. As outlined in the last paragraph, the design challenge should be short and easy to remember, a single sentence that conveys what team want to do. We often phrase these as questions which set the team up to be solution-oriented and to generate lots of ideas along the way.

Starting from the challenge statement, the participants are asked to collect ideas, search for case studies or other interesting information that could enrich and stimulate the discussion.

A worksheet in A3 format on which we made two distinct areas: What I know and Case studies in which to insert what is asked for. On the worksheet we asked:

> Gather all the useful elements to work on the challenge. You can use texts, images, symbols, etc.

> *What I know* – Gather the information you already have regarding the field of the challenge

> *Case studies* – Tell us about some interesting case studies you know that could be inspiring for the challenge.

Design Tools Collection

see *Frame the Design Challenge*

ReFrame the Design Challenge

Figure 38 – Scenario worksheet.

Properly framed design challenges allow for a variety of solutions and take into account constraints and context.

This is the first tool used during the workshop session and allows grouping all the ideas that have emerged from the participants.

The template, identical to the previous one but in the A2 format, helps the participants in the workshop phase to collect knowledge and personal experience on the subject of the challenge in order to share the same vision.

Design Tools Collection

see *Existing Knowledge, and Create Insight*

Envisioning

Making sense of the gathered data is accomplished by seeing the patterns, themes, and larger relationships between the information. This process can be messy and difficult at times, but ultimately very rewarding. Seeing the patterns and connections between the data will lead the participants quickly toward real solutions. There are several steps in order to Extract Key Insights and Create Frameworks.

Once the teams have pulled out the visions from what they heard, you can start creating opportunity areas. The process of translating insights into opportunities is about moving from the current state to envisioning future possibilities. Opportunities are the springboard for ideas and solutions.

Define the scenario in which you are moving (envisioning) or an overall vision in which you put yourselves through a collage of blank sheets. Material to be made available; pictures, newspapers etc.

Design Tools Collection

see *Collage and drawing*

Brainstorming

From the scenario the participants start to think of concrete ideas that lead to a concept. With defined opportunities, the team will shift into a generative mindset to brainstorm hundreds of solutions and rapidly make a few of them tangible through prototyping. During this phase, solutions are created with only the customer Desirability filter in mind. Brainstorming is a highly efficient technique for eliciting the generation of a great number of ideas within a short time span. The main principle of brainstorming is "suspended judgement"; indeed, the creative solutions arising from brainstorming should not initially consider an idea's viability or possible implications. In the process of Ideation, Brainstorming provides a rich approach to generating ideas about important issues that have emerged during the Immersion and Analysis phases.

It is important not to concentrate on the quality of each idea, but to strive for quantity. Every idea is potentially a good idea, and must be recorded and evaluated, selecting suitable criteria for judgement, at a later stage. This technique requires a cooperative environment in which freewheel

thought associations are encouraged. What is called cross-pollination is induced in the participants, i.e., the concept of transferring knowledge from one field to another.

Design Tools Collection

see *Brainstorming*

Bundle Ideas

After having collected many ideas, it is time to combine them in sturdy solutions. Bundling Ideas takes you from strong individual concepts to shared solutions of substance. The team have to think of it as a game of mix and match, with the end goal of putting the best parts of several ideas together to create more complex concepts. It is necessary to try different combinations; keep the best parts of some, get rid of the ones that aren't working, and consolidate the thinking into a few concepts you can start to share.

This step is followed by the voting with the three factors of design thinking which create a successful idea: what is most desirable, what is technically feasible to actually implement and how to make the solution financially viable. It is a balancing act, but one that is absolutely crucial to designing solutions that are successful and sustainable. The participants proceed with three different colours that correspond to the DT areas and carry on the idea with the most votes and a mix of factors, not the one with the most votes in absolute.

Design Tools Collection

see *Bundle Ideas and Dots*

Idea Description

Figure 39 – Idea's description worksheet.

In this converging phase which follows clustering and the selection of the idea, what has been selected has to be structured more concretely. This is an intermediate phase in which the description of the idea precedes realization through prototyping. All those elements that keep a first structuring of feasibility of the idea have to be defined. The necessary effort to briefly describe the idea and schematize it through a drawing leads the participants to reflect on the key elements that lead from the idea to the concept.

The A3 format worksheet guides the participants in rewriting and defining the idea that emerged in the phase of brainstorming.

Make Ideas Real

Prototyping is about building to think. This means creating the solution so that it can be communicated to others and making the idea better. Prototyping allows participants to quickly and cheaply make ideas tangible. Making an idea real reveals so much that mere theory cannot, this is the power of tangibility. When the goal is to get impactful social solutions, it is necessary to make them real and not just in abstraction.

According to the DIY approach people are doers, tinkerers, crafters, and builders. Building the ideas is useful for testing them, and because actually making something reveals opportunities and complexities that we'd never have guessed were there. Making is also a fantastic way to think, and it helps bring into focus the feasibility of our designs. Moreover, making an idea real is an incredibly effective way to share it.

The participants, after a first part of construction of the model, are invited to implement it through reflections on the basis of the Factors Star. They take one point of the star at a time and check, through the questions, that that fundamental element is present and well developed in their concept.

Figure 40 – Prototyping materials.

The tool used is the Creative Box

Design Tools Collection
see *Make Ideas Real, Rapid Prototyping*

Concept Description

This is a fundamental passage to clearly define the concept that has emerged and how the fundamental factors were integrated. Through reflection participants can convert tacit knowledge into explicit knowledge and improve their thinking and solutions. It helps rationalize all open thoughts, further clarifies the idea through further convergence. Lastly, the participants are asked to present their concept to the other groups.

Figure 41 – Project's description worksheet.

The A3 format template allows participants to proceed with further reflections on the idea to check that everything is coherent and defined.

5. The Workshop implementation

The section describes in detail the experiences collected from the exploratory and generative workshops, in Italy and in Spain, carried out in the Education&Research area. These experiences allowed an experimentation which led to the cumulative acquisition of knowledge.

Carrying out the process and the planned tools allowed us refine and continually improve the flow of activity and of the tools, testing the changes made each time.

The reflections which led to these changes come both from the observation of the research team in the workshop phase and from the debriefs with the participants which allowed collecting their feedback.

The section first reports the reflections made on the series of pilot workshops in which the process planned on the bases of the research carried out and on the initial background was tested. This is followed by the descriptions of the exploratory and generative workshops in the two countries.

The different workshops will be related according to the following pattern: a short introduction, the description of the flow of the different activities, the tools used and finally, the conclusive reflections which are the points taken into consideration for the refinement, completion or change of activities.

5.1 Pilot explorative series

The pilot workshops were fundamental for testing and putting into practice the hypothesis of the project described in the previous section and the flow of activities, with the relative tools and the times defined for the series of exploratory workshops.

Through this first pilot series, we wanted to evaluate not only the efficacy of the tools but also the involvement of the participants their emotional state during the activities, the times of ease or frustration, the moments of real collaboration or individual closure. There was a great deal of feedback received and many reflections were triggered off which led us to understand that the hypothesized and planned process was perfectly in line with the objectives pre-fixed to immerse the participants in the context of the DiDIY in order to identify its potential and the social repercussions, allowing them to launch a challenge to be solved together with the group. These considerations were obviously also useful for us to make the modifications necessary in order to make the flow of the session of co-design linear and smooth and all the tools used and designed ad hoc effective.

The pilot exploratory series therefore allowed refining the initial project of the planned workshops. Further modifications in the flow and in the tools are continually made during the exploratory and generative series in order to increasingly refine the tool kit being created.

A total of 3 pilot workshops were organized, two in Barcelona and one in Milan.

The description and the reflections which emerged from the pilot workshops in chronological order of taking place are shown below.

5.1.1 Pilot explorative workshop – Barcelona

The first two pilot workshops were held at the "Digital DIY Community Day Barcelona" event planned by the partners of the European project in Barcelona on 6th July 2016.

The workshops organized were:

Workshop on DiDIY&Education (EDU)

Workshop on DiDIY&Open Business Model (OBM)

Location: MediaTIC/Cibernarium, C/Roc Boronat, 117.

Length of the workshop: 10.30 a.m. - 2.00 p.m.

Participants: despite what was expected in the planning, there was no prior selection of the participants as it was an event open to the public. Experts in education, teachers, makers, designers, photographers and those interested in the subject registered for the workshop on DiDIY&Education. Technicians of FabLab, makers, representatives of crowdfunding platforms, experts in creativity and people interested in the subject registered for the workshop on DiDIY&Open Business Model.

Environment: the workshops were held in two parallel sessions in the same place. A space that was big enough to accommodate the installation of the virtual platform and the two workshop sessions was prepared, providing a dynamic, personalizable and sufficiently flexible environment to be able to adapt to the requirements of the people. The numerous participants were divided into 5 work tables. The adoption of this configuration comes from a need for facilitation of the tables and the process which requires interaction with the virtual platform.

Description of the flow of the different activities

Making use of the "Strategic Visualization" tool (see Figure 11), the facilitators started the workshop session with a general introduction.

The participants then divided into the two sessions and started the first activity "Create your Avatar" (see section 4.4.1 Discovery, paragraphs Create your Avatar). This activity, as planned, broke the ice, helping to generate a favourable climate, which encouraged the team spirit and sharing the objectives allowing them to get to know one another. The activity was also conceived to divide the participants of each session into work groups. There were two for the EDU workshop and three for the OBM workshop, made up on average of 4 participants.

The total number of facilitators which had been foreseen was five; of whom 3 experts in the IDEActivity research team and 2 selected from the partners of the Project. One of the expert facilitators acted as a supervisor for both the sessions.

The exploratory workshop, as described in the previous section, consisted of activities of analysis of DiDIY through case studies, the identification and the comprehension of fundamental elements for DiDIY to conclude with the formulation and launch of a challenge. The different activities were always launched through the specific activity cards which show how and why the activity must take place.

The first activity of analysis started through the interaction with the scenic representation of the platform. The participants of both the sessions, in groups, went to the DISCOVERY page of the platform where they found the description of the phase they were in and various brochures on the case studies selected. Each group, after having chosen one, took it to their work table. The group

analysed the case through the specific tools "Gameboard" and "Card gameboard" (see section 4.4.1).

The work table was previously prepared with: Gameboard, Card gameboard, Post-its, felt pens, small games that help to keep a creative atmosphere during the activity (tops, bells, etc).

During the analysis, the participants created connections between some aspects of the case analysed and their personal and professional experience, generating extremely interesting discussions which led to an enrichment of the contents.

This aspect is fundamental because as well as enriching and completing the contents linked to DiDIY, it increased the involvement of the participants and therefore their active participation.

The divergent phase of analysis concluded with a convergent phase of clustering through the specific tool developed in the planning phase. In the EDU session, the two work groups identified in collaboration the common fundamental elements in their respective analyses made on the case studies selected. The activity appeared hard and difficult as the participants of one table were not able to have a complete vision of the most important reflections dealt with by the other table only through the Post-Its and vice versa. In the OBM session, on the other hand, not all the groups reached the clustering phase.

In the following activity, which included the choice of a shared challenge, its clarification and the reformulation through a challenge phase, there was one again an interaction with the DiDIY open platform. The participants found, on the CHALLENGE page of the platform, the gallery of pictures they could use as inspiration for the first individual formulation of the challenge.

At this point of the process there was a separation between what happened in the two workshops. The tables in the EDU workshop were able to complete, although quickly, the whole exploratory session, carrying out all the activities foreseen but not using the tool planned for the reformulation of the challenge, whereas no table in the OBM workshop carried on after the identification of the fundamental elements.

These last activities were all done very quickly both due to the little time remaining and due to the mental fatigue of the participants who had not had the break necessary between the various activities.

As can be read in the Agenda of the workshop in Table 3 a break had been planned which necessarily had to be respected to help relax after activities which require a great cognitive commitment. Another fundamental point which was not followed, but which had been planned, was the debrief, useful for collecting immediate feedback linked to the emotional and empathic impact that were difficult to collect later.

The workshop ended without the plenary debrief phase, with the collection of individual feedback only of a few participants.

Time	Activity name	Activity description	Stuff	W.EDU	W.OBM
5	Welcome and presentation	Facilitators will welcome participants and will inform them about the different activities of the workshop helped by a strategic visualization poster. Facilitators will also introduce themselves.	Poster strategic visualization (wall)	Marita (supervisor)	
2	Let's go into the platform	Facilitators will conduct participants at the starting point of the workshop where the 1st activity (energizer) will take place.	Indicate each table with label EDU and OBM	Chiara	Wouter
15	Energizer	*Create your own Avatar! Each participant will build his/her own avatar through a collage of 7 images. This collage will show their creative thinking profile. (stress that is an attitude and all profile is important in the design process) *Facilitators give username tag according to the predominant colours *Each participant will introduce himself/herself at the group through the avatar.	Poster personality (w) Evocative image (table) Username Tag (t)	Carmen Chiara Carmen	Beppe Wouter Beppe
3	Log In	Once created the avatar, the participants can Log into the platform. Give the first activity card ANALISYS (Discovery)	Bell Activity CARD	Chiara Carmen	Wouter Beppe
70 (10.55) .... 20 .... 25 25	DISCOVERY DiDIY	OBJECTIVE: Through this activity, participants can highlight the potential, benefits and innovative features of DiDIY through the analysis of pre-selected best practices. The activities has 3 steps: .... * DiDIY best practice ANALYSIS Participants have to read and analyse the best practice brochure and then write the project objective in the centre of the gameboard. .... * DiDIY best practice MAPPING Give the activity card MAPPING and explain the activity. Participants identify the key people, technologies and elements in the best practice with the help cards. .... * Reflection on benefits and DiDIY innovative features Give the activity card IMPACT and explain the activity. Participants reflect on the results and benefits generated by the best practice. They write on post-it and put on the board. Facilitators guide this activity.	Gameboard (t) Game Card (t) Coloured Post it (t) Colour felt pens (t) Activity CARD Activity CARD	Carmen Chiara Carmen Carmen Chiara	Beppe Wouter Beppe Beppe Wouter
25 (12.05)	CLUSTER	OBJECTIVE: Through the cluster activity participant will understand the fundamental elements of digital making to be considering for the launch of a new challenge.	Tech flower poster (w)		

Table 3 – Detailed agenda of the facilitators.

Tools

In this paragraph, we have decided not to replicate the description of the individual tools already present in the previous section on the planning of the workshops, but to show for each of them only and exclusively the reflections that emerged from the experience of the pilot workshop.

Strategic Visualization – see Figure 11

The presentation through the "strategic visualization" poster, having references to tools that the participants had not yet seen was not understood. The poster, which was to be a point of reference for the participants, due to the lack of time, was not consulted during the activities. This necessarily leads to a reconsideration.

Create your Avatar – see section 4.4.1, paragraph "Create your Avatar"

The activity found great consensus and curiosity with the participants who, despite the presence of posters of explanation hanging in correspondence with the areas with the EDU and OBM work tables, asked for further explanation. The time used was therefore much higher than planned. This first activity which had been thought of exclusively for warming up and division of the groups has to be planned with adequate times.

Discovery activity cards – see section 4.4.1, paragraph "Activity cards"

The division into Analyse, Mapping and Reflects is not important for the purposes of the analysis and the introduction of the "Reflect" card introduces an element of interruption into the creative flow of the participants.

Gameboard – see section 4.4.1, paragraphs "Gameboard"

The gameboard is so full of information that it appears visually chaotic. It does not give the idea of being a support to complete and enrich and the participants were reluctant to stick their Post-Its on it. The cards linked to the individual areas and those of Help, positioned in the specific spaces obtained on the gameboard, occupied the work space, not allowing it to be fully exploited.

