D4.4 RESULTS DERIVED
FROM DATA COLLECTION AND ANALYSIS

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Executive summary

Deliverable D4.4, "Results derived from data collection and analysis", presents and discusses the data gathered during the interviews and the online survey concerning the status of Digital Do It Yourself in education throughout Europe. During the first 18 months of the Project, we have P2 ABACUS has mapped the key actors and stakeholders in Europe and through workshops, expert interviews, and case studies DiDIY project has shed light on some of the solutions that are being practised in the field. The discussion and implications of the collected results are outlined in D4.5, "Strategic plan".

Revision history			
Version	**Date**	**Created / modified by**	**Comments**
0.0	10/10/2016	ABACUS	First draft.
0.1	16/11/2016	ABACUS	Second draft for partners' review.
0.2	18/11/2016	LIUC	Several revision.
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0.5	06/12/2016	ABACUS	Improved results and added conclusion.
0.6	07/12/2016	ABACUS	Review of 0.5.
0.7	13/12/2016	ABACUS	Review of 0.6.
0.8	20/12/2016	LIUC, ABACUS	Final draft.
1.0	26/12/2016	LIUC	Approved version, submitted to the EC Participant Portal.

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1. Introduction

As extensively discussed elsewhere (see D4.1, "Research space and agents"), it is known that most European countries developed their own educational systems during the Industrial Revolution. At that time, the mission and objectives of national educational systems was to prepare young generations to the upraising industrial job market. According to the very nature of industrial production, linearity, conformity, and standardization of contents were highly rated features of the didactic approach of the time. After a few decades, at the beginning of the so called "Information Age", the advent of new digital technologies and social media has however started reshaping the European citizens' life and society. Since then, societies asked for the educational models to change in order to adapt to the surrounding new social conditions. Results, though, have not been uniform, at least at the European level.

In order to be able to adapt to a constantly changing job market and its surrounding society as a whole, *new generations of students are required to acquire a vast amount of digital competencies and skills that traditional schools struggle to provide*. More specifically, besides the operational knowledge of specific technological tools and software, whose utility is likely to expire in a handful of years, *young citizens need to develop a novel attitude towards new technologies and towards learning*. In this sense, what might be needed in this new societal context might be a new approach toward learning and (self)education that radically differ from the delivery of fixed contents and notions to which teachers and students have been used to so far. Similarly, older generations facing re-collocation on the job market (which, after the recent economic crisis, represent an increasing share of the population) are facing hard times trying to acquire this flexible attitude toward learning and self-education (which imply also, but is not limited to, digital skills) to which they have never been exposed in school and are now considered mandatory for almost all positions.

Observing the current situation of formal and informal educational systems across Europe, it emerges that societies have been working to fill this gap between traditional school education and emerging societal needs by adopting novel, and potentially revolutionizing, solutions. In recent years, a "holistic" approach to education has been gaining momentum. Starting from educative practices outside schools but still related to institutional contexts (museums, associations, etc.), educators and learners have been trying to fill this gap with a significant number of differ initiatives; among those, the so-called "Maker Movement" has in particular received a lot of attention lately. Aim of this study is *to understand the current European situation regarding the adoption of the Digital Do It Yourself attitude in education*, and *to identify successful practices* that may provide useful examples.

2. Methods

The methods adopted to carry out this research are fully described in D4.3 "Methodological plan". For the sake of this document, it will suffice to say that three main qualitative methods have been exploited, namely (a) questionnaires/online surveys, (b) semi-structured interviews, and (c) workshops.

2.1 Questionnaires and online survey

A survey was developed (see D4.3 and D8.3, "First online survey", for further details) and distributed to students and teachers that participated in both general and DiDIY specific events. The same questionnaire was launched through the Project website (www.didiy.eu). The structure and the content of the questionnaire was adapted throughout the course of the Project in order to optimize the data collection. This resulted in four different versions of the questionnaire, which were administered at different time points to different cohorts of informants. Answers are distributed as follows:

Date of collection	Questionnaire version	N. of answers
19/03/2015	1	29
8-12/04/2015	2	38
27/10/2015 01/11/2016 18/4/2016 19/7/2016	3	14
21-26/04/2016 9-12/05/2016	4	41
TOTAL		122

The final version of questionnaire was made up of 10 sections: questions were identified so as to collect the opinions of responders using both open-ended questions (see questionnaire' section about "makers") and scalable questions (see sections on "making" in general, "digital making", "Internet of Things", DiDIY and creativity, DiDIY and flow of communication, DiDIY and role of teachers and trainers, DiDIY and role of sharing) (see https://docs.google.com/forms/d/e/1FAIpQLSeirXjmQ3zWTnaDYrjt1PDURD7v0pV-gp9xKIkjxxCETwaH3A/viewform and Annex 1).

A conclusive section was devoted to the collection of some personal details (demographic such as age, gender), educational background, and the informant's acquaintance with DiDIY instruments. The questionnaires were fully anonymous and were implemented using Google modules. A collection of screenshots is reported in Annex 1, which includes the detailed results of the four different questionnaires.

2.2 Semi-structured interviews

Thanks to their open and loose structure, qualitative interviews allow for the collection of subjective experiences, meaning, and attitude toward specific topics. An extensive mailing list of European stakeholders was developed during the first 18 months of the Project. This list comprises contacts from:

1. European Ministries of School and Education;

2. European Agencies of School and Education;

3. research centres;

4. fab labs;

5. coder dojos;

6. maker spaces;

7. hacker spaces;

8. the RoboCup Junior initiative;

9. the First Lego League initiative;

10. the Eurobot initiative.

Two hundred and sixty four (264) email addresses were collected and a personalized email with request for an interview was sent to each. The first contact was made via email, introducing the Project (brief description, link to the website, and a copy of the project's brochure in attachment) and enquiring into the recipient's interest to proceed with a further contact in view of a possible telephonic interview. Once agreed a date and time, a list of open-ended questions was shared. The outline of the topic guideline is reported in Annex 2. At the beginning of the interview (via telephone, or Skype), the interviewer introduced her/himself and briefly sketched the Project's outline and objectives. Before continuing, the interviewee was informed that the interview was not going to be recorded but that interviewer would have produced a written report to be included in a final overall report, i.e., this deliverable. The report of the interviewed was shared with the interviewee and he/she was asked to review it, edit it (if necessary) and approve it. Once received a reply via email with a formal written consent to publish the report, this was included (see Annex 3).