The item "objective" as a starting point of the analysis generated confusion and discussion amongst the participants who were unable to identify a shared objective. The absence of a clear distinction between the three main areas to be analysed, generated at some moments frustration in the participants who were unable to understand its purpose.

The three levels of interpreting the phenomenon represented on the gameboard, deriving from literature (see research model in Introduction) and that should have facilitated reflections, were not taken into consideration by the participants. The model we structured is conceptually too complex for it to be a useful tool in co-design sessions.

Gameboard cards – see section 4.4.1, paragraphs "Gameboard cards"

People cards. The cards conceived to be filled in on the front and back made the participants complete them slavishly, wasting a lot of time and taking it from the analysis of the other areas.

Key factor cards. Those relative to the technologies were used as a prompt but without having been filled in on the back, as requested.

The cards with stimulus questions for the discussion led the participants to reflect on the impacts of the case study and not on the individual key elements without which a project could not exist. A reformulation which allows separating these two phases is therefore necessary.

Impact cards. Some questions turned out to be complex or difficult to understand. From the workshop, there emerged reflections on some areas that had not been covered which we deemed opportune to include and implement in the next version of the impact cards.

Case study – see section 4.4.1, paragraphs "Case study"

The very attractive and high impact large poster turned out, during use, to be cumbersome and difficult to handle. At some tables, when consultation was slow and frustrating for some, the facilitator related the case starting discussion. Only one of the groups visualized the multimedia content through the QR code. The choice of the case studies was a reason for discussion in the groups due to the fact that we had not shared the criteria with which they had been selected.

Changing the format of the brochure and implementing the use of the multimedia contents would definitely encourage interaction and acquiring the information necessary is a short period of time.

Technological Star Poster – see section 4.4.1, paragraphs "Technological Star Poster"

The tool works and did not undergo any substantial modifications during the workshops, except some graphic adjustments.

Challenge activity cards – see section 4.4.2, paragraph "Activity cards"

The Challenge activity cards were not used during the session.

Wishful thinking cards and gallery – see section 4.4.2

The tool was used only in the EDU workshop. The integration of a picture gallery with the Wishful Thinking tool increased its effectiveness. During the workshop it was observed that the tool worked better with people more involved in the area investigated (e.g., teachers).

Blog Poster – see section 4.4.2, paragraph "Blog Poster"

The poster copies the layout of a blog but, as it is more designed and defined, does not give the idea of being a support to be completed and enriched and in fact the participants were reluctant to stick their Post-Its on it.

Challenge statement poster – see section 4.4.2

The tool was used only partially to reformulate the challenge sentence. Not many reflections could be collected. The participants did not clearly understand the passage from the Wishful Thinking sentence to the challenge sentence.

Summary reflections

We decided to collect in a conclusive paragraph all the *learning* and *warnings* that had emerged from the integration of the reflections made both on the flow and on the tools. To foster the clarity and interpretation of all the input that will have a repercussion on subsequent implementations, it seems opportune to list them by points. In this paragraph, only the indications useful for refining the process and the tools, but not the solutions adopted, will be described.

The following emerged:

I. The objectives and the methods of the workshop have to be explained clearly to the participants at the start of the activity. As the objective was not reached with the Strategic Visualization, we have therefore decided to modify the method of presentation at the following sessions.

II. The experimentation of parallel sessions of workshops with different topics, the groups of which hypothetically should have been able to form the project community of one another, did not bring the advantages such as to consider it a standard method.

III. For the purposes of the success of the activities, an expert facilitator has to be present at each work table to involve and continuously stimulate the participants during the workshop. The expert facilitator is the person who knows the specific objective very well, the subject discussed and the process to be followed, and therefore is able to guide the reflections and converge towards a result. The presence of a single expert facilitator overseeing several tables conditioned the results. To the point that where the expert facilitators were not present continuously, the objective was not reached.

IV. The groups made up of 4-5 people were able to dialogue well, generating results further in-depth, if formed, as hypothesized, by a mix of profiles including at least one expert of DiDIY and experts linked to the specific area of the workshop.

V. The "Create your Avatar" which had a positive result amongst the participants has to be recalibrated as a useful and significant activity for the work of the group, therefore giving it a worthier space. It was discovered that some participants, especially teachers and educators, use similar tests to form work groups in their professional environment.

VI. The activities cards were given out at the start of each step then the participants quickly put them to one side even though they had not understood the task. The further explanation was given by the facilitator not only for the activities but also for the specific tool to be used. The participants preferred to rely on the human contact with the facilitator, not fully understanding the value of the cards.

VII. During the phase of analysis there were moments when the participants felt lost compared to the sequence of tools and their use. It becomes important to try and define the rules of interaction between the participants and tools that must not interrupt the flow of communication between people.

VIII. Only one group of the pilot workshop used their own devices to access the multimedia contents connected by the QR code printed on the brochure of the case study (see section on tools – case studies).

IX. Clustering, despite the difficult passage from individual group analysis to collaborative classification, led to interesting results. One critical point is the lack of participation by all those in the group. The motivations are probably to be found in the profiles of the people involved in the analysis and the length and accuracy with which it was carried out. It is fundamental that the contribution is really collective for the wealth of details and for the different facets to emerge, therefore this will be carefully taken into consideration. Managing the group dynamics will become one of the Tips in the guidelines.

X. Apart from the analysis, no other activity allowed open discussion on the topics linked to EDU or OBM. It was noticed however how the people were far more collaborative if asked to produce knowledge in the first person. As a consequence, this led us to reflect on the inclusion of an activity dedicated to discussion and sharing in the subsequent sessions of workshops.

XI. The participants must be informed on the criteria (*see section 4.4.1, paragraph "Case study"*) according to which the case studies were selected that do not claim to be the best or the most significant in absolute.

XII. The interaction with the platform did not generate the type of fundamental physical and emotive involvement that we hoped for the participants. The freedom to explore the platform did not allow the participants to grasp its peculiar aspects. The process was not recognized, nor that specific steps exist corresponding to the pages of the platform. Seeing it was also difficult with moments of maximum affluence during the selection of the case study and the gallery of inspiration. It is therefore necessary to simplify the information and interactions, implementing the immersive experience.

XIII. The need to compact into half a day, the time available during the Community Day, a workshop planned to take a whole day showed that the hypothesis made is correct. The time was insufficient to carry out the planned activities and therefore to reach the objectives established by the exploratory workshop. It is therefore important to keep the planned length of the various activities, also according to the quality of the results that are to be obtained.

XIV. During the co-design session, not having initially shared the rules of conduct, the participants often used mobile phones, causing the interruption of the creative flow and moments of distraction. The rules of the day establishing during the planning and distributed in the environment have to be shared with the participants before starting the session. They have to be proposed as suggestions to keep the creative and collaborative atmosphere high throughout the whole duration of the workshop.

XV. The workshop is also very challenging for the participants, it requires great reflection and concentration. The inclusion of intermediate breaks and activities such as team-building and energizing to reactivate the energy and rest the mind is fundamental.

5.1.2 Pilot explorative workshop – Milan

The third pilot workshop was organized in Milan on 1st August 2016 with the intention of testing the updated activities and the tools on the basis of the reflections that had emerged from the pilot workshop in Barcelona. It was decided to organize this pilot session with designers, linked professionally with the environment of DiDIY, to collect feedback and project-building ideas on the flow of the workshop and on the tools created.

The workshop organized was:

Workshop on DiDIY&Design

Location: Polifactory – Campus Bovisa - Politecnico di Milano. Via Privata Schiaffino 22-30 Edificio B3

Length of the workshop: 10.00 a.m. – 5.00 p.m. (6 hours)

Participants: the participants were selected from colleagues of the Politecnico and external professionals. At the workshop on DiDIY&Design, the participants were designers expert in DIDIY, designers who use digital technologies to prototype and quickly test their ideas, and freelance designers.

Environment: The workshops were held in an area of the open space of PoliFactory, the makerspace – fab lab of the Politecnico di Milano. The space has 3 rooms equipped with digital technologies (3D printers, laser cutters, CNC milling machines…) a kitchen, an area for relaxation, an area with work tables and a free area that was prepared ad hoc for the workshop.

Description of the flow of the different activities

Like the previous ones, the workshop starts with a general introduction by the facilitators but without the aid of the Strategic Visualization.

The participants immediately started the first activity "Create your Avatar", but completed it with a moment of "Log in" when, once they had become avatars, they entered the platform one by one accompanied by the sound of a bell.

To foster the immersion into the context, in this workshop we anticipated the interaction of the participants with the installation, creating a dedicated time when they had time to observe, read and understand the various sections in the platform.

Two groups are formed on the basis of the profiles identified through the Foursight, each one made up of 3 participants. An expert facilitator of the research group facilitates each table.

In this pilot session, in addition to the Gameboard, the Gameboard Cards, Post-Its, felt tip pens and small games, the participants also found the case study and a tablet to foster looking up the necessary information.

Unlike the previous workshop, having made changes to the gameboard and to the arrangement of the cards, positioned in special boxes with compartments, the work tables looked tidier.

Consultation of the case studies, as well as on paper, was also accompanied by digital consultation, with access easier through the tablets available on the work tables.

The different activities are always preceded by the specific Activity cards but which have been changed in relation to the changes of flow of the workshop (see section on tools – activity cards).

As well as having simplified and united the sequence of actions planned in the phase of analysis of the case (see section on tools – activity cards analysis and mapping) a brainstorming session was also included after the clustering phase.

The idea of including a specific brainstorming session on the area investigated in the workshop (in this case DiDIY&Design) comes from the desire to involve the participants more in the theme they were asked to take part in (see point X of the paragraph Summary reflections – Pilot workshop, Barcelona). Specifically, the brainstorming investigated with the participants how DiDIY modifies the role of the professional designer, at a time when everyone has the possibilities and the tools to design.

The workshop ended without having done the activities planned to clarify and launch the challenge, due to a lack of time and the excessive tiredness of the participants, but with a result of enormous value. The little time and the tiredness were generated by a continuous solicitation of the participants, by us, to reflect on the interaction with the tools they were using, on the experiential level of the individual moments and on their involvement as designers.

The research group made a last debrief in a plenary session at the end of the day to collect feedback and project-building ideas with respect to the installation, the flow and the tools.

Tools

In this section, only the tools that were implemented with respect to the indications of the previous pilot workshop are described.

Discovery activity cards

Analyse&Mapping
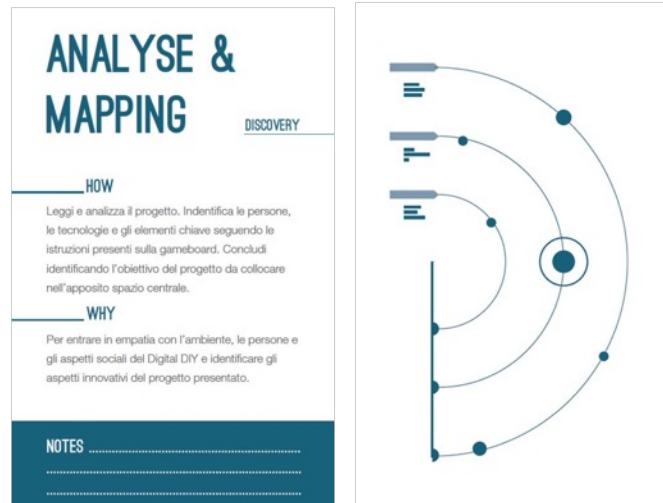
Figure 42 – Analyse&Mapping activity card. Front and back side.

How   Read and analyse the project. Identify the people, the key components and the impacts, following the instructions on the gameboard. Conclude identifying the project objective and place it in the designated central area.

Why   To enter into empathy with the context of DiDIY and identify the main aspects of the project presented.

Input

This card combines the activities of the three Discovery cards (*see section 4.4.1, paragraph "Activity cards"*). The participants read and analysed the case study without interruptions, using the tools prepared for this specific activity of analysis.

Gameboard

Figure 43 – Gameboard_v1. Dimension: 70 x 100 cm.

The gameboard presents a visual simplification of the work surface, the lines are lightened and blank parts have been left for the reflections of the participants. It has been enlarged from a dimension of 60x60 cm to 70x100 cm.

The three areas have been characterized by different colours and the cards have been put into special containers as shown in the photo page 109. The central care in which the objective is shown is kept but used as the final part of the Discovery activity, see activity card *Analyse&Mapping*

Input

The descriptions of the People, Key Factors and Impact areas integrated on the gameboard were superfluous for the purpose of performing the activities. The three levels of interpreting the phenomenon of DiDIY shown on the gameboard were not noticed by the participants in this case either. The item objective as the conclusive point of the analysis produced a wring result as it devalued the analysis and the deconstruction of the case that had just been made. It is important to create the instructions of the gameboard in the next version.

Gameboard cards

The cards, which are all of the dimension 9x9 cm, have been simplified graphically and aligned with the graphics of the gameboard_v1.

People card
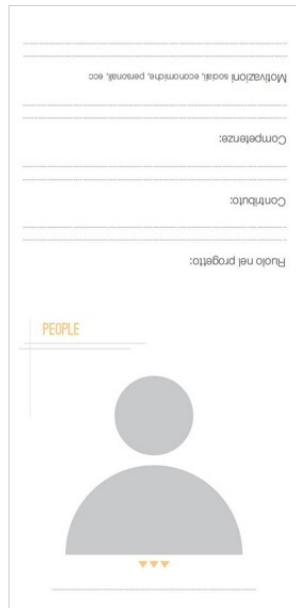
Figure 44 – People Card_v1. Dimension: 9 x 18 cm. Foldable.

Compilation on the front and back remains unchanged although, folded in half, the card takes on a vertical configuration to recall a pawn.

Input

During the session, the participants did not fill in the cards and did not even use them as pawns. The participants wrote directly on the Post-its. As these were the only cards to be filled in that were left, the most correct choice is probably to transform them into aid cards with questions.

Key factors card

Figure 45 – Key factors technology cards_v1.

The two types of cards in the pack have been changed as follows. The description of the cards on the technologies was kept on the front, while a specific question was put on the back: *What does the use of this technology allow in the case study? (*Figure 45)
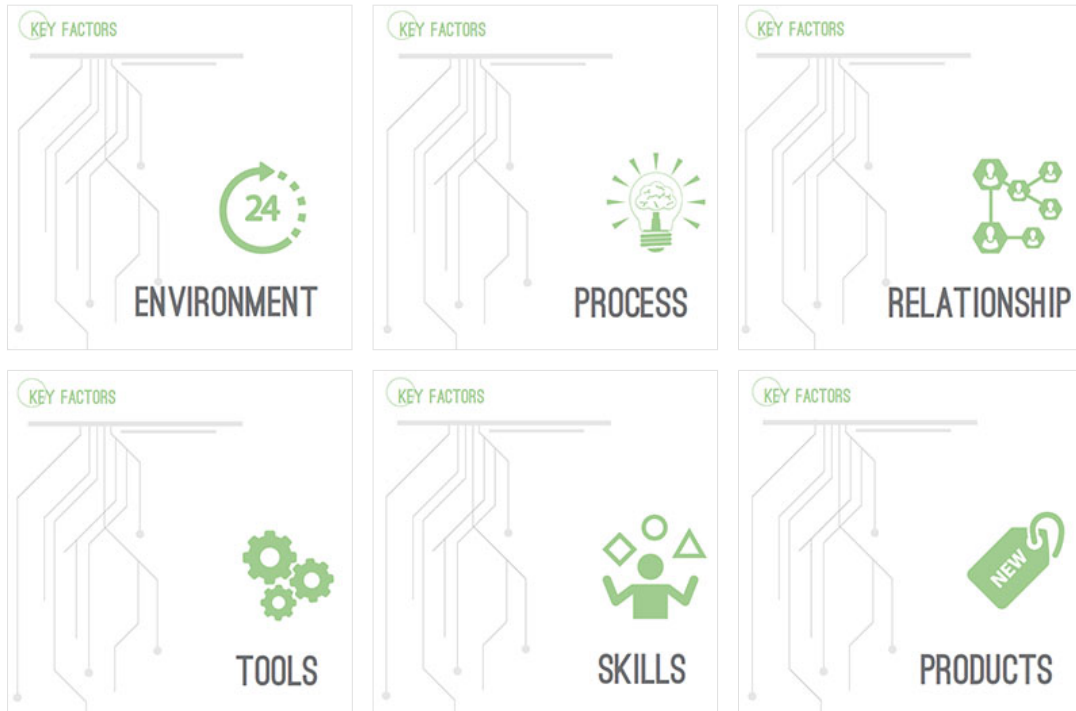
Figure 46 – Key factors cards_v1.