2.3 Workshop

For a detailed overview of the data collection carried out by means of the Co-creation workshops please refer to D4.7, "Creative design and education and research".

A pilot co-creation workshop was held during the Project meeting in Barcelona, Spain, on the 6th July 2016, and around 30 people took part to the initiative. The first co-creation workshop in education ("exploratory") was held on September 9th, 2016 at the premises of POLIMI ("Polifactory"). The second ("generative") was held at the same premises on December 14th, 2016. The third ("exploratory + generative") was held at the premises of Ateneu De Fabricaciò La Fàbrica del Sol, Barcelona, on December 1th, 2016. For further details, please refer to D4.7.

3. Results

3.1 Online questionnaire

One hundred and twenty one (121) questionnaires were completed and collected. The charts illustrating the results are in Annex 1.

3.1.1 Description of the sample

The sample was composed by 40 female, 72 male, and 9 people who preferred not to answer (Figure 1). The average age was 23.2 ± 7.4 years. In particular, there were 45 people under 20; 62 people in the years' range 20-40; 4 people in the years' range 40-60; and 0 people over 60. Ten people did not answer to the question (Figure 2).

In all questionnaires a question was included to enquiry into the professional background of the respondent. The question was divided into four areas: 8 people declared to have an artistic background; 21 people a humanistic background; 44 people a scientific-technological background; 39 people a technical-professional background; and 9 people did not answer (Figure 3).
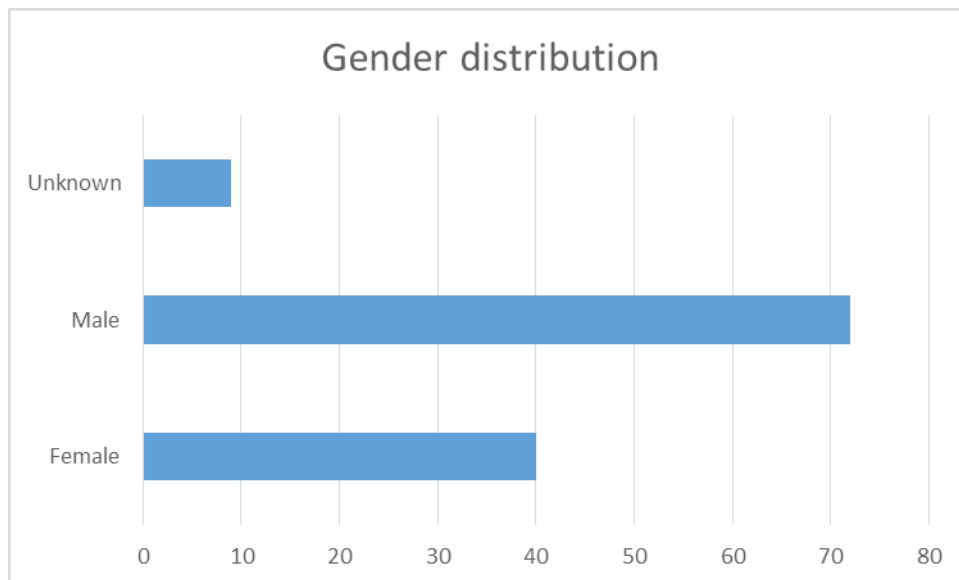

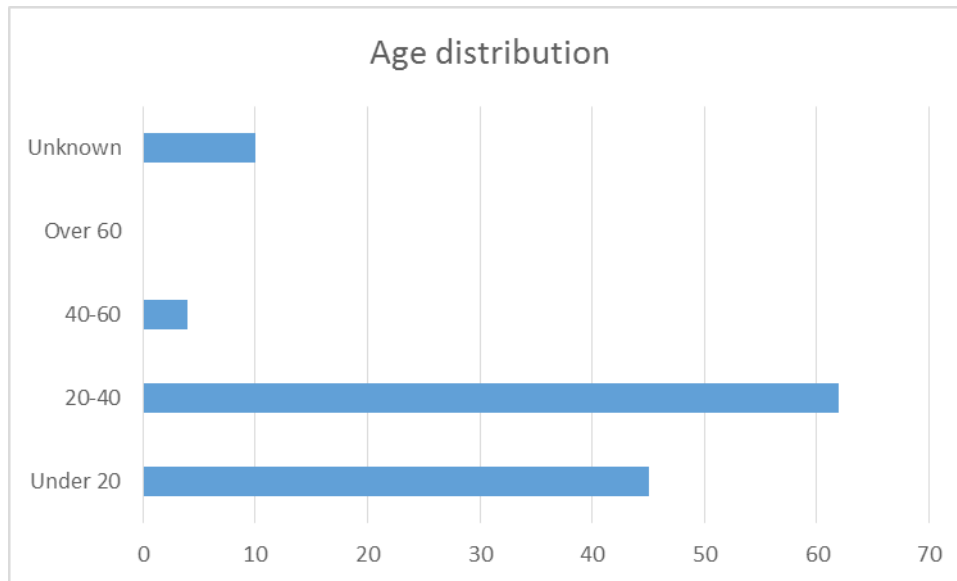
Figure 1 - Gender distribution.
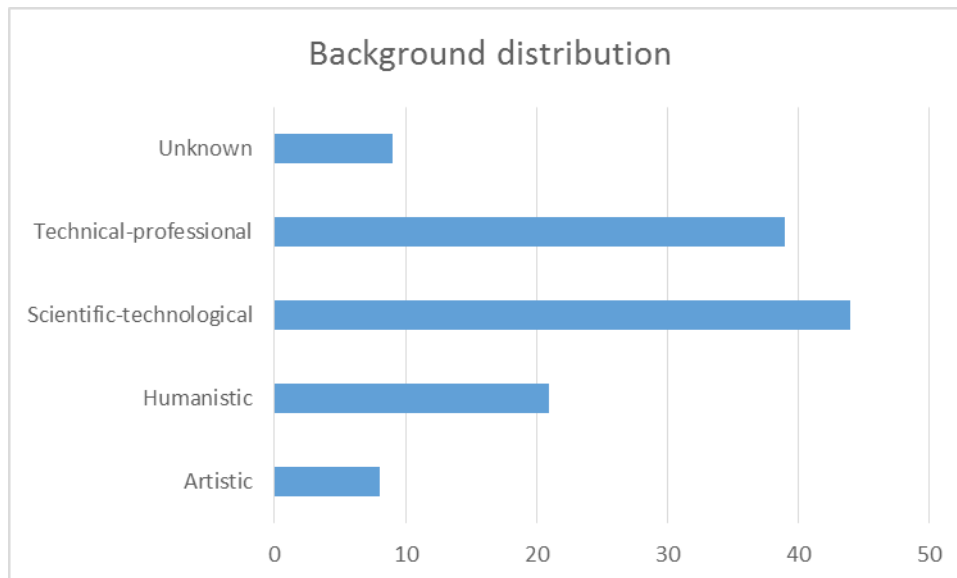
Figure 2 - Age distribution.