The key factors cards show exclusively the categories on which to reflect without asking specific questions (Figure 46).

Input

The categories without questions did not provide any help or stimuli for reflection to the participants.

Impact card

Figure 47 – Impact cards_v1.

The impact card only change their graphics to adapt to the gameboard visual style. The questions on the back remain the same.

Case studies
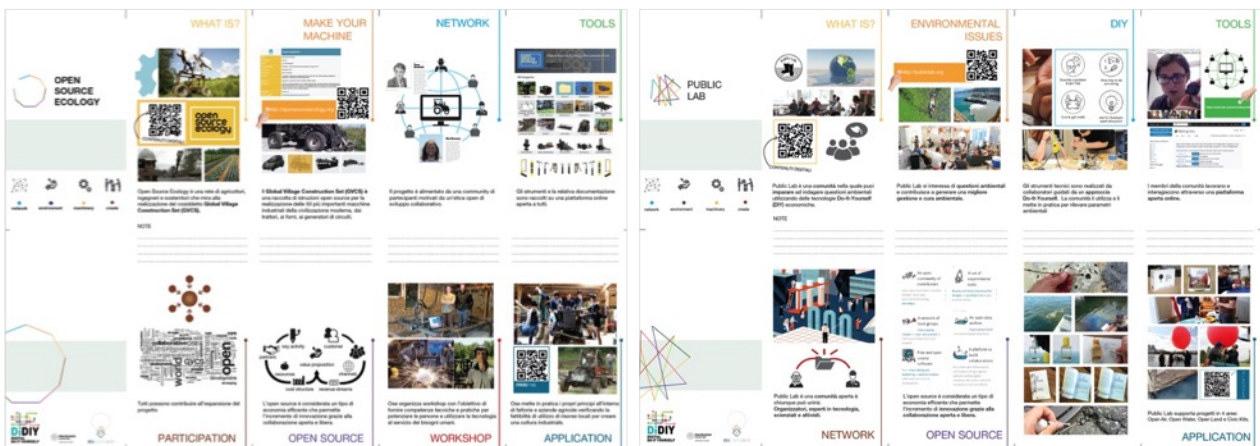
Figure 48 – "Open source ecology" (left) and "Public Lab" (right) brochures. A3 size folded like a wallet.

The poster was reduced in size to make it easier to consult. A multimedia presentation accompanied, supported and enriched the case study. Created using the Microsoft Sway program, pictures, key words and in-depth videos were collected.

Open source Ecology https://sway.com/SBSlWNiSTuiPfTPN

Public Lab https://sway.com/q9u5tUKXUo1s7q1w

Input

In a smaller size, it lost its value as a facilitator tool because it was too small. The need was felt to differentiate the case studies, adding one for each area. The presentation allowed going into some aspects of the case in depth or understanding more quickly through pictures and key words the points on which to reflect.

Summary reflections

As for the previous pilot workshop, only the indications useful to implement the process and the tools will be described.

The following emerged:

I. Opt for a space were the participants can get to know and see from close up the digital technologies of production and come into contact with people who work and collaborate with the research centre is definitely an asset. The kitchen and the area for relaxation allow spending the times of the various breaks of the day in an environment other than that of work. The only difficulty identified, but which is an added value, is linked to the lack of dividers to isolate the area where the workshop is being held from the other areas of work used by researchers and students. It is therefore decided to hold all the workshops in these facilities of POLIMI and to identify a corresponding one in Barcelona.

II. The oral presentation, as was foreseeable, was not incisive as the participants did not have the possibility to elaborate and visually process the information on the objective of the workshop session. Preparing a video presentation to screen on the European project, the role of the research team with the objectives to be reached, the description of the objectives of the workshop and the activities of the day could be the right compromise to give the initial basic information for gradual comprehension.

III. The rules of the day that everyone has to know and respect in order to keep a creative and collaborative atmosphere were shared at the beginning.

IV. Although each participant had the time to interact with the platform, carefully observing the different pages and the design process marked on the carpet, the participants, due to the overload of information did not clearly identify the relationship between activities, process and tools. Before starting with the exploratory workshops, changes have to be made by making the platform become the point of reference for the flow of the workshop, for the change of activity and the steps of the process. With respect to the project-building path, the various techniques used to create the tools in correspondence with the pages of the platform on which the tools are used must also be highlighted.

V. The Log In moment included gives value to the "Create your Avatar" activity therefore it could be interesting to create in the exploratory workshops a real Log In Centre alongside

the platform in which to distribute the labels with the profiles and an explanation of the resulting profile is given.

VI.   The combination of paper and digital material for reading the case study allowed creating methods of consultation that meet the different types of users, and therefore those who prefer collaborative learning made easier by the poster and those who prefer individual learning helped by the digital presentation. Tablets and computers were therefore put at the disposal of the participants to make access easier to the multimedia contents.

VII.   The three levels of interpreting the DiDIY phenomenon represented on the gameboard were not noticed by the participants in this case either. It was decided to eliminate them in the next version.

VIII.   Some questions of the Gameboard cards are formulated in such a way as to have a single and direct question. These questions have to be reworded so that they generate open reflections and do not block the flow.

IX.   The clustering took place in two different times as one group was slower than the other in the analysis. Collaborative clustering was simpler as the group had already been able to reflect on the concepts that had emerged during the analysis. The decision was taken for the exploratory workshops to include a double passage of clustering, first individual inside the group and then shared between the various groups.

X.   The brainstorming activity included worked fairly well even though the participants did not feel very involved in the subject. This reflection is fundamental as it drove us to make targeted invitations to people with skills and knowledge closely linked to the themes of the various workshops. It also made us reflect on the importance of preparing and stimulating the participants with specific material relative to the theme of the brainstorming. With the inclusion of the brainstorming, the times dedicated to each of the activities performed has to be divided into new modules.

XI.   To allow the participants to arrive prepared at the workshop, it was decided to activate a web channel of sharing, where to include useful information, case studies, interesting websites and presentations. The participants can both consult and upload material inherent to the thematic area for which they have been invited to participate. The channel could represent the point of reference for the participants in the workshop before, during and after the co-design session (see section 5.3).

XII.   The Challenge activity necessarily has to be shortened and simplified conceptually to lighten the participants during the final flow of the workshop.

5.2 Explorative workshop in DiDIY&Education – Milan

See flow description in section 6.

Tools

In this section, only the tools that were implemented with respect to the indications of the previous pilot workshops are described.

Discovery Activity cards

The activity cards have been changed based on the feedback collected at the previous workshop and also in relation to the fact that the activity no longer starts with the objective. They have been changed as follows.

Analyse

Figure 49 – Analyse activity card. Front and back side.

How   Read and analyse the case study. Identify the people, the key components and the impacts, using cards and the gameboard.

Why   To enter into empathy with the context of DiDIY and identify the main aspects of the case study presented

Bundle
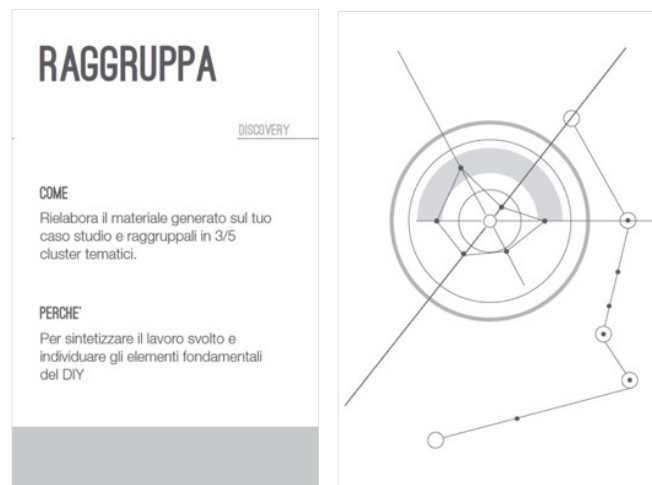
Figure 50 – Bundle activity card. Front and back side.

How   Rework the material generated on your case study and group it together in 3/5 thematic clusters.

Why   To summarize the work done and identify the fundamental elements of DiDIY

Share and negotiate

Figure 51 – Share&Negotiate activity card. Front and back side.

How   Share the clusters identified and negotiate with the other participants the significant factors for the area of reference

Why   To define the fundamental elements of DiDIY to be considered in the launch of a new challenge in the specific are of reference

Input

The Discovery activity cards have reached their definitive configuration

Challenge activity cards

Construct
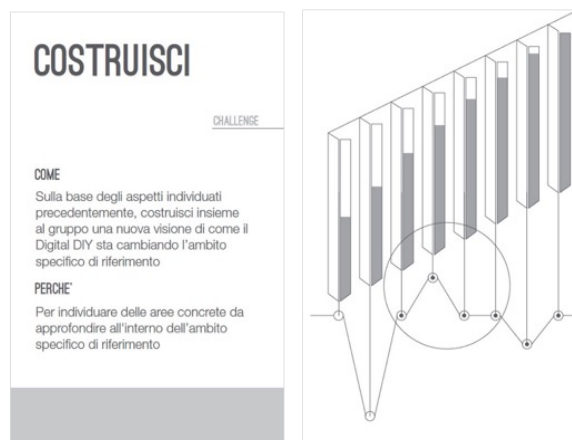
Figure 52 – Construct activity card. Front and back side.

How   On the basis of the aspects previously identified, construct with the group a new vision of how DiDIY is changing your area of reference

Why   To identify concrete areas to be studied in depth in your area of reference

Launch a challenge

Figure 53 – Launch a challenge activity card. Front and back side.

How   Identify and select a particular interesting aspect to study in greater depth and on which to launch a challenge

Why   To start together with your team a project relative to DiDIY which brings a benefit to your area of reference

Input

The Construct activity will be eliminated in the subsequent workshops

Gameboard

Figure 54 – Gameboard_v2. Dimension: 70 x 100 cm.

The dimensions of the poster 70 x 100 cm are kept and it is stuck on a Poliplat support which makes the tool a real gameboard on which to work. Compared to the previous workshop changes have been made in the graphics and the content. The gameboard has been simplified and completed with instructions for use. Both the objective placed at the centre as no longer functional for the purposes of the analysis of the case study and the representation of the three levels of DiDIY, because it was difficult to understand for the participants, have been eliminated. The descriptions of the areas have been revised to improve their efficiency.

Input

Simplified this way, the gameboard has correctly performed its function of support for the analysis, reaching its definitive configuration.

Gameboard cards

People cards

Figure 55 – People cards_v2. Front side.

People cards_v2. The cards have been revised and changed to standardize them with the other two types: on the front, in addition to the name there is a description of the area to which it is linked, People. On the back, a question or a stimulus to help the participants reflect.

The list of cards with name and question is as follows:

ACTORS: Who is involved in the case study?

ROLES: What are the roles of the people involved?

RELATIONSHIP: What are the relationships among the people involved?

MOTIVATIONS: What are the motivations that drive the people involved?

BENEFICIARIES: Who are the further beneficiaries of the case study?

OTHER: What other aspects related to the people are important to point out?

Input

Difficulty in keeping the first three questions separate. They will be united on a single card in the subsequent version

Key components cards

Figure 56 – Key components cards_v2. Front side.

These cards have also been standardized to the others, the questions are wholly reworded.

The list of cards with name and question is as follows:

ACTIVITIES: What are the key activities that enable the happening of the case study?

TOOLS: What other tools are used in the case study?

WORK ENVIRONMENTS: What are the physical and virtual environments where the case study takes place?

COMPETENCES: What are the competences that are used in the case study (technical, creative, behavioural,...)?

OTHER: Which other key components are important to point out?

Figure 57 – Key components technology cards_v2. Front side.

Input

Some questions are still complex, therefore they are to be implemented in the subsequent version.

Impact cards

Figure 58 – Impact_v2 cards. Front side.

Like the previous ones, the Impact cards have also been changed and the questions reworded. The intention is to provide ideas for reflection and not questions to which the participants have to give a specific answer.

The list of cards with name and question is as follows:

NEW WORKING ENVIRONMENT: Reflect on the impacts generated by working in the physical and virtual environments of the case study

NEW WAYS OF WORKING: Reflect on what new ways of working are triggered by the case study, in relationship to the physical and virtual environment where the work takes place. (e.g., decentralisation of production sites, promotion of collective work, etc)

NEW WAYS OF THINKING: Reflect on what new ways of thinking are enabled by the case study (e.g., stimulation of creativity, stimulation of the community, etc)

NEW WAYS OF LEARNING: Reflect on what new ways of learning are enabled by the case study (e.g., individual learning, collaborative learning, learning by doing, etc)

NEW COMPETENCES: Reflect on how the competences put in place impact the person

NEW PRODUCTS: Reflect on the new ways of using the products (physical or not) made in the case study

NEW MARKETS AND BUSINESS MODELS: Reflect on the business opportunities opened up by the case study. Reflect on the new business models opened up by the case study

NEW RELATIONSHIPS: Reflect on how the new relationships in the case study impact on the person and on the community

NEW SOCIAL EFFECTS: Reflect on the effects that the case study has on society (e.g., social inclusion, sharing of knowledge, democratization, customization of products, etc)

NEW LEGAL AND ETHICAL ASPECTS: Reflect on the legal aspects opened up by the case study. Reflect on the ethical aspects opened up by the case study. What other impacts does the case study generate?

Input

Some questions are to be implemented in the next version

Case studies
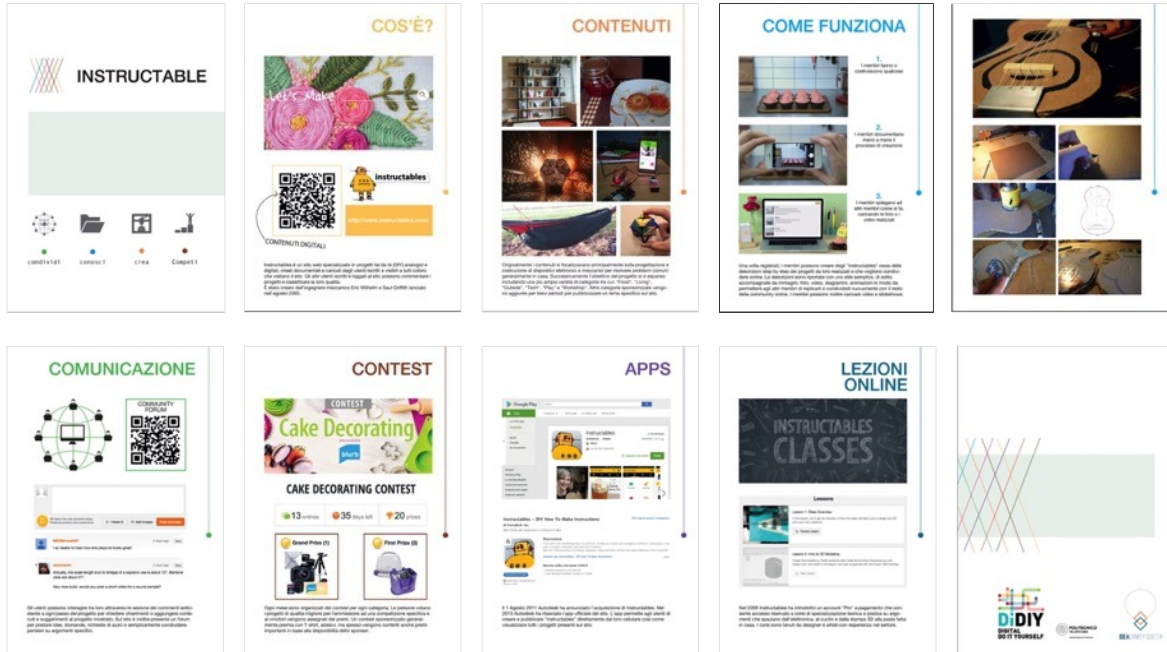
Figure 59 – Best practice_v2.1. Pages of the "Istructables" spiral-bound A4 booklet.