Figure 3 - Background distribution.

3.1.2 Attitude toward DiDIY

The questionnaires comprised different areas/main topics which were intended to investigate the current attitude of the respondent toward DiDIY movement. In particular, the main findings referred to:

1. Adjectives or expressions that come in mind when you think of a Maker:

The most reported words are *creativity* and *creative*, cited 23 times; the words *innovation, innovative, new* are cited 16 times.

2. Feelings about making something with your own hand:

Question "Making something with your own hands" was divided into the following positive and negative issues:

Positive: satisfactory, challenging, saves money, develops your competences, reassuring, teaches patience, useful to find a job, reduces wastes, makes your dream come true, brings together technology and art, makes you independent,

Negative: useless, waste of time, boring, hobby, is for nerds

Respondents had to score each issue selecting *false/irrelevant, sometimes (neutral), often/true*, according his/her personal feeling.

The results, shown below in Figure 4, were obtained using the Boolean operation Exclusive-NOR Function (XNOR):

A	B	A XNOR B
0	0	1
0	1	0
1	0	0
1	1	1

In particular, taken the *positive issue* equal to 1 and the *negative issue* equal to 0, and taken the *often/true* answers equal to 1 and the *false/irrelevant* answers equal to 0, we have:

Issues	Answer	Feeling
Negative	False	Positive
Negative	True	Negative
Positive	False	Negative
Positive	True	Positive

Example:

Satisfactory (*positive issue*) with scoring *true = positive feelings;*

Satisfactory (*positive issue)* with scoring *false =negative feeling;*

Boring (*negative issue*) with scoring *true = negative feeling;*

Boring (*negative issue*) with scoring *false = positive feeling.*

The output of this question has 46,86% answers with positive feelings; 12,95% answers with negative feelings, and 28,11% of neutral answers. 12,08% answers were blank.
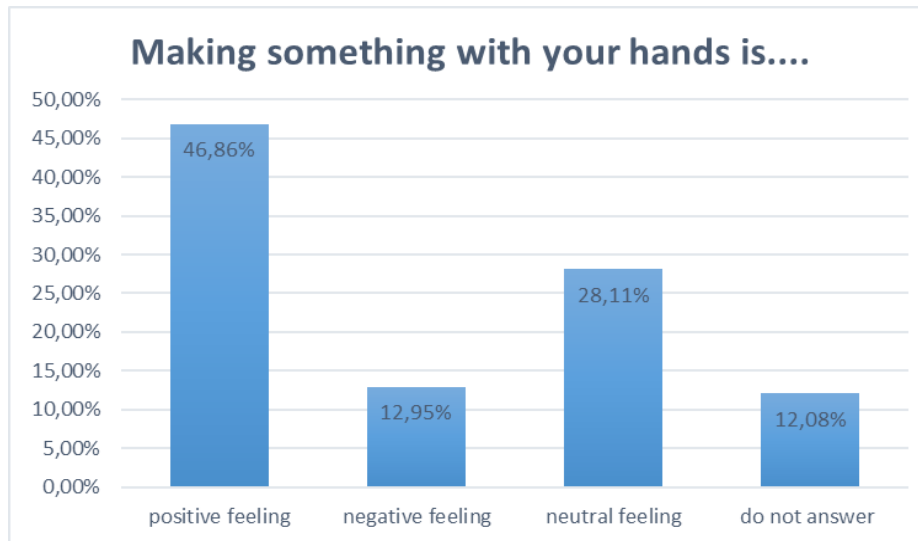
Figure 4 - Percentage of positive and negative feelings on "making something with your hands" question.

1. Feelings about Digital Do It yourself

Question "What do you think about Digital Do It yourself" was divided into the following positive and negative issues:

Positive: good ideas will save our world, is a way of making lots of money fast, you cannot be an entrepreneur without technology, finally an active use of technology, useful to find a job

Negative: it is just a game, better to leave it to professionals, good to show off.

To each issue the interviewed had to score selecting *do not agree, partially* (neutral), *true/almost true.*

The following figure (Figure 5) was obtained using the same logic Exclusive-NOR Function (XNOR), taken the *positive issue* equal to 1 and the *negative issue* equal to 0, and taken the *true/almost true* answers equal to 1 and the *do not agree* answers equal to 0.

Example:

Useful to find a job (*positive issue*) with scoring *true = positive feelings;*

Useful to find a job (*positive issue)* with scoring *do not agree=negative feeling;*

It is just a game (*negative issue*) with scoring *true = negative feeling;*

It is just a game (*negative issue*) with scoring *do not agree = positive feeling.*

The output of this question has 38,56% of positive feelings; 16,64% of negative feelings, 21,14% of neutral feelings; 9,38% of not know and 14,27% of not answer.
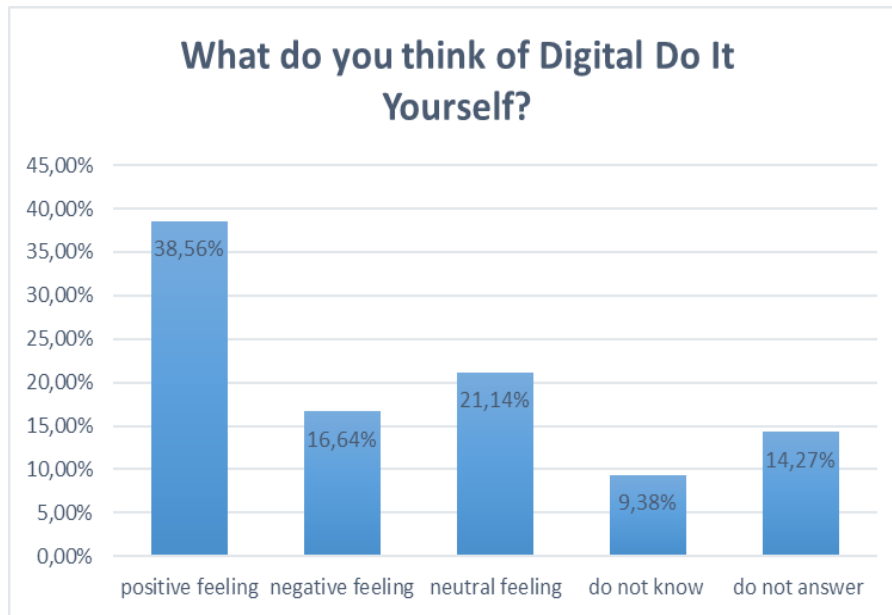
Figure 5 - Percentage of positive and negative feelings on "what do you think of DIY" question.