A solution of spiral-bound A4 size booklets was opted for, thinking of creating a more consistent and therefore more functional product for the participants.

Instructables: https://sway.com/93G5ERhlqiCh5WCS.

Input

The overall view of all the elements of the case has been lost: individually they are simple and less significant. The case study is thus excessively simplified which invalidates the effectiveness of the tool. The case studies become 4: the Instructables case is added. The multimedia presentation with Sway was also provided in this case, consulted using the tablets and computers made available.

Technological Star Poster
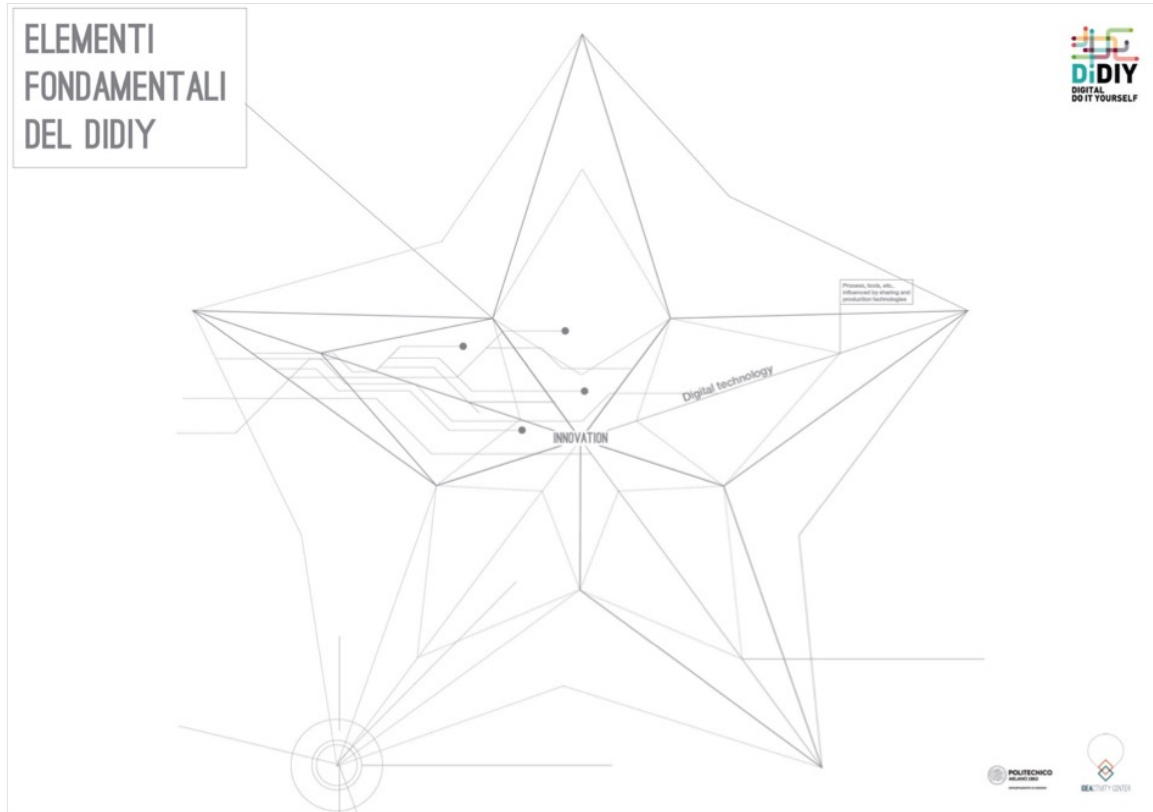
Figure 60 – Technological star poster.

The poster has been changed graphically in order to adapt it to the graphic layout of the remainder.

Blog slack – #education channel

Slack is a group chat in which information, articles, videos and case studies specific for the theme of DiDIY & Education are collected. The participants can consult the material uploaded before the workshop to become familiar with the themes that will be dealt with.

The participants are also invited to contribute actively by posting their experiences, expressing their opinions and sharing their knowledge with the other participants. The blog aims to be a point of reference before, during and after the workshop to create a container of know-how achieved "by" and "with" the actors who are actively engaged in the change. The challenges that emerged in the workshop sessions have been uploaded on to the slack channel to give the participants the chance to clarify the challenge and generate ideas before the generative workshop.

Input

Only a few participants commented on the challenges that emerged, adding contents. The reflections that originated are linked to the need to keep a community of people active through actions that can stimulate participation.

Summary Reflections

As for the previous pilot workshops, only the indications useful to implement the process and the tools will be described.

The following emerged:

I. The involvement of expert figures in the field of digital making together with professionals of the education area for the formation of the work tables with multidisciplinary skills linked to the themes of the project was the ideal choice for the generation of rich and interesting discussions.

II. The video presentation was more incisive but the participants at the end of the day did not understand the objective of the workshop in full. The cause is due to the overload of information given to the participants and which made them lose the focus of the day.

III. The elements to be sacrificed include the story of the installation and the presentation of the results reached by the partners in the specific area. This last moment totally interrupted the flow of thoughts of the participants who found it hard to resume the open talk activity.

IV. "Create your Avatar" and the Log in Centre obtained positive feedback, reaching their definitive configuration.

V. The Instructions or Rules of the game were not respected by all the work tables. The participants found it hard to write on the Post—Its and unfortunately some of the reasoning were not recorded. The facilitators helped the groups in transcribing the information.

VI. The groups carried on the analysis using the board cards and the facilitators pushed the participants to reflect and to create connections with their personal and professional experience, obtaining very positive feedback. These stimuli increased the level of involvement and the active participation but above all generated results with specific nuances for the education area (see section 6).

VII. The Discovery activity requires a great deal of time to be developed correctly and to obtain the results desired. The cards, even though used sequentially or randomly, depending on the facilitator, are nevertheless the starting point of reflections and flows of thoughts. Their use is therefore deemed fundamental.

VIII. Clustering has to be carefully explained and with examples so that the participants can understand the meaning of the activity and of the Technological Star Poster tool.

IX. The common clustering is very difficult both due to the difficulty in finding a shared vision of the factors and due to the complexity of describing each factor in an accurate way. This phase generated heated debate among the participants on the themes linked to DiDIY and education. During these discussions, the facilitators were able to identify and extrapolate at the time various issues that could be transcribed as challenge sentences. Eliminating the open talk and wishful thinking activity, uniting the clustering phase with the identification and launch of the challenges could be the right strategy to simplify these phases.

X. The open talk activity seemed redundant and therefore did not work very well because the discussions had already emerged in the clustering phase.

5.3 Generative workshop in DiDIY&Education – Milan

See flow description in section 6.

Tools

Factors star
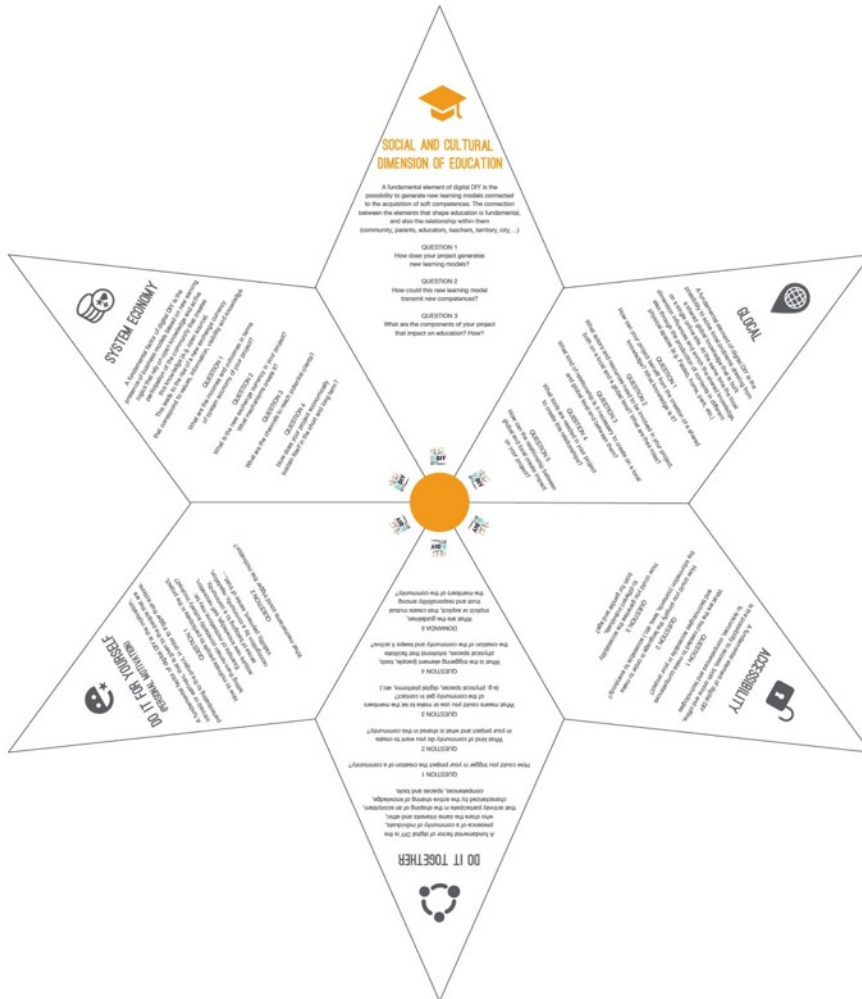
Figure 61 – DiDIY&Education factors star.

The description of some factors was not easily comprehensible, therefore simplification is necessary.

Brainstorming cards

Figure 62 – Brainstorming cards.

Blank cards have been prepared to fill in according to the three categories shown below. The participants were asked to fill in the cards before the brainstorming and they were used randomly during the generation of ideas.

PILLS OF INNOVATION: indicates an innovative aspect linked to a service or a product that has struck you

FIGURE: indicates a commonly recognized figure who is an inspiration to you

ANECDOTE: think of an anecdote in your life that has inspired you

Project description worksheet – Figure 41

The integrations of the fundamental factors in the concept have been told on blank sheets of paper due to a lack of space on the template.

Summary Reflections

As for the exploratory workshops, for the generative workshops we also wanted to collect all the *learning* and the *warnings* that emerged from the integration of the reflections made both on the flow and on the tools. For clarity and coherence with the previous ones, the inputs are listed by points.

The reflections that emerged are listed as follows:

I. The video presentation was simple and effective. The participants understood well that they were taking part in the construction and verification

II. Of a process of project-building that has as output the development of a toolkit of project-building that helps in the launch and design of a challenge in the world of DiDIY.

III. The installation of the platform was not presented because at the exploratory workshops it did not generate added value for the participants who, already overloaded by the great deal

of information, were unable to enter into empathy. The platform is a further container of information useful for our future objective but not necessarily for the purposes of correctly carrying out the activities.

IV. One of perhaps the most delicate points that emerged during the session concerns the involvement of participants who did not attend the exploratory phase, the reasonings that emerged and the launch of the challenge. It was fairly difficult to make them immersed into the context, especially during the phase of creation of the scenario. This difficulty leads to two reflections: the need to integrate into the generative workshops videos or images that can provide in a short period of time an overall vision of the potential of DiDIY; the possibility of organizing integrated exploratory + generative workshops held on one day (see paragraph 5.4).

V. As anticipated in the description of the flow, the phase of defining the idea was a confused passage which entailed a slowdown of the times and therefor a downturn in the collaboration and concentration of the participants. In defining the idea, the participants anticipated some aspects of the project-building, also conditioning the subsequent activities of the workshop. There is a hypothesis for the next workshops not to use the canvas and to write the idea that has emerged from the brainstorming on a sheet of blank paper.

VI. The cards inserted in the brainstorming phase were a great stimulus for the participants, helping to expand the type and the quantity of ideas presented (see section 6).

VII. The project-building phase turned out to be very effective as it allowed visualizing the idea and freezing the concepts which until earlier had been stated orally. The decision is taken to keep this technique in all the subsequent workshops, slightly modifying the timetable: 10 minutes of prototyping of the initial idea, then followed by 50 minutes of prototyping of the concept inserting the factors.

VIII. The project-building with the factors took place effectively and was concluded with a description of the concept that emerged and how each single factor was integrated.

IX. It is necessary to conclude the activities of the generative workshop with a description of the concept that has emerged and how each single factor has been integrated.

5.4 Integrated exploratory + generative workshop on DiDIY&Education – Barcelona

Summary Reflections

As for the previous workshops, only the indications useful to implement the process and the tools will be described.

The following emerged:

I. The integrated workshop combines the activities of the exploratory and the generative workshops in a single day. The flow of activities is therefore optimized for 8 hours of work, omitting some passages that are not fundamental for the success of the activities (for example Create your Avatar). Through these workshops, the new objective of the research group is to verify the project in a condition of use that is closer to the real one where, probably, the same team of people deals with an exploratory phase and a generative one consequentially.

II. The participants showed great enthusiasm and collaboration for the activities of the workshop and as they are competent and motivated, they keep the flow of reflections high and active throughout the duration. This reflection is to be considered during the definition of the conditions of using the toolkit.

III. The comparison between the clusters that emerged and the fundamental factors, which the participants were asked for, did not produce results because it required very deep reflections that take time and a great cognitive effort. The factors emerge from a process of selection and union tackled with commitment by the research team and which cannot be implemented at the workshop.

IV. The concept designed coherently meets the challenge launched and for the participants was simple and linear as they were already immersed in the context. In addition to the simplicity, the satisfaction emerged of having completed it concretely.

V. A fundamental reflection which emerged in the debrief phase is lined to the method of including the fundamental factors in the toolkit. According to the participants, the phenomenon is so vast that in time it could be necessary to increase the number and type of factors both to adapt to the needs of the group of users who use the tool both to remain continuously updated and to remain continually updated with the passing of time.

5.5 Final conclusions

The experiences of the workshop have contributed to continuous experimentation, verification and implementation of a project-building process, of specific activities and relative tools in order to produce a toolkit and guidelines which also help non-designers to formulate a challenge and design a concept to apply the potential of DiDIY in their professional area.

The toolkit represents all the techniques and tools designed and collected whilst the guidelines include the conditions necessary to start and set up a session of co-design and the flow of activities to be performed during the session, referring to the specific tools.

The list of *learning* and *warnings* that emerged from the various workshops which will contribute to drawing up the guidelines is as follows:

I. With the sequence of workshops, various configurations of groups were experimented, in terms of number of participants and it emerged that the optimal number for the complete session of co-design (exploratory and generative) is 5-6 people.