2. Feelings about the Internet of Things

In the questionnaires, there was also a question on the feeling toward the Internet of Things. The options were:

Positive: an incremental evolution, a revolution

Neutral: let's talk about this in a few years

Negative: just a slogan, a good idea but nothing new.

In this question, the interviewed had just to select his/her personal opinion without scoring each issue.

The Internet of Things has 49,07% positive answers; 12,04% negative answers; 15,74% neutral answers. 16,67% do not know and 6,48% do not answer.
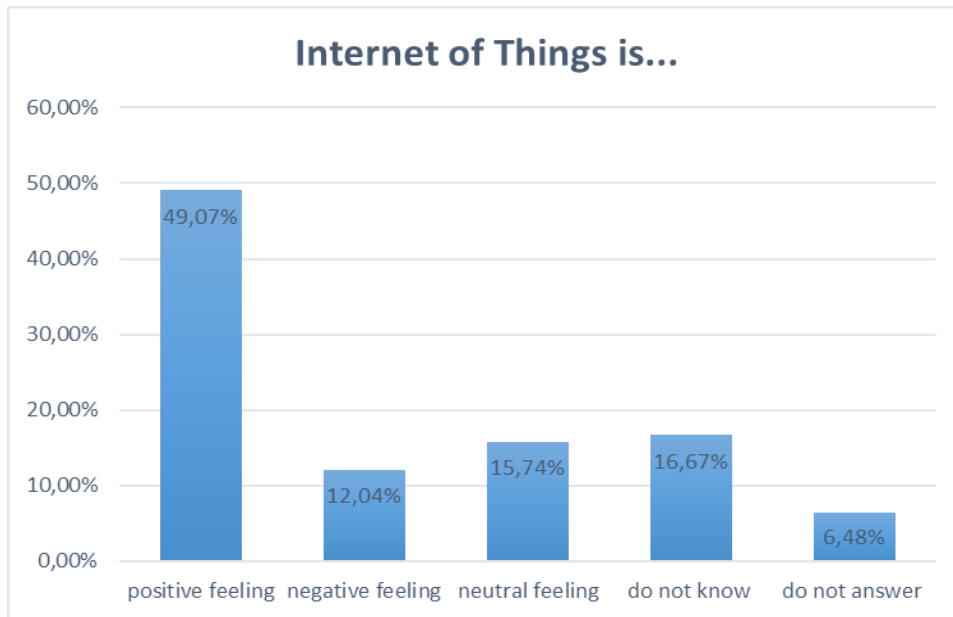
Figure 6 - Percentage of positive and negative feelings on the Internet of Things.

3. Knowledge and use of new DiDIY tools

We were also interested to discover the knowledge of new tools in DiDIY environment, therefore we asked the knowledge of the following tools: software to create and manage websites, blogs, etc; software and hardware to create digital video/audio; 3D printer and scanner; Arduino/Raspberry Pi, etc.; and 3D software (CAD).

The results are: 5,03% Never heard of; 38,76% I know they exist; 30,18% Used sometimes; 16,57% Often used; 9,47% Do not answer (Figure 7).
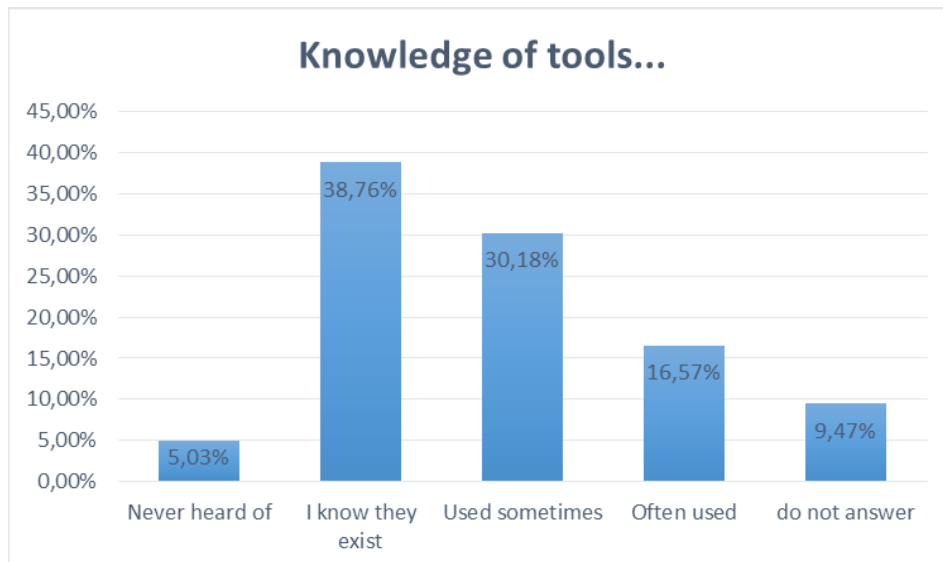

Figure 7 - Knowledge of DIY tools.

3.1.3 Creativity, communication flow, role of teachers and trainers, sharing

This group of questions was administered to a subgroup of 55 people. The questions were grouped according to four macro-areas: creativity, flow of communication, role of teachers and trainers, and sharing. The results are reported in the following figures and tables.
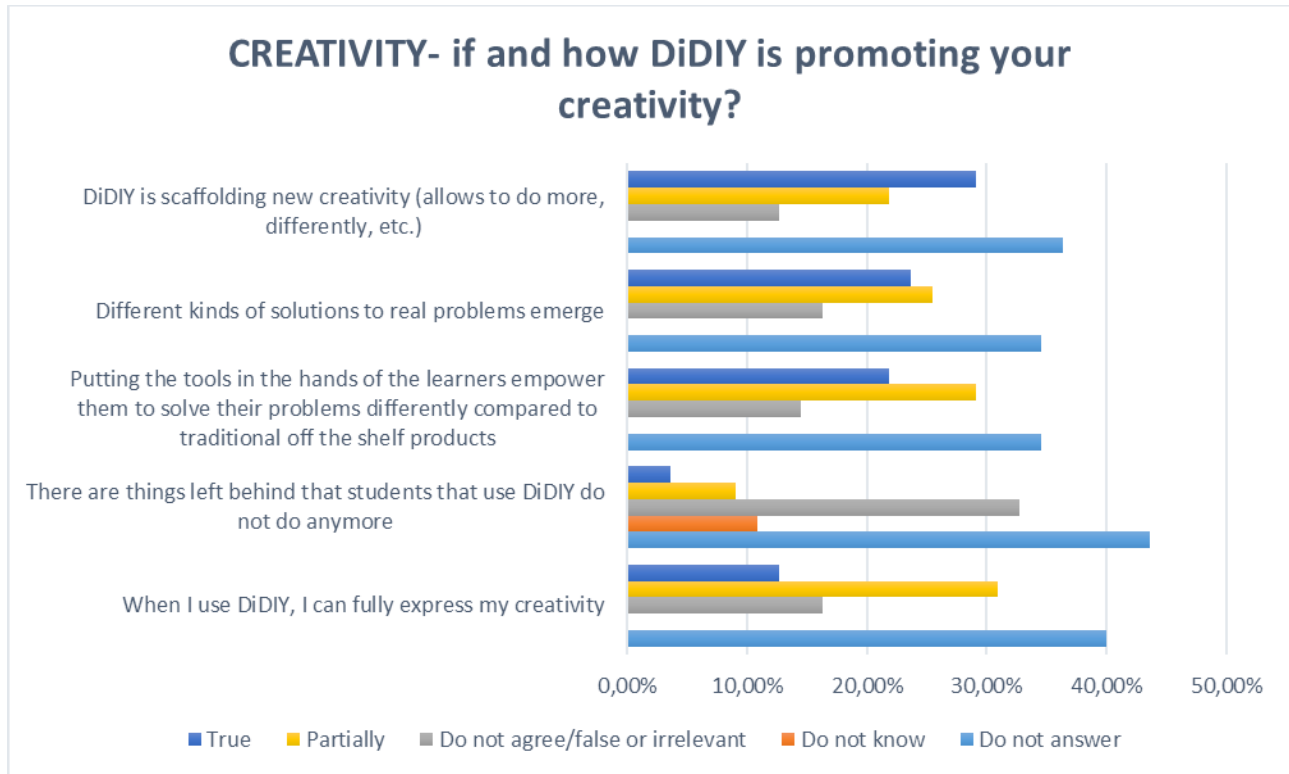

Figure 8 - Creativity: if and how DiDIY is promoting your creativity.

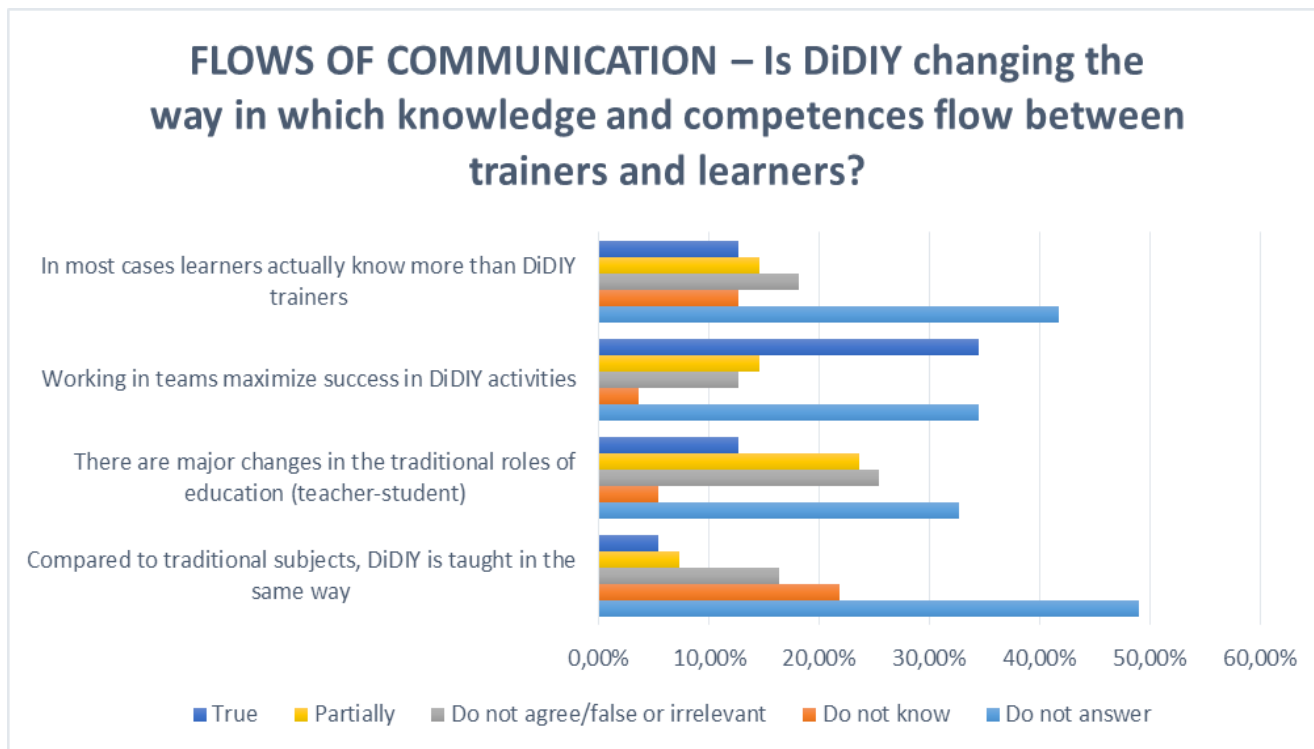|	CREATIVITY – If and how DiDIY is promoting your creativity?				
	When I use DiDIY, I can fully express my creativity	**There are things left behind that students that use DiDIY do not do anymore**	**Putting the tools in the hands of the learners empower them to solve their problems differently compared to traditional off the shelf products**	**Different kinds of solutions to real problems emerge**	**DiDIY is scaffolding new creativity (allows to do more, differently, etc.)**
Do not answer	40,00%	43,64%	34,55%	34,55%	36,36%
Do not know	0,00%	10,91%	0,00%	0,00%	0,00%
Do not agree/false or irrelevant	16,36%	32,73%	14,55%	16,36%	12,73%
Partially	30,91%	9,09%	29,09%	25,45%	21,82%
True	12,73%	3,64%	21,82%	23,64%	29,09%

Figure 9 - Flows of communication:
if DiDIY is changing knowledge and competences flow between trainers and learners.