II. If the group is made up of profiles with multidisciplinary profiles, complete results with many nuances are obtained. One of the highly-recommended conditions for the success of the co-design session will be to involve different profiles, including at least one expert of digital making, one expert of teaching/education and possibly a designer.

III. One of the highly-recommended conditions for the success of the co-design session is the involvement of competent and highly motivated people. This condition proved to be fundamental to keep the flow of reflections during the session high and continuous.

IV. It is fundamental that the contribution is collective for the wealth of details and for the different facets to emerge, therefore the management of the group dynamics which will become one of the Tips in the guidelines must be taken carefully into consideration.

V.   One of the fundamental conditions for the success of the co-design session is assigning roles in the group. A facilitator has to be appointed, who moderates the reflections and leads the group in the various steps of the project-building path, and a time-keeper, who monitors the times established for each activity. It is certainly useful to involve a someone to document from outside the group who takes note of the intermediate results that have emerged from the various activities.

VI.   One of the suggested and highly recommended conditions for the success of the co-design session is the preparation of the working environment. The guidelines will include suggestions on how to recreate a creative environment which stimulates sharing and collaboration.

VII.   We think that a web channel of sharing in which participants can consult, upload and insert useful information, case studies, interesting websites and presentations is fundamental. It should become the point of reference for those who want to develop a project with a strong social impact with DiDIY.

VIII.   The combination of paper and digital material for the case study creates methods of consultation which satisfy various needs, those who prefer collaborate learning helped by the poster and those who prefer individual learning helped by the digital presentation. For the design toolkit it is necessary to reflect on the ways with which to create the archive of case studies and how to manage them, allowing people to add new ones following a specific format.

IX.   The activity cards were not widely used in the workshops, they will become a fundamental tool of the toolkit as they will allow, on the one hand, training the facilitators who want to use and apply the process in areas of personal interest, and on the other will allow participants in a self-organized session to understand and carry out all the activities of the project-building path.

X.   The toolkit and the guidelines can be used both by those who already know the phenomenon of DiDIY and has in mind a challenge idea to design, and for those who do not know the phenomenon and therefore first have to explore it and identify a project-building challenge.

XI.   In the brainstorming phase, it would be interesting, especially with regard to the toolkit, to insert tools to stimulate the participants, including cards, videos, images, etc.

XII.   An important reflection that is still open which emerged during the workshops concerns the decision to transform the fundamental factors into a tool. The phenomenon is so vast that it could be necessary in time to increase the number and type of factors both to adapt to the needs of the group of users who use the instrument and to keep continually updated with the passing of time. With this reflection in mind, it is important to continue the experimentation through the workshops.

The reflections that emerged derive from the workshops held to date in the area of Education, Work, Creative Society and Legal System. Further workshops are already scheduled in January and February which will support the research group in the completion of planning the toolkit and the guidelines.

5.6 Process reflections

Activities are designed and crafted exploring thoughtful variations, learning from them, and modifying the practice accordingly (Pedler et al. 2005). The activity presented in the deliverables features a constant alternation between different types of communication: iconic, objective and behavioural. As the event unfolded, participants displayed a gradual change in attitude, shifting from an initial state of confusion and curiosity to constantly increasing involvement and collaboration.

The decision to emphasize the emotional and perceptual dimension by developing an experiential path, configured as a space for reflection, enabled participants to achieve a rapid and in-depth understanding of the design process, providing a setting for the individual consideration required for learning. As we had hypothesized, the establishment of a multisensory experience allowed participants' in-depth understanding of the design process by involving all the senses.

Physicality was expressed in terms of participant relations with the space and with others, amplified their involvement and heightened the emotional value of the experience by fostering extremely high levels of attention throughout the activity. The creation of a customized physical environment facilitated time-management and provided a visual and experiential dimension to the design itinerary. Moving through the space, along the pathway, proved a highly effective method for fixing the various stages of the activity – and therefore of the design process – in the minds of participants.

These kinds of playful activities are intended to stimulate people's creative potential, and preventing negative emotions. They promote active and creative relationships at both cognitive and relational levels and have proven, in our experience, to be a very effective means of knowledge-transfer.

The experience of applying the IDEActivity methodology and toolkit at the workshops led to very positive feedback. Participants pointed out how the effectiveness of the transfer of the methodology and the toolkit materials had been facilitated by the overall atmosphere, space and communication management. Furthermore, the importance of the environment, which was designed ad hoc for the activity, and around which the whole learning experience revolved, was underlined.

The emotional involvement and stimulation of the senses, the freedom allowed in the use of the space and the employment of images and visual thinking, as the preferred channel of communication, led the participants to a quick and more effective learning experience.

A really interesting output is the comparison between the different elements characterising DiDIY of a workshop with the same results as other previous ones, therefore with different people and places. The coincidences are so similar and the level of details the same, with the same combination of models in the case studies, which makes us reflect on how these sequences of iteration conducted in a similar way between the different groups of people take on consideration scientific importance. This comparison of results from different workshops seems to indicate the efficacy and also the pertinence of co-design as a process of experimentation in the context of DiDIY. A very open process has been guaranteed, controlled mainly by the participants, in which they decided and agreed on common models. Taking into account both the role of the facilitators as co-designers (at the key times, deeply involved in guiding the group discussions) and other quantities of uncontrolled variables around each discussion group, we can notes that the participants in the various workshops reached about 80% of the same conclusions, including with similar words, on the key elements. These points can probably become interesting elements in relation to the dynamics of collective intelligence, crucial in the attitude towards digital sharing and collaboration.

6. Workshop in DiDIY and Education Experience

The section describes in detail the experiences collected from the exploratory and generative workshops, in Italy and in Spain, carried out in the Education&Research area.

The different workshops will be related according to the following pattern: a short introduction, the description of the flow of the different activities, the conclusive reflections which are the points taken into consideration for the refinement of activities.

6.1 Workshop general aims

The co-design workshops on Education&Research intend to explore how digital production technologies (e.g., additive manufacturing and coding) and sharing (e.g., open source) may influence and modify learning and skilling process.

Learning flow

An important objective is to deeply understand: how the learning process take place during making activities and which is the role of the different persons involved (students, educators, makers, parents,…). The questions are: *Who are the persons involved in the learning processes? How the teaching/learning flow happens?*

The learning process and the persons involved are different according to the activities, the space and the tools used. For example, in communities of practice participants learn from others' prior frustrations (Wenger 1998). The community served to alert members to false paths and unproductive approaches when trying a new project. Sharing knowledge among learners is fundamental, regardless of age. *"If you learn something, you are responsible for teaching it."* "(Jeff Sturges, founder of Mt Elliot Makerspace.)

Teacher as designer

Norris (2014) argues that teachers should support the development of positive self-concepts and identities as part and parcel of the design process.

An important issue to investigate during workshop is about the role of the teacher in the constructivist pedagogy when face with the challenge of using technology in the classroom.

In this context, teachers are asked to design a learning environment to support children in their explorations, to scaffold learning, and to provide interesting materials for children in order to make concrete projects to share with others in the community.

Do teachers need to have specific design and technical skills to face with this challenge? Could it be possible to develop a model for educate future teachers to integrate DiDIY technologies in the classroom so that they can develop technological fluency and to become designers of their own technologically-rich curriculum?

Makers as teachers

FabLabs is the place where students can face with digital fabrication. FabLab integration in schools means that students can live a place where they could safely make, build, and share creations. This

integration can bring several advantages: students can experience new way of work (long term projects), team collaboration and also they can learn how to manage failure (Blikstein 2013). How can FabLabs be part of the education ecosystem? What role can FabLabs play in design school's curriculum?
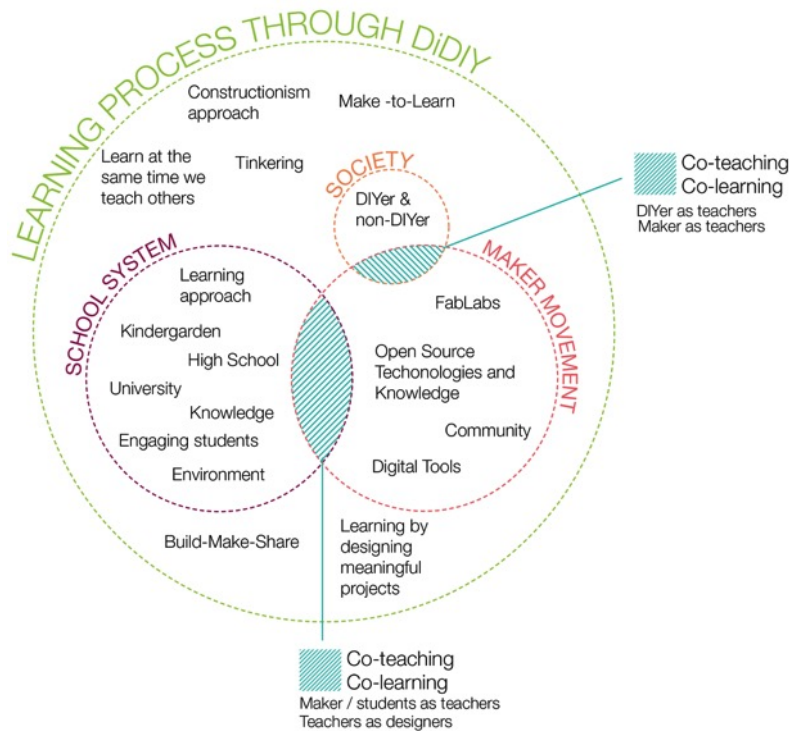
Figure 63 – The Learning process through DiDIY.

The aim of the workshop in education and research area is to test and design, together with teachers and educators, a specific process that could be applied in the different educational environment and that could increase such skills as creativity, critical thinking, collaboration and communication.

The final goal is to contribute to the creation of a valuable learning experiences based on creativity where the teacher became the designer of the activities and the facilitator of the learning process.

In preparation for the workshop it was useful to Identify the personalities we want to work with.

The participants who were sent a personal invitation were identified and selected on the basis of well-defined profiles.

For the education workshop, our aim was to create a group with mixed skills: experts in digital technology and experts in education, who nevertheless had a strong interest in both areas.

Although the choice required a considerable organizational effort, we deem it is crucial to be able to observe the phenomenon of education from different points of view. The experts we decide to select and who took part in the workshop on DiDIY&Education were: primary and secondary school teachers, high school and university professors, makers interested in education, educators that run educational programs outside schools using digital making (inside museums or Fablabs),

professionals in different departments of the school system. We tried to involve people that already apply digital technologies at school, that use alternative educational methods, or who are interested in the topics.

6.2 Workshop description

6.2.1 Explorative workshop in DiDIY&Education – Milan

The explorative workshop on DiDIY&Education was held in Milan on 9th September 2016.

Location: Polifactory – Campus Bovisa - Politecnico di Milano. Via Privata Schiaffino 22-30 Edificio B3

Length of the workshop: 10.00 a.m. – 5.00 p.m. (5 hours of activity + 1 hour break)

Participants: The participants were identified and selected on the basis of well-defined profiles during the project-building phase. A personal invitation was then sent that explained the objectives of the event. Teachers from primary and secondary schools, teachers from high schools and technical schools, educators from outside the scholastic context, makers and FabLab personnel who use making and coding to organize educational activities in schools or at the FabLabs, experts on education and tinkering who carry out activities in museums took part in the workshop.

Environment: As anticipated, it is the same one used in the pilot workshop in Milan.

Description of the flow of the different activities

To start to create a convivial and relaxed atmosphere in which to express their creativity, the participants were welcomed immediately with breakfast. They were then guided shortly afterwards on a 10-minute visit of the Polifactory space to get to know the activity and see the machines at their disposal.

The workshop starts with a screened presentation about the DiDIY Project, the role of the POLIMI research team with the relative objectives to be reached, the objectives of the workshop, the project-building path, the platform and the activities of the day. This presentation is followed by sharing the rules of the day to be respected in order to keep a creative and collaborative atmosphere (see Annex II – Creative Rules).

At the start of "Create your Avatar" the participants choose 7 images, from those put at their disposal, which most represent them and they go to the Log In centre alongside the platform. Here they are given a profile depending on the images chosen, through a label on which they write the user name that identifies them as avatar. Each of them is given the explanation which figure corresponds to their profile with respect to Foursight.

This is followed by individual presentations to foster the generation of collaborative dynamics and the formation of the work groups. A total of 3 work groups are formed, each one made up of 4 participants. The groups have been made up trying to create multidisciplinary teams with different profiles and mixed skills linked both to digital making and to education. Each table is facilitated by an expert of the research group.

The phase of analysis started with showing the relationship between the activity of the Discovery DiDIY workshop, the DISCOVERY page on the platform and the step of the design process to

which this activity of analysis corresponds through markets linked to one another. During the workshop on the change of each activity, the two markers change position in the installation, moving to the page of the platform and along the creative process.

The number of case studies that the participants can choose from (see *tools section – case studies*) has been increased. Each group, after consulting with one another, selects their favourite one.

The pilot workshops allowed finding an ideal configuration for the work table. The tools that the participants find for the analysis activity are: Gameboard, Box with the Gameboard cards, the Instructions, the sheet with the QR Code and a Tablet to access the digital presentation of the case study and to access Internet information, coloured felt tip pens, Post-Its in different colours, and small games that help keep a creative atmosphere during the activity (tops, bells, etc).

The facilitator explains the analysis activity making use of the activity Cards and also highlighting he rules of the game which are also present near the gameboard.

After the group has analysed the case autonomously, each facilitator intervenes working together with their group. The activity as planned lasts one hour and the discussions stimulated by the tools should take shape on the Post-its.

The first phase of Discovery ends with a break and re-opens with the individual group clustering in order to identify the fundamental elements of DiDIY which have emerged from the analysis.

The group activities end and the participants come together to work collaboratively. A representative of each group relates the case analysed and shares the reflections and the fundamental elements identified. In the next phase the participants negotiate and identify the fundamental clusters shared deriving from the union of the three work tables (see section 6).

The presentation made by Abacus on the impact of the phenomenon of DiDIY in the area of education which is the result of their research opens the afternoon session.

The flow of the workshop resumes with the open talk activity the theme of which is "New visions on how DiDIY is changing education" in which, from the discussion by participants, reflections useful for the last planned activities are generated.

Through the "Wishful thinking" tool, each participant chooses from the idea that have emerged the challenge they want to launch.

The workshop ends with a debrief in plenary session to collect feedback and ideas for project-building with respect to installation, flow and tools.

The participants are given a toolkit made up of the explorative tools used for the workshop and present in that of IDEActivity.

6.2.1 Generative workshop in DiDIY&Education – Milan

The generative workshop on DiDIY&Education was held in Milan on 14th December 2016.

Location: Room in the Department of Design – Politecnico di Milano. Via Durando 38-A.

Length of the workshop: 10.00 a.m. – 5.00 p.m. (5 hours of activity + 1 h break)

Participants: none of the participants involve in the exploratory workshop was able to take part in the generative workshop. New participants were therefore identified and selected on the basis of well-defined profiled and they were then sent a personal invitation. Students, researchers and designers took part in the workshop.

Environment: The workshops were held in a room at the Department of Design of the Politecnico di Milano. The room was simply equipped with tables and chairs and was prepared ad hoc by the research group.