	FLOWS OF COMMUNICATION – Is DiDIY changing the way in which knowledge and competences flow between trainers and learners?			
	Compared to traditional subjects, DiDIY is taught in the same way	There are major changes in the traditional roles of education (teacher-student)	Working in teams maximize success in DiDIY activities	In most cases learners actually know more than DiDIY trainers
Do not answer	49,09%	32,73%	34,55%	41,82%
Do not know	21,82%	5,45%	3,64%	12,73%
Do not agree/false or irrelevant	16,36%	25,45%	12,73%	18,18%
Partially	7,27%	23,64%	14,55%	14,55%
True	5,45%	12,73%	34,55%	12,73%
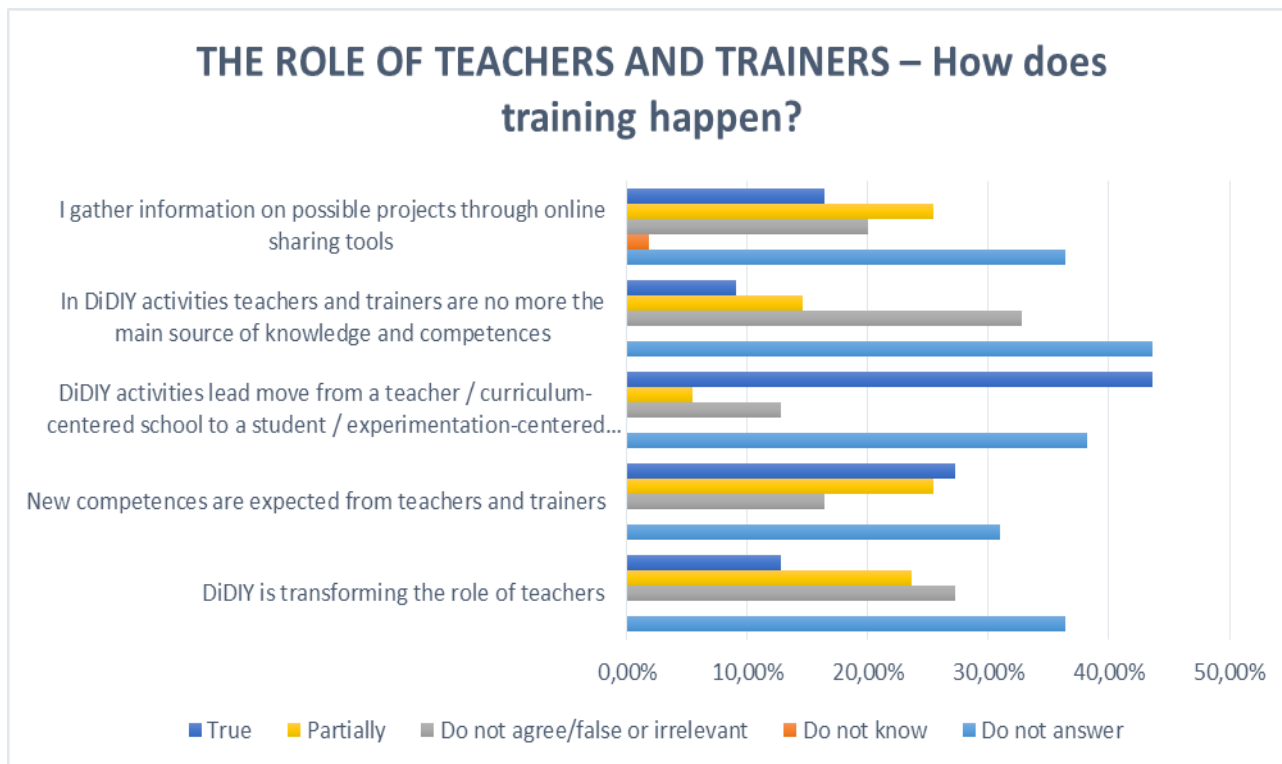
Figure 10 - The role of teachers and trainers: how the training happen.

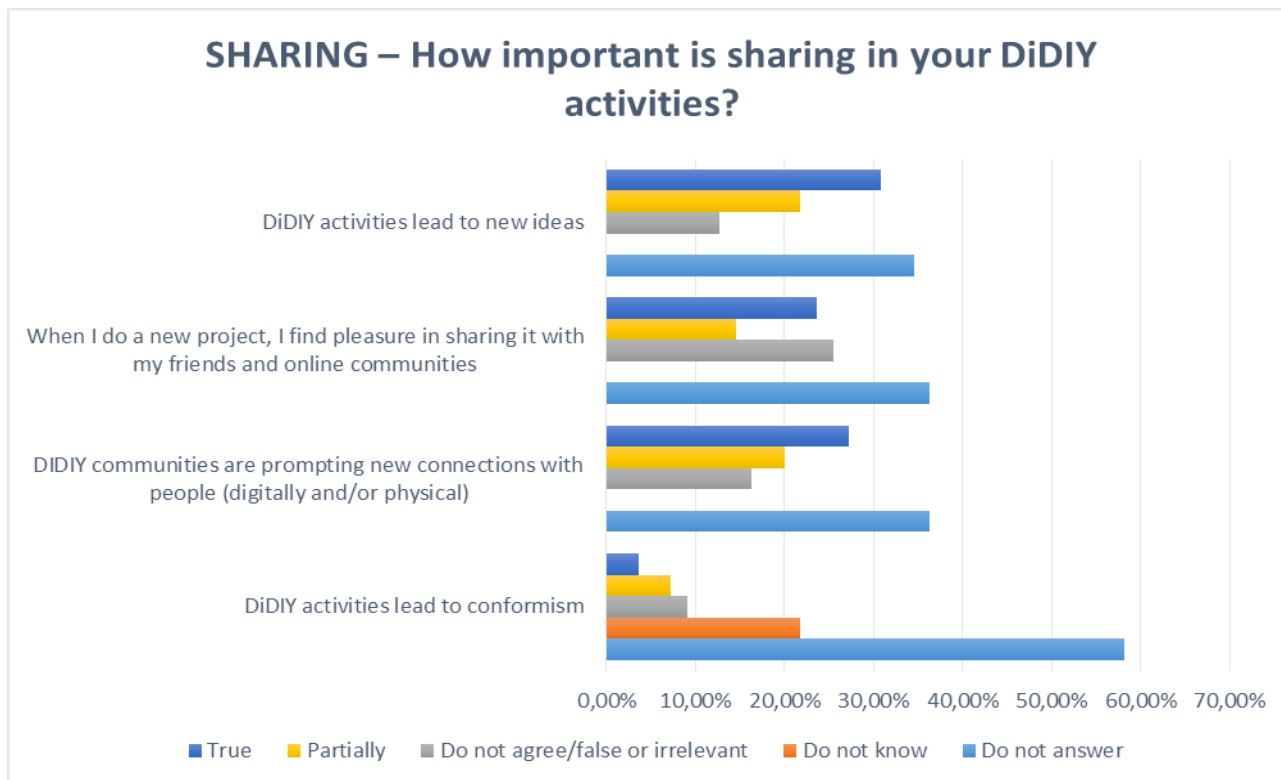|	DiDIY is transforming the role of teachers	New competences are expected from teachers and trainers	DiDIY activities lead move from a teacher / curriculum-centered school to a student / experimentation-centered education	In DiDIY activities teachers and trainers are no more the main source of knowledge and competences	I gather information on possible projects through online sharing tools
			THE ROLE OF TEACHERS AND TRAINERS – How does training happen?		
Do not answer	36,36%	30,91%	38,18%	43,64%	36,36%
Do not know	0,00%	0,00%	0,00%	0,00%	1,82%
Do not agree/false or irrelevant	27,27%	16,36%	12,73%	32,73%	20,00%
Partially	23,64%	25,45%	5,45%	14,55%	25,45%
True	12,73%	27,27%	43,64%	9,09%	16,36%

Figure 11 - Sharing: how important is sharing in DiDIY activities.

	SHARING – How important is sharing in your DiDIY activities?			
	DiDIY activities lead to conformism	**DIDIY communities are prompting new connections with people (digitally and/or physical)**	**When I do a new project, I find pleasure in sharing it with my friends and online communities**	**DiDIY activities lead to new ideas**
Do not answer	58,18%	36,36%	36,36%	34,55%
Do not know	21,82%	0,00%	0,00%	0,00%
Do not agree/false or irrelevant	9,09%	16,36%	25,45%	12,73%
Partially	7,27%	20,00%	14,55%	21,82%
True	3,64%	27,27%	23,64%	30,91%

The complete results of each questionnaire are reported in Annex 1.

3.2 Interviews

Twenty-seven (27) persons replied to the first contact and all of them agreed to an interview. Twenty-two (22) interviews were collected and are included in Annex 3. Four (4) contacts did not generate a report due to: topic out of scope, repeated missed calls. Fifteen (15) EU countries were thus represented in the study (namely: Belgium, Bulgaria, Czech Republic, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Portugal, Spain, the United Kingdom). Overall, all the three geographical European macro-areas (North, Centre, South) were covered.
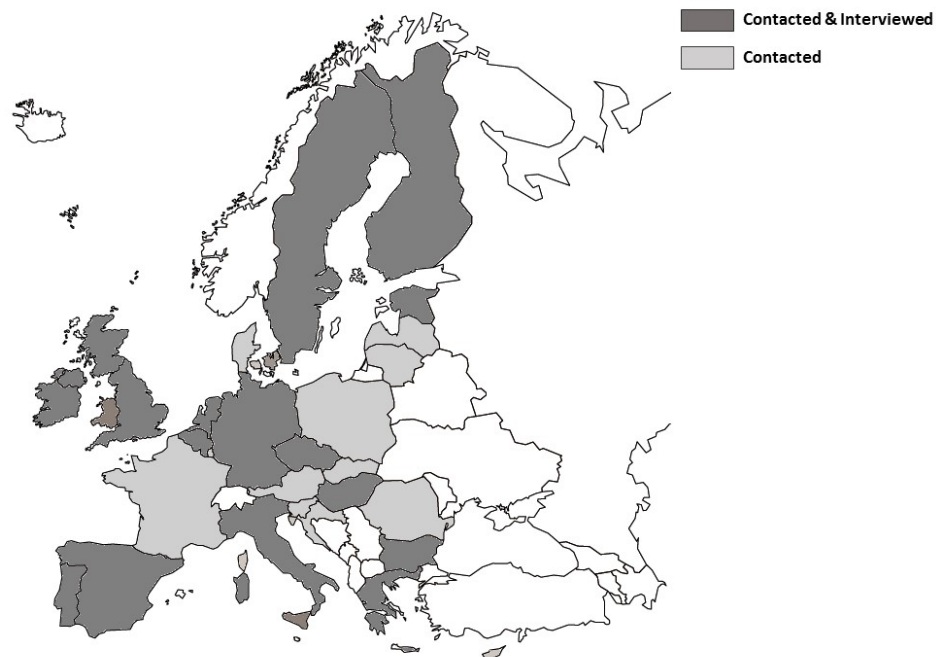
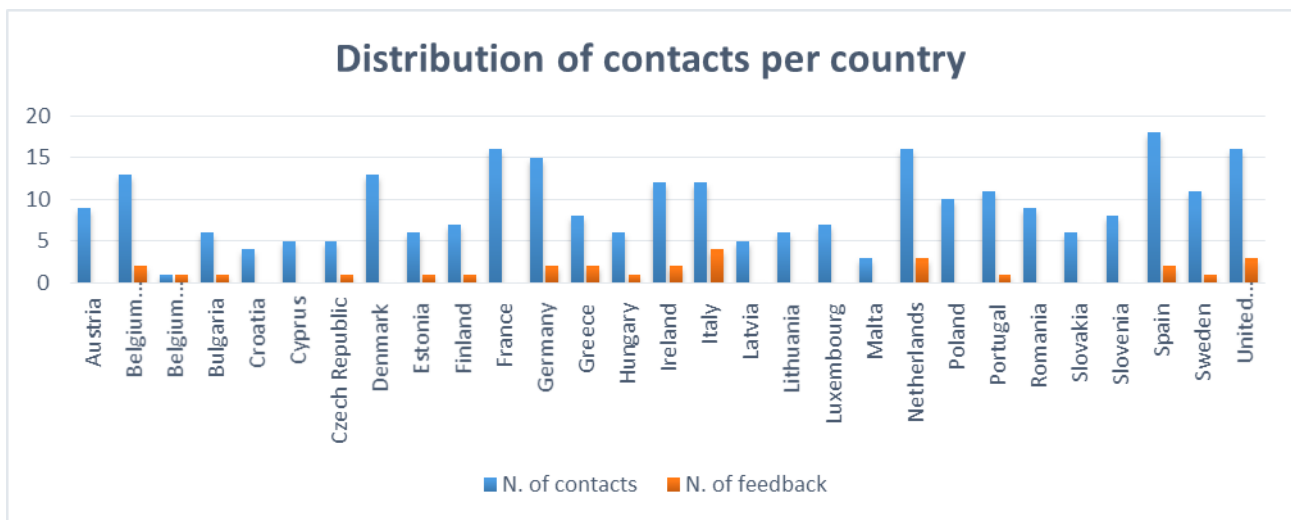Figure 12 - Map of EU with countries covered by the interviews.