Description of the flow of the different activities

The workshop begins with a presentation on the European DiDIY project, the role of the POLIMI research team and the relative objectives to reach, the exploratory experience already carried out, the results obtained and the activities of the day with the objectives to be reached. This presentation was followed by the rules of the day to be respected in order to keep a creative and collaborative atmosphere (see Annex II -Creative rules)

The participants form a single work group to be able to sustain a more stimulating discussion. As planned in the project-building phase, the generative workshop will start from sharing personal knowledge and experiences on the theme of the challenge selected at the exploratory workshop. The idea is refined and through a creative phase of brainstorming and project-building, the creation and construction of a well-defined concept will be reached which will include the fundamental factors (see section 6) and which meets the challenge launched.

In the generative workshop the different activities are not accompanied by a relative card but are explained orally by the facilitator. They will nevertheless be structured for the toolkit to be issued.

The session of the workshop begins with the creation of the scenario using the Scenario tool (see paragraph 4.*5 Generative workshop*), already sent by email to the participants before the start of the workshop, together with the challenge on which they were to work in the workshop.

In this first activity the participants share their personal knowledge and experience in the theme of the challenge, designing a scenario shared by all the members of the group. After this, through a brainstorming, many ideas are formulated, the one receiving the most votes will be selected to be designed with the factors in the next phase. Please consult the section on project-building for the criteria of voting.

The facilitator distributes to each participant 3 cards to fill in and which will be used during the brainstorming toe stimulate the generation of ideas (*see Tools - brainstorming cards*). Through the brainstorming many ideas are formulated and the one receiving the most votes will be selected to be

designed with the factors in the next phase. The idea selected in described briefly on a piece of paper. Please consult the section on project-building for the criteria of voting.

After a break, there is the phase of prototyping tool (see paragraph *5.x Generative workshop*), through which the participants visualize the first draft of their idea. This idea is implemented both conceptually and visually through using the fundamental factors of the tool "Factors star" (see paragraph *5.x Generative workshop*) for the design. Each point of the star which corresponds to a fundamental factor of DiDIY and presents indications which lead to reflect on the meaning of the factor. In turn each participant takes a point, reads the content and together with the group implements the idea. To conclude, the concept is described in detail also indicating hoe each single factor has been integrated. The activities end with the presentation of the concept designed.

The workshop ends with a debrief in a plenary session to collect feedback and project-building ideas with respect to the flow and the tools.

6.2.1 Integrated explorative and generative workshop in DiDIY&Education – Barcelona

The integrated workshop on DiDIY&Education was held in Barcelona on 1st December 2016.

Location: Meeting Room in Ateneu de Fabricaciò La Fabriqa del Sol – Passeig de Salvat Papasseit, 1 – 08003 Barcelona

Length of the workshop: 10.00 a.m. – 5.00 p.m. (5 hours of activities + 1 hour break)

Participants: The participants were identified and selected on the basis of well-defined profiles and they were then sent a personal invitation. Makers, educators, Ph.D. students in DIY, students, researchers on topics such as making and tinkering in education took part in the workshop.

Environment: The workshops were held in the meeting room of the Ateneu. The room was simply equipped with tables and chairs and was prepared ad hoc by the research group. An area of relaxation was created for the coffee break, an area for the work of analysis and clustering and an area for prototyping and project-building.

Description of the flow of the different activities

The workshop starts with a presentation on the European DiDIY project, the role of the POLIMI research team, the activities of the day and the relative objectives to be reached. This presentation is followed by the rules of the day to be respected in order to keep a creative and collaborative atmosphere (see Annex II).

The participants, after having introduced themselves, form a single work group to be able to sustain a more stimulating discussion. The table is facilitated by an expert of the research group.

As for the other exploratory workshops, the participants have at their disposal for the analysis activity: Gameboard, Box with the Gameboard Cards, the Instructions, the sheet with the QR code and a tablet to access the digital presentation of the case study and to access information on the Internet, coloured felt tip pens, Post-Its in different colours and small games that help to keep a creative atmosphere during the activity (tops, bells, etc). The analysis activity starts by choosing the case study from the three available.

The participants were very competence and involved in the topic, the analysis was therefore full of contents. The flow of reflections was always very lively and the cars were used only as a tool to guide the contents of the flow. Precisely for the wealth of knowledge that emerged, the analysis activity continued for the whole morning.

The workshop continued in the afternoon with the clustering activity which collected the fundamental elements of DiDIY which emerged from the previous reflection.

During this activity, the fundamental factors which had emerged in the exploratory workshops held until then (see section 6) were presented to the participants, and they were asked to make a comparison to evaluate which of their clusters could be integrated. This passage was really difficult and came to an end without the expected result (see points III in the section Summary reflections).

The discussion allows the facilitators to identify the challenge phrases which are collected on a poster and, lastly, voted by the participants (see section 6).

The generative session starts directly with the brainstorming in which multiple ideas are generated with the one receiving the most votes being selected to be designed with the factors in the next phase (see section 6).

The next phase is that of prototyping and project-building with the fundamental factors of DiDIY. A specific space to receive all the material was obtained in the room where the workshop was held. The activities end with the presentation of the concept designed.

The workshop ends with a debrief in a plenary session to collect feedback and ideas on project-building with respect to the installation, the flow and the tools.

6.3 Final conclusions

The experiences of the workshops described so far have contributed to spreading knowledge of the project both in Italy and in Spain.

Overall, about 350 contacts, of educators, teachers, schools, researchers, FabLabs, museums, SMEs, artisans, lawyers, policymakers, … have received an explanation of the DiDIY Project and an invitation to take part in one of the workshops. All were directed to visit the website of the project and to consult the results produced by the different partners in the four specific areas. Many asked to be kept updated on the activities of the DiDIY Project.

The workshop was also spread through a visit to many FabLabs in Milan and through participation in events and conferences with topics related to the projects, held both in the Milan area and outside it, including the Maker Faire.

Overall around 30 people took part in the workshops in the sphere of DiDIY&Education, personally experiencing a specific project-building process for DiDIY, thus becoming ambassadors of the method to be reproduced in the environment of education.

The experiences of the workshop have contributed to continuous experimentation, verification and implementation of a project-building process, of specific activities and relative tools in order to produce a toolkit and guidelines which also help non-designers to formulate a challenge and design a concept to apply the potential of DiDIY in their professional area.

The toolkit represents all the techniques and tools designed and collected whilst the guidelines include the conditions necessary to start and set up a session of co-design and the flow of activities to be performed during the session, referring to the specific tools.

7. Workshop results

The explorative and generative workshops based on the method of co-design allowed the research team to actively involve people in research activities and knowledge creation highlighting their desires and aspirations for the construction of new possible futures. Involving people using a co-design approach allowed the research team to be in empathy with people, to have meaningful conversations with them and to collect their ideas regarding the impact of DiDIY on Education. The importance of involving competent profiles active on the topics treated emerges from this, in order to collect significant data that can contribute to the specific research carried out by the leader partner of the WP4 on Education and Research.

This section presents the data collected at the exploratory and generative workshops on DiDIY&Education held in Milan and Barcelona. In particular, the explorative workshops allowed collecting the fundamental elements that the people involved deemed were qualifying for DiDIY, together with a series of challenges that tackle real needs in the area of education. The generative workshops, on the other hand, provided answers in terms of possible scenarios and benefits generated, to some of the challenges selected.

Section 7.3 relates the process of processing the data which emerged from the explorative workshops held in Italy in the four areas investigated by the Project, made by the research team in order to identify the fundamental factors of DiDIY common to the 4 areas and the fundamental factors of DiDIY specific for each area.

The section ends highlighting the contribution made by the co-design workshops to the research of the WP3 on Education and Research.

7.1 Results of the explorative workshop on DiDIY&Education – Milan

During the exploratory workshop, the participants, divided into groups, started from the analysis of a case study for each group. This analysis allowed them to break down the case study, taking into consideration people, fundamental elements and impacts. At the end of each analysis, the participants clustered the results, extrapolating the fundamental elements of the DiDIY. Subsequently, each group shared their clustering with the others, in order to reach a common clustering. During this process, the participants obtained challenges in the area of reference.

7.1.1 DiDIY fundamental element

Fundamental element from "Open Source Ecology" (*Single group*)
(Cluster linked to the specific case study)

This classification and implementation has been made by the reflections which have emerged from the Open Source Ecology case study. The group, after having analysed and discussed the project, as shown in the project-building section, with the help of the facilitator identified the main concepts that emerged.

Participants
Makers who deal with education, Teachers interested in new technologies, Director of the educational programme of a Museum

Elements that emerged

Figure 64 – Fundamental element from "Open Source Ecology".

The concept of *system ecology*, understood as the set of the components that intervene in and impact education and the relation between them (community, parents, educators, teachers, the area of reference, the city, etc), was positioned at the centre of the star.

- *Sharing*. The sharing factor is necessary to identify belonging to a community which on the one hand shares the same ethic and the same system ecology, and on the other shares, through network infrastructures knowledge, experiences, projects to help support the other members of the community.

- *Successful idea or leader figure*. To create a community or to keep the participation in a community project high, the figure of a positive leader capable of stimulating the creativity and motivation of the participating community is necessary. Consensus and motivation to take part are also the result of the driving force of the idea that consequently becomes the leader idea.

- *Community*. Set of people who have in common similar interests and demands who share technical and different transversal skills (soft skills). The community becomes the place to draw on specific skills according to the requirement of the project. The community ought to be open to accepting an equal number of men and women.

- *Motivation*. A factor necessary to activate the interest in a project or a community. Motivation can be of various natures: interest, economic need, local necessity, etc.

- *Digital technology*. Digital technology is a means that allows breaking down frontiers and allowing the spread of an idea or a project to the different local communities spread around the world to solve their local needs, readapting the solutions according to their culture and geographical area of reference.

Fundamental element from "Fab Academy"

(Cluster linked to the specific case study)

This classification and implementation was carried out by the reflections resulting from the Fab Academy case study. The group, after having analysed and discussed the project, as shown in the idea-building section, identified the main concepts that emerged with the help of the facilitator.

Participants

Makers oriented towards education, Teachers (in particular with experience in alternative teaching methods), Students who work with new technologies.

Elements that emerged

Figure 65 – Fundamental element from "Fab Academy".

The participants decided to put the *super guru*, understood as the concept of a strong figure who by fame and charisma can attract and motivate students, almost creating a form of subjection, at the centre of the star. A leader figure that almost does not transmit technical skills but knowledge,

objectives and overall visions, that hedonistically builds up his recognition towards the community of reference. The central position wanted to make clear that some initiatives, although excellent, require a conceptually old pyramidal structure.

- *Do It FOR Yourself (Motivation)*. There are mainly two motivational aspects shown by the participants: one linked with the recognition by a community and the other more intrinsically linked to the acquisition of new skills. The hedonistic aspect appears with the recognition of a community that the person recognizes as "cool" while the acquisition of transversal skills which are autonomously managed fosters the ability to reinvent and generate new situations.
- *NEW transversal MODELS*. Models based on soft skills that allow learning how to learn. Models that allow adapting to the current fluidity and dynamism in work and in learning, where there is no clear separation between the various specialised skills. A fundamental aspect is the acquisition of a formative model more than of skills which can be spent immediately.
- *Sharing*. A new operative and mode and attitude that includes sharing and comparison. It is not only material sharing but of ideas, skills and knowledge, technologies, spaces and economy; an active exchange between peers which generates progress as in a scientific community.
- *Leadership*. A charismatic person ("super guru") who has a strong and engrossing and shareable vision.
- Digital Technology. Technologies understood as facilitators of processes already in progress at a social level. These are technological skills which are quickly developing but as they are not mature, they have to be guided so that they respond adequately to the modern fluidity. The creativity that before was dependent on technologies can overtake them today by creating them.

Fundamental element from "Instructables"
(Cluster linked to the specific study case)

This classification and implementation was carried out by the reflections resulting from the Instructables case study. The group, after having analysed and discussed the project, as shown in the project-building section, identified the main concepts that emerged with the help of the facilitator.

Participants

Makers oriented towards education, Teachers (in particular with experience in alternative teaching methods), Students who work with new technologies.

Elements that emerged

Figure 66 – Fundamental element from "Instructables".

- *Community*. The creation of a peer to peer community is fostered, where there are no subgroups and everyone can share, learn, be inspired by others, express and receive opinions. This community means that the practice of teaching is democratised, as everyone can access online knowledge and the content created by the community itself. On the other hand, anticipation in this community cab at times be interpreted as a desire to gain visibility and use the service as a showcase more than as a collective environment. As a consequence, a mechanism of reputation creates a social/cultural dimension. The transmission of knowledge is encouraged, which allows an exponential diffusion of knowledge and skills. The generative flow that is created stimulates a relationship of "quick-fire answers" in which releasing feedback is encouraged. All this has an impact on the individual, the community and society.

- *Status*. The interaction between individuals and the service and between the individuals themselves takes place through defined procedures. At the same time, there is the risk that dangerous/ethically incorrect activities may be shared. The guidelines, including rules, motivations and strategies, and the intrinsic organization of the roles ensures that this does not take place.

- *Accessibility*. Ample accessibility to the contents generated by the users is encouraged. Accessibility is ensured by the possibility of accessing the platform from several devices, with different roles (e.g., open visitor, user, user pro) and using a common language. In

addition, the contents are made even more accessible by the tutorials, which help simple self-expression. Sharing these contents is made easy by using a single format which is found in everything that is put online. All this produces the sensation that everything is possible and that everybody can do everything. The shared contents could be filtered, for example by age group, level of difficulty, material, costs, times).

-   *Digital technology*. Digital technology is used as a means and allows being able to use a technological instrument of communication between the individuals. In addition, as well as communication, digital technology allows carry out real projects which exploit the technology itself.

Common DiDIY fundamental element

This classification and implementation emerges from the sharing of the single group clusters in order to reach a common clustering.
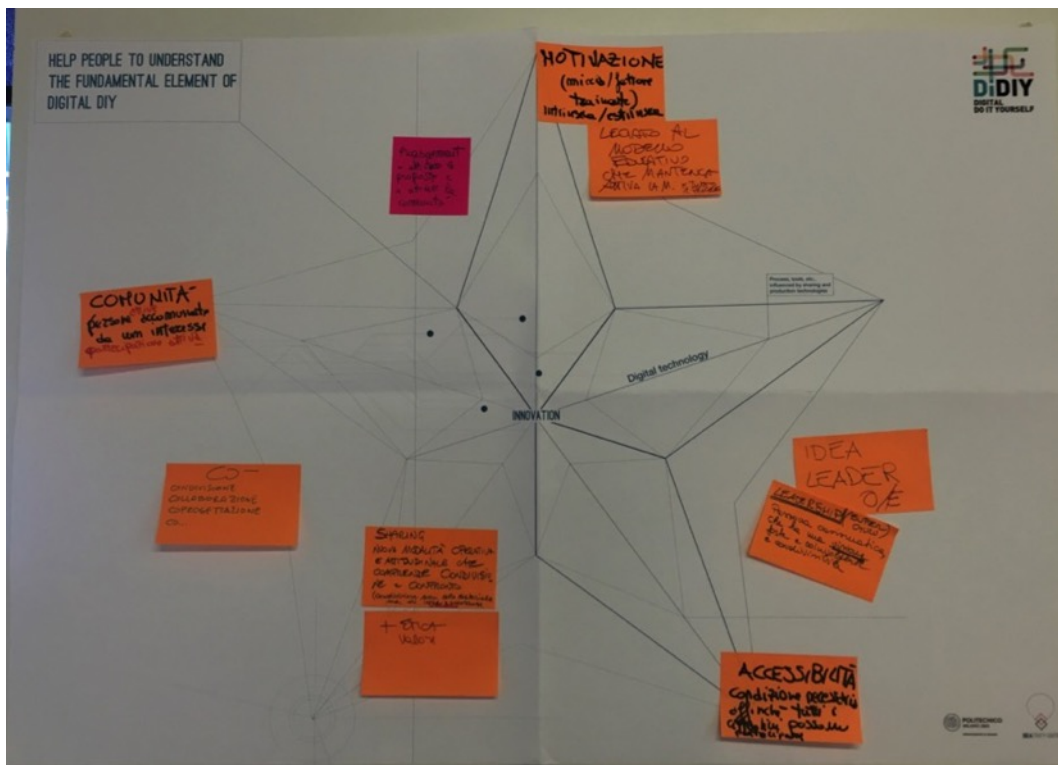

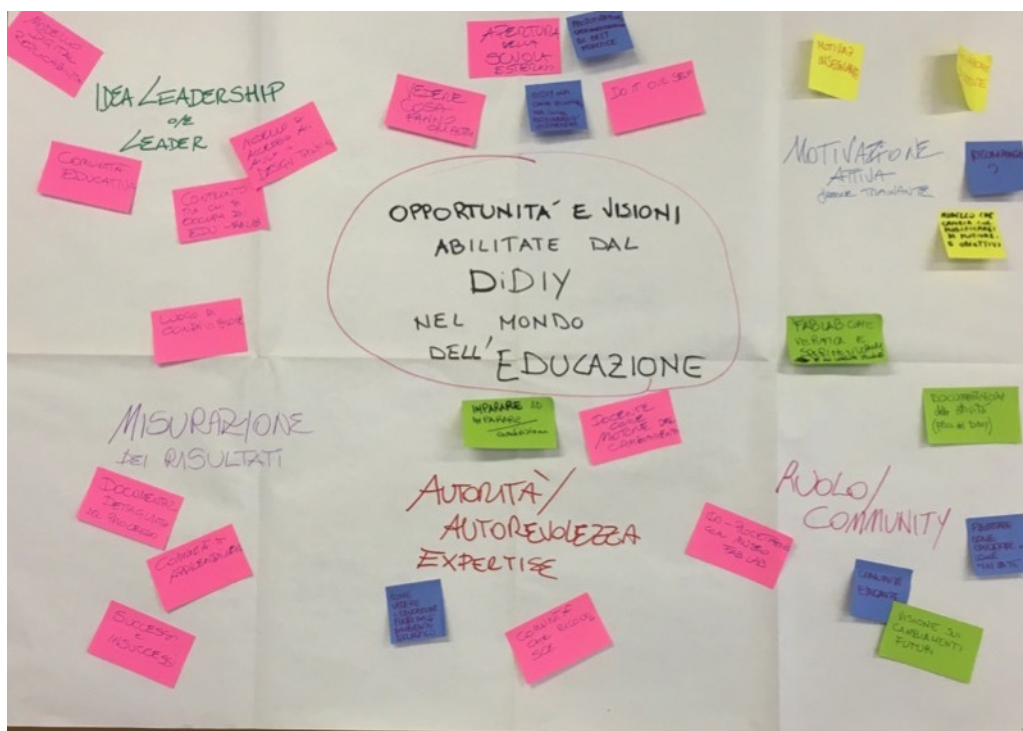Figure 67 – Common DiDIY fundamental element.

Figure 68 – Open talk.

- *Community*. The set of individuals having in common an interest ad an ethic, who take an active part in building up an educational ecosystem, in which sharing, collaboration, co-planning and, more in general, the activities that unite the community, are qualifying factors.

- *Motivation*. This represents the fuse for the activation of the individual's participation in the community and the driving factor that allow keeping his/her involvement constant. The motivation can be intrinsic, therefore linked to an innate predisposition of the individual and extrinsic, linked to external factors of reward and satisfaction. Motivation is the recognition by a community that consider cool, feeling part of a community. Acquisition of skill, do it for yourself, self-management, reinventing oneself.

- *Accessibility*. All citizens must have the chance to take part in DiDIY activities, so it is necessary to create the necessary conditions so that this can take place. This means both supplying the possibility of easily reaching points of access to the technology, but also providing a simplification of language to accept a wider range of public of different ages.

- *Sharing*. A new way of operating and a new attitude that includes sharing and comparison. A qualifying factor in the community is the active sharing of ideas, skills, knowledge but above all of a vision and ethical values.

- *Idea leader and/or leadership*. A charismatic person (super guru) who has a strong and enthralling vision. The super guru has a strong vision that has developed skills other than technical ones. He/she has developed a vision, has skills and charisma but does not develop the technical part.

7.1.2 Design Challenges

During the common clustering, the groups brought out different topics, reflections and criticalities deriving from the analysis of the case studies and from their personal experience. These criticalities were recorded and transformed in the form of a challenge, using the structure of the common question, "How can we…?" Afterwards, each single participant voted the 3 challenges which, in their opinion, are the most significant in the field.

Challenges

I. How can DiDIY be exploited to keep 'motivation high and constant' during educational activities?

II. How can we organize and manage an educational community of DiDIY including through assigning roles in it?

III. How can objectives and results in acquiring soft skills qualified by digital making be measured/evaluated?

IV. How can we help an educator identify, inter alia, an idea leader or a super guru (authority/authoritativeness/expertise)?

V. How can DiDIY become a strategy or a system of connections to create an educating community?

VI. How can DiDIY become a methodology (including the evaluation of the objectives) to innovate the educational system?

7.2 Results of the explorative workshop on DiDIY&Education – Barcelona

During the first part of the workshop (explorative) the participants started from the analysis of a case study. This analysis allowed them to investigate the case study, taking into consideration people, fundamental elements and impacts. At the end of each analysis, the participants clustered the results, extrapolating the fundamental elements of DiDIY. During this process, the participants derived challenges in the area of reference and chose one of them

7.2.1 DiDIY fundamental element

Fundamental elements from "Open Source Ecology"
(Cluster linked to the specific case study)

This classification and implementation has been made by the reflections which have emerged from the Open Source Ecology case study. The group, after having analysed and discussed the project, as shown in the project-building section, with the help of the facilitator identified the main concepts that emerged.

Participants
People in charge of international education programmes, Researchers in education

Elements that emerged

Figure 69 – Fundamental elements from "Open Source Ecology".

- *Multiple identities*. Possibility for the person to play, act and experience different identities. Possibility of expressing the self in different identities influenced by cultural and social aspects.
- *Debugging process*. Attitude of working that is based on iterations and continuous learning. Frustration along the way becomes a building material to work on, in order to learn from mistakes and improve.
- *Meaningful projects*. Activities put in place in DiDIY must be anchored to the context and actively put in place with concrete results. The results must answer real needs.
- *Network of communities and individuals*. Need for a digital and a physical hub that connects, facilitates and feeds existing networks of communities and individuals. The network shares knowledge and solutions.
- *Accessibility*. Opportunity to access resources and need for understanding what to do with the resources available, by applying a strategic approach to accessibility.

7.2.2 Design Challenges

During the clustering, the group brought out different topics, reflections and criticalities deriving from the analysis of the case studies and from their personal experience. These criticalities were

recorded and transformed in the form of a challenge, using the structure of the common question, "How can we…?" Afterwards, each single participant voted the 3 challenges which, in their opinion, are the most significant in the field.

Challenges

   I.   How to develop an open attitude in students, in order to be able to participate in the DiDIY movement?

  II.   How to shift from an authorship based mindset to a co-design mindset?

 III.   How to build a DiDIY edu program grounded in the real and shared needs of the students?

 IV.   How to overcome and take advantage of the frustration encountered along a project?

Challenge	Votes
I	2
II	6
III	0
IV	0

7.3 Fundamental factors resulting from the Explorative Workshops

A critical piece of the Exploration workshop is finding the insights that will drive our design out of the huge mass of information we have collected.

After having collected the results of the explorative workshops in the 4 areas investigated by the project, the research group has put into a system, combining and pairing the numerous concepts that emerged to identify the common aspects and the potential of the DiDIY recognized by the participants.

This systematization is made up of different and repeated phases of processing in order to achieve complete results that include all the wealth and knowledge produced by the participants and the nuances that have emerged from the specific professionalisms involved. We want to recall that. As described in the section of planning of the workshops, the participants, with our support, grouped together similar concepts giving a name to the group and describing them.

A first interpretation of the results that emerged during the phase of clustering the workshops allowed us to identify those elements that can be replicated and designed which were then considered fundamental for the generative phase.

Subsequently, we identified the clusters common to several areas, making a detailed analysis and integrating their descriptions in order to reach a rich and complete definition of the elements. Specifically, the integrated clusters were selected not only if defined with the same name but above all if the descriptions corresponded.

After this first selection, choices were made regarding the elaboration of the clusters that emerged that were not identified as common. On the one hand, elements we deemed inseparable as components qualifying one another, such as for example the Do-It-Together cluster which includes community and sharing and which will be described later were integrated. On the other, we decided

to transfer the concepts written in some clusters to others, because we deemed that they were facets of the elements in which they were included. An example of this type of choice is the Accessibility cluster.

Lastly, we decided to select a cluster which was representative of each area investigated through the workshops.

This enormous work of re-elaboration of the data obtained led to identifying *the fundamental common and specific factors* at the basis of the DiDIY and of the individual areas.

One aspect recognized by all the participants that is indispensable for the current movement linked to digital technologies in DIY is the change of mindset from individualist to collaborative. This aspect was not transformed into a fundamental factor as it cannot be planned as an element in itself but together with other factors which generate this type of attitude, but will be underlined and described in the guidelines of the tool kit as a positive attitude and approach to deal with a project in this context

The factors came from the integration of the explorative workshops held in Italy in the four Project areas. The integration with the explorative workshops held in Barcelona will be reported in the Deliverables 5.5 and 6.6.

7.3.1 Fundamental common factors of DiDIY

Idea leader

One fundamental factor of the DiDIY is the necessary presence of an idea leader, i.e., a driving force, who stimulates in order to keep the participation in the project high.

The leadership is therefore defined here as the motivating force to reach the objective.

This driving force can also be represented by a leader figure identified as a super guru, i.e., a charismatic person with a strong and engrossing vision who does not necessarily have technical skills. The three key words which identify this element are stimulate, motivate and coordinate for a common objective.

In order to create a community or to keep high the participation in a community project, the presence of an idea or of a positive figure leader that can stimulate the creativity and the motivation of the participating community is necessary.

Do It for Yourself – personal motivation

One fundamental factor of DiDIY is the personal motivation of the people involved, Motivation is the factor necessary to activate the interest in taking part in a community project and to keep its involvement constant.

Motivation can be intrinsic, therefore linked to an innate predisposition of the individual and extrinsic, linked to external factors of reward and satisfaction.

The elements on which pressure can be put to involve people and activate their participation are described as follows:

- to acquire skills: people take part because they enrich and acquire new skills and knowledge;
- to reinvent themselves: people take part because they have an opportunity to refresh and improve certain aspects of themselves;

- a sense of belonging to a community: people take part because they feel part of a large community made up of people who share similar interests;
- hedonism/reputation; people take part to be recognized by a community that consider cool;
- showcase/visibility: people take part for promotional purposes;
- remuneration: people take part because they have something to gain or a return,
- sense of intrinsic confidence: people take part to increase their self-confidence.

Do It Together – Community and sharing

One fundamental factor of DiDIY has been defined Do It Together. This factor refers to a community of individuals, who have in common an interest, a vision and ethical values, who take an active part in the collaborative construction of an ecosystem in which sharing represents a new way of operating and a new attitude. The members of the community are active users and share ideas, knowledge, skills, spaces and tools.

In some cases the community is characterized by a set of explicit or tacit guidelines which correspond to the manifesto within which the community identifies itself.

As a member of the community, the individual has to be responsible for his/her actions with regard to the other members and in turn has to be able to trust the knowledge shared internally.

In the community, the presence of an activating element is necessary: this can be a person, a place, an institution. The activator supports constructs and reinforces the elations within the community. On example if the Fab Lab or the figure of the community manager.

Accessibility

One fundamental factor of the DIY is the possibility of easily accessing technology, knowledge and skills, both online and offline. Accessibility is understood both as the physical possibility of reaching points of access to technology but also the need to translate the technical languages to develop empathy and make consulting the contents easier for a vast public of peers, men and women, of different ages.

Accessibility is also translated into a simplification of the normative languages which regulate the use of the shared ideas of the community.

The ease of access to technologies allows individuals and organizations to draw on skills, consequently allowing their growth and the development of determined skills.

The individual also, through the practice of DiDIY, has the possibility of accessing personal resources to experiment his/her capacities in order to reinvent him/herself both in professional life and in daily practice.

Glocal

One fundamental facto of DiDIY has been defined Glocal. This Glocal factor refers to the interrelation between local demands/resources and flows of global skills.

The reflection originates mainly from the idea that a problem or a need come into being at the level of local community. From a need that originates locally, there is then diffusion as an idea at global

level. The force of this element is that it is a local problem (and relative solution) which can be common to different situations in different countries is shared globally. There is therefore the *reciprocal influence between local and global*.

The local area is seen as a stratifier and as simplifier of contexts, The contents, collected in global virtual places, are initially produced at local level and resume the needs and the requirements identified locally, These contents are then shares on global virtual supports, without overlooking their local production, In the enormous mass of data, thinking of one's local reality can guide the choice of the useful ones. For this reason, *the local area becomes a stratifier of the collective knowledge but at the same time a simplifier*. The close bond with the local area allows exploiting the human and material resources of the same, generating benefits for the community.

Other important aspects linked to local and global are: the possibility that a local need is solved by shared skills and multi-channel, or when the contents which are enclosed in a single virtual space, are conceived in multiple local physical spaces (e.g., Fablab, home, park, etc). Local understood as multispatial and Global as a single online container where knowledge is conveyed.

System economy

One fundamental element of DiDIY is defined System Economy where system means a set of elements that are interconnected with one another by reciprocal relations, but which behaves as one. This refers to different elements which contribute to making a project in the DiDIY context sustainable such as: business models, social impact, economic sustainability and planning.

DiDIY, according to the participants, can generate two distinct business "models": the first is translated into new markets of reference for the world of traditional production, the second creates new models that did not previously exist. The companies that understand their potential have the possibility of exploiting DiDIY to create new hybrid forms of production and communication, working not on the simple use of the tool but at strategic level. In the second case, the technologies qualify new forms of unforeseen innovation which can also appear on alternative unnamed markets.

As far as economic sustainability is concerned, in addition to the traditional forms of financing, one factor deemed fundamental is the presence of business models based on new logics of gain which put pressure on open and diffused knowledge and on the active participation of communities that process this knowledge (e.g., open source). All this allows the birth of a new money of exchange which corresponds to values, information, visibility and knowledge.

7.3.2 Fundamental specific factor of DiDIY for education

The social and cultural dimension of education

One fundamental element of DiDIY for the field of education is the possibility to apply formative an educational model with a new awareness. Models that allow the adaptation to the current fluidity and dynamism in work and in learning, in which there is not clear division or separation between the various specialized skills. These models allow acquiring technical and soft skills. The ecology of the educational system, i.e., the set of components that intervene and impact education and the relationship between them (community, parents, educators, teachers, the local area of reference, the city, etc) become fundamental.

7.4 Results of the generative workshop on DiDIY&Education – Milan

During the generative workshop, the participants started from a challenge launched in the explorative workshop and first of all examined the context of the challenge and built up a scenario. Subsequently, the participants generated different ideas through a brainstorming session, they grouped them together, gave them titles and voted for them. The voting took into consideration criteria such a feasibility, coherence with the brief and the desirability for the user. Lastly, the participants planned this idea in the details, considering the fundamental factors identified in the exploration phase.

Participants

Students who work with new technologies

Challenge

During the exploratory workshop the participants extrapolated challenges. The challenge most voted for is taken as a starting point and launched in the exploratory workshop.

"How can we organize and manage an educational community on DiDIY including through assigning roles internally?"

Scenario

From the challenge launched, the participants were asked to share their knowledge in the context of the challenge and to share some case studies or ideas they consider interesting. Following this sharing, the participants built up a shared scenario.

At the basis of an education which actively involves the individual, there is a system based on sharing one's knowledge and interests and on increasing the value of the knowledge of others.

In this system, everyone is asked to contribute, generating educational material in order to create a sort of personal educational profile, which will be shared with all the users belonging to this educational community. With a way of use similar to that of a social network, everyone can show interest and save in their personal formative profile contents produced by other users.

All this allows the creation of an infinite chain of educational content, which supports the individual in the organic acquisition of skills, making good use of the sharing with other users and highlighting one's personal interests and inclinations.

7.4.1 Brainstorming ideas

After having constructed the scenario, the participants took part in a brainstorming session to find concrete ideas in the scenario described. The ideas were then clustered and each cluster was given a title. Lastly, the ideas were voted for according to three criteria (feasibility, coherence with the challenge and desirability) and the idea receiving the most votes was selected.

- *Community of education*: Possibility of creating a community of education between different people coming from different backgrounds. The community of education is a network in which by sharing contents everybody can contribute to improving each other's knowledge.

Whenever somebody has a question, he can indeed post it to the community and ask for concrete help. The community can do this in two different ways:

- Online: through the use of a platform. In the platform it is possible to connect contents to other related contents, to create an educational pattern and path
- Offline: through offline thematic workshops

- *Edu influencers*: Educational programs inspired by famous people, not only in the educational field, that let users acquire some knowledge in the field related to a specific person. For example, a program could be the "Mark Zuckerberg" educational program.

- *Reviews*: People can post on a platform some educational contents and the users of the platform can see this content, rate it and review it according to the concrete benefits it provides.

- *Education portfolio*: Possibility of getting an online education profile in a form similar to Linkedin. Each user will have their educational profile and will be visible by anybody (company, professor, community) who is looking for those skills (both hard and soft).

- *Daily/weekly education pills:* Online or offline wall, that suggests to a person how to define their educational goal and consequently collect as many educational pills as the ones he aimed at. For example, everyday a user could decide to get at least 10 educational pills and then document them, in order then to remember everything and keep an eye on their educational path.

- *Education history:* Possibility of documenting the things learned throughout a certain period of time and then print them out, in the form of a book or a booklet, in order to keep track of their personal educational path.

- *What is it?:* Mobile application that lets a user record a conference or a speech and have a real time feedback on the background of knowledge related to that speech. The application is especially useful for people that attend this kind of event, without previous knowledge of the topic.

- *Memories of education:* Online profile where to store any kind of content in order to keep track of personal's educational path. For example, if a daily situation has taught a user something, the user can take a picture of the situation and save it with some specific tags, that connects that situation with the learning effect.

- *Educational device:* Device to place at home, for example on the bedside table, that either projects on to the wall or tells the education contents acquired during the day. This device becomes a sort of assistant to keep track of the personal's education path.

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Ideas	Votes for feasibility	Votes for coherence with challenge	Votes for desirability	Total votes
Community of education	3	3	1	7
Edu influencers	2	2	2	6
Reviews	2	2	0	4
Education portfolio	0	0	4	4
Daily/weekly education pills	1	1	0	2

Education history	1	1	0	2
Ｗhat is it?	2	0	0	2
Memories of education	0	0	2	2
Educational device	0	0	1	1

7.4.2 Idea-building

The idea selected was developed through rapid prototyping. The participants made a tangible representation of their idea using the material supplied. In addition, the participants continued the project-building of their idea, integrating the fundamental factors obtained from the exploratory workshops.

Idea – Howto

Howto is a community of people around the world that are interested in acquiring new practical knowledge and sharing the knowledge they already have. Thanks to a digital platform, everybody can post and share, through videos or images, contents related to a specific topic. At the same time everybody can like content coming from other users. By creating or liking contents, users create their own educational profile that becomes a tool to acquire trust and recognition by the community. The people in the community can indeed evaluate each other's personal contents and review them. The best contents are evaluated, with the status of the user growing, up to becoming a topic's guru.

Gurus are then invited to offline meetings, where they meet the community and organize a workshop handing on their knowledge.

Fundamental factors – Elements of the idea
Glocal
-   Glocal sharing of contents
-   Local organization of workshops and meet up
-   Feature in the platform that lets users browse content also according to the location of the content's creator
-   Local companies can contact gurus

Do it for yourself
-   Improve personal knowledge for something that can't be done by the single user alone
-   Gain visibility
-   Upgrade status (up to guru)
-   Make money by answering questions asked by the community
-   Creation of an appealing profile for companies or any other client

Accessibility
-   Specific tags for the suggested age for accessing the contents
-   Different levels of the content (pro, basic, elementary) to help user screen the contents that best suit him

- Organization of offline meetings to meet in person the other users and help everybody get in touch with the community

System economy

- Organization of "not for free" workshops connecting companies or schools to gurus

Do-It-Together

- Use of a digital platform to create and share contents
- Possibility to see and connect contents coming from all the users, not just gurus
- The contents are reviewed by the community, according to the concrete contribution to knowledge

Social and cultural dimension of education

- Classification system that recognizes and shows the user and the community the level the user has reached (new recruit, apprentice, expert, professional, guru)
- The status is visible to the community and to companies

7.5 Results of the generative workshop on DiDIY&Education – Barcelona

In the generative section of the workshop on DiDIY&Education in Barcelona, the participants generated concrete ideas in the challenge, voted for the best idea and developed it taking into consideration the fundamental elements which had emerged in the first part of the workshop.

7.5.1 Brainstorming Ideas

After having selected a challenge, the participants took part in a brainstorming to find concrete ideas in the challenge described. The ideas were then clustered and each cluster was given a title. Lastly, the ideas were voted for and the idea receiving the most votes was selected.

- *Teachers as tutors, facilitators, trouble makers.* Involve teachers in redesigning the way they teach in order to become tutors, facilitators and trouble makers that challenge the classroom.
- *Edu punk.* Students decide with teachers what the topics are that they want to work on throughout the year. Moreover students form working groups and face concrete challenges on the selected topics in a collaborative way.
- *Teacher training*. Training program for teachers that involves them in redefining the way they teach. The teacher training is held together with researchers.
- *Affinity based groups.* Possibility for students to match and work together with other students, according to their personal interests and attitudes. Students can indeed participate in a call based on a specific story or challenge, where they point out what they are interested in and are consequently put together in a group with people sharing the same interests. The group will work together throughout the year on a group assignment and the evaluation will be based not on the result itself but on the level of collaboration and contribution to the group.
- *Kids connect with others to find out needs.* Possibility for students to connect with the neighbourhood or some institutions in order to research their needs and start a project based on the concrete needs they identified. In the other way, someone from the neighbourhood or some institutions could come directly to the class and talk about what they need.

- *Celebration of failure.* Organizations of events in which students are stimulated to talk about their failures, in order to build a trustful and open environment among students and stimulate the adoption of a trial and error approach.
- *Kids design their space.* Give students the possibility to design their own collaborative tools and spaces, shared among a group. These tools and spaces can be tackled according to the specific needs students encounter along the project.
- *In progress evaluation.* Possibility to evaluate student's work during the process and not only according to the final result.
- *Learning design (how to design the activities).* Design of the learning activities based on challenges and based on adventure. Students are given a one-day challenge they need to solve throughout the day, also looking for a solution inside the community. The learning path becomes similar to a game.
- *Collaboration-based evaluation.* Evaluation of the students based on their capability to collaborate.

Ideas	Votes
Teachers as tutors, facilitators, troublemakers	3
Edu punk	2
Teacher's training	1
Affinity based groups	1
Kids connect with others to find out needs	1
Celebration of failure	1
Kids design their space	1
In progress evaluation	0
Learning design (how to design the activities)	0
Collaboration based evaluation	0

7.5.2 Idea-building

The idea selected was developed through rapid prototyping. The participants made a tangible representation of their idea using the material supplied. In addition, the participants continued the project-building of their idea, integrating the fundamental factors obtained from the exploratory workshops.

Idea – Edu classroom

Edu classroom is a way of organizing the classroom in which students are divided in groups, working on different topics and according to their specific interests. Since the spaces are flexible, each group can modify the space as it prefers, in order to better suit their needs while working together.

Each group has a board showing the other groups the problems or issues they are facing, asking the other groups for help and contributions.

The board allows the navigation of students between the different groups, in order to keep their connections flexible and erase the barriers of the classroom.

The board is not only physically put in place in the classroom, but also digitally available, so that everybody can see online what's going on in the classroom.

The classroom is connected to the local community in two ways.

On the one hand the classroom gathers needs and insights from the community and solves the problems by designing solutions as part of their educational program.

On the other hand the community provides the classroom with resources, tools and facilities and creates a working bridge between the two realities.

In this kind of classroom there is an underground learning space, where students can connect with the teacher in order to face issues, such as frustration.

A great highlight is put on soft skills and emotional learning. Therefore in the classroom there are soft spaces for reflection, sharing and wellness in the classroom in order to stay happy and create a place full of pleasure.

Students are encouraged to share their projects inside the school but also outside the school.

That's why every class has a portfolio that gathers all the projects, showing not only the results, but also the connections they allowed, the resources they used, who has been helped.

8. Workshops outcomes for education purposes

In this section, the qualitative results collected through the workshops are processes to generate reflections which contribute to the enrichment of the results of the research of the WP4 on Education & Research.

The data collected are the result of a path of co-design which took place together with experts of the formal and informal education sector and experts of digital making.

The design toolkit under development will thus give the opportunity to those who use it to continuously generate reflections on the topics approached and also project-building solutions to apply the potential of digital making to the area of education.

8.1 The role of sharing

Sharing is one of the fundamental elements of DiDIY recognized as such by many of the participants involved in the explorative workshops in Milan and Barcelona.

The sharing element is necessary in order to create and keep alive a community which on the one hand shares the same ethics and the same system ecology, and on the other shares, through network infrastructures, knowledge, experiences, spaces, projects for helping/supporting the other members of the community.

Sharing is thus a new way of operating and a new attitude that includes sharing, discussion and an active exchange between peers which generates progress as in a scientific community.

Sharing allows bringing together people who have in common similar interests and needs who share different technical and transversal (soft) skills. This community becomes the place to draw on for specific competences according to the learning needs of the individual.

The higher the motivation that drives individuals to share, the more the community will be a container of unlimited knowledge and competences.

The sharing element is a qualifying characteristic of the Do-It-Together factor, a factor which can be replanned and reproduced in order to generate an educational ecosystem which makes the formation of competences and the exchange of knowledge easier. Inside this ecosystem, sharing and collaboration between individuals can be horizontal and vertical. Collaboration between individuals takes place on two levels: horizontally inside the community and vertically between individuals and different communities.

During the generative workshops on DiDIY&Education, many ideas emerged to try and develop an educational system based on sharing one's knowledge and interests and on making the most of the knowledge of others (see section 6.4.1).

8.2 The role of teacher

One significant concept that emerged from the workshops on DiDIY&Education is that teaching can no longer be understood solely within the scholastic system, but it is fundamental to speak of an ecology of the educational system, understood as the set of components that intervene and impact education and the relationship between them.

The "educating community" is talked about, including in it not only the family, the school and educators, but also the local area of reference, therefore the neighbourhood or, better, the city.

Thanks to the spread of digital technologies, the distances in the area are shortened and the possibility of action of education by formal and informal experience has extended. Today the educating community goes well beyond the borders of the city: e-twinning, access to the Internet, the use of devices extend out of all proportion the possibility of contact, recognition and learning. Building up an educating community is a new skill of the teacher that not only undergoes/procures/weaves relations with the local area, the families and the educators, but ought to know and map out the local, national and international possibilities of intersection, connection, support and learning. Teachers therefore become designers of strategies, seen as resources to identify materials, information and opportunities outside the scholastic context. The city becomes the fabric of relations in which the FabLabs, makerspaces, etc, and the makers and experts of technology become teachers, bringing students closer to the real world through the development of significant and concrete projects.

The reflections that emerged during the workshops also included the idea that to create an educating community or even simply a community circumscribed to a group of students and to keep participation in it high, the teacher also has to represent the figure of a positive leader, capable of stimulating creativity and the motivation of the participating community. This figure is at times defined as the super guru as representing a strong figure who almost does not transmit technical skills but knowledge, objectives, overall visions and strategic approaches to identify and select the multitude of resources available, exploiting them to the best for their interests.

8.3 Learning flows

From the reflections that emerged from the workshops, the process that the students face during the making activities is defined the "Debugging process", i.e., an attitude of working that is based on iterations and continuous learning. Frustration along the way becomes a building material to work on, in order to learn from mistakes and improve.

Some participants deem that the phenomenon of DiDIY has generated a new awareness of education in which the educational and learning models of the past return to be applied with ways and activities adapted to the contemporary age. According to others, on the other hand, DiDIY allows creating new transversal models, based on soft skills and which allow learning how to learn. These models allow the adaptation to the current fluidity and dynamism in work and learning, in where there is no clear division between the various specialized skills. One fundamental aspect is therefore acquiring a formative model and a process more than skills which can be spent immediately.

Through DiDIY, the learning flows extend outside the sphere of schools, also incorporating a social and cultural dimension through which there is an exponential diffusion of knowledge and skills. The generative flow which is created stimulates a relationship of continuous collaboration and response, which boosts the issue of feedback.

Thanks to the technologies of digital sharing, the learning flow takes on the characteristics of being multi-channel and spatiality. The contents of learning of the students and work can be enclosed in the same virtual container which acts as a bond in order to decentralize the place of learning in different parts of the world (different countries and different cities) and in different contexts (in the local FabLab, at home, in the park, etc). The creation of a peer to peer community is fostered, where there are no subgroups and where everyone can share, learn, be inspired by others, express and

receive opinions. This community means that the practice of learning is democratized, as everyone can access knowledge online and the contents created by the community. According to this idea, some participants have defined the new way of learning qualified by DiDIY as dynamic learning. Rather than a linear, isolated way of learning, dynamic learning takes place exponentially by activating learning from each project carried out by the community. The activated learning in turn allows the birth of new projects that will in turn activate other learning and so on.

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Annex 1. Design Tool Collection

See http://www.didiy.eu/public/codesign-workshops/annex_i_desig_tool_collection.pdf.

Annex 2. Creative rules

See http://www.didiy.eu/public/codesign-workshops/regole_della_giornata_en_2-min.pdf

Annex 3. IDEActivity toolkit gift

See http://www.didiy.eu/public/codesign-workshops/12_libretto_gadget-min.pdf

Annex 4. Workshops invitation material

Invitation flyer:

see http://www.didiy.eu/public/codesign-workshops/didiy_workshop_flyer_eng.pdf

Invitation e-mail:

see http://www.didiy.eu/public/codesign-workshops/invito_workshop_barcelona.pdf

Annex 5. Digital content

Flickr Photo Album: see https://www.flickr.com/photos/147342500@N04/albums

- co-design Explorative Workshop on DiDIY – Pilot – Barcelona
- co-design Explorative Workshop on DiDIY&Education – Milan
- co-design Generative Workshop on DiDIY&Education – Milan
- co-design Explorative+Generative Workshop on DiDIY&Education – Milan
- co-design Explorative Workshop on DiDIY&Work – Milan
- co-design Generative Workshop on DiDIY&Work – Milan
- co-design Explorative+Generative Workshop on DiDIY&Work – Milan