Figure 13 - Distribution of contacts per country.

3.2.1 The role of sharing

The context is the widespread and affordable access to the Internet and the growth of the free software and open source and open hardware movements. We asked if working on common projects and share working spaces with colleagues-friends could lead to new ideas or, on the contrary, to conformism, and if DiDIY-related learning processes lead a reshaping of the roles of individuals.

From the answers of several respondents (5[1], 8, 9, 11, 12, 13, 14, 18, 19, 21) we saw that *sharing plays an important role* in FabLabs, CoderDojo, Eurobot, MakerSpaces, and schools. In these environments, instruments, tools, and competences are constantly being shared. These initiatives operate so as to create interesting things, to engage people in something they like to do. This is a

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[1] Numbers near the institutional name are referred to the progressive number of the interviews as reported in Annex 3.

great opportunity for children to learn new technical and social skills, as well as to learn from each other (18). An open vision leads to new ideas and products: however, this sharing is not market-driven, but rather comes from the desire to see things made (5). The problem solving techniques and the working group amplify the role of sharing as a tool to learn together. Creativity is less related to group activity or to the leader, but the environment itself allows people to be creative, because there are no constraints (9). DiDIY-related learning processes tend to reshape also the roles of individuals, given that working in a group lead to an enhanced communication, compared to the standard student-teacher relationship (14). Indeed, teaching to a friend could improve the understanding on what you are teaching, and learning from a friend could improve the self-confidence.

However, there were some perplexities related to the idea that now pupils might be more content-producers than before. Friedrich-Alexander-Universität (8) reported that this aspect has in fact not changed and that pupils do it at the same rate, but maybe in other forms, although certainly sharing has become easier nowadays. The novelty does not reside in producing, rather in sharing: creativity overall might be decreased, while the ability to reuse works done by others, hence reducing one's workload, might have increased. It must be noted that the students' motivation in producing new knowledge could be very limited overall (why should they, if not required?) because, as with the general population, very few people are interested in providing services to others for free, and students might have others priorities, rather than producing content.

AltLab (19) reported the feeling that the circumstances in Portugal might differ from those of the other European countries. The digital movement is important, but not everyone understand this opportunity: in Portugal hackerspaces are seen as universities, with teachers and students. Therefore, the general attitude of hackerspaces' attendants is not as an independent maker but like a passive students.

Indire (12) in Italy studied the role of sharing in the schools and found that these are moving fast. In particular, there is a strong sharing approach of tools and competences in schools with a technological attitude. This movement depends from the innovation that maker space, fab lab and other different contexts can bring to the society: professors tend to follow the technological trends, having an imprinting from the society.

3.2.2 Learning flow

As a project, we were also interested in understanding how communication and sharing are reshaping the learning flows between students and teachers, and how the learning process takes place during "learn-by-doing" activities. In particular, which formats/contexts, facilitated by which tools and led by which roles, are the most successful.

We received different feedbacks from the stakeholders operating in the education area. The most common opinion was that *learning is changing, being nowadays more focused on the differentiation and personalization of the learning environments* (1, 2, 3, 9, 10, 11). *Students want to decide what and how to study*, while adult learners need to develop new competences to be part of the professional evolution in the technological world (1). Students need to be prepared for 21st century world, and this means that they need to go beyond the traditional curriculum (20). It is possible for pupils to create and share content and teachers need to do an effort to introduce this new knowledge in schools, which it is recognized as a very important skill for the future. In general, *these activities are not integrated in the class curricula but are optional/extra activities outside school hours* (counter example: when made mandatory, students lost motivation, teacher had to choose best candidate (19)). FabLab Frosinone (13) reported their experience of using dedicated open platforms to share research processes and competences. He believes that currently students

have low independence, and this is why his fab lab is trying to create open and reusable knowledge. Most of them are "hands-on" meeting or project-based workshop where, after a very brief introduction, they start working on a common project as a group. *Motivation to learning is the key*: this new learning flow is not any more a "teaching flow" but a "reasoning flow" ("I don't know the answers to everything, let's find out together") (21).

The critical issues were identified in *how to sufficiently structure such learning*. Strong pupils might be able to successfully perform according to this new paradigm, as they might have enough discipline to develop their own learning strategy and path, but other might need more help (21).

Another critical issue is a too much optimistic view in making, as a trendy movement: making is important but thinking is important too (11). *A critical thinking about making is essential, and an ethical point of view* on distributed manufacturing, recycling and so on, *must be kept*.

Furthermore, it was highlighted the need to teach the so called "digital sovereignty" to pupils (8). Even if they grow up in digital environment they are not able to cope with the broader consequences of technologies uses (i.e. the memory of the Internet, for how long one own information will be found on the Internet in the future, or 20 years after one's death). For this reason, it could be important teach the ethical issues related to the use of technologies, which kind can be safe or unsafe to share on the net, and how does it feel for a person in the target of the Internet discussion. With regard to this "soft" topics, technologists might not be the best teachers, as they might be rather "blind" to the topic, being expert on how to use the technology but lacking the background/competencies to reflect on it. Teachers in ethics, languages, social life, and religions, could give different and valuable perspectives about the implications brought forward by the use of these technologies.

3.2.3 The role of the teacher

How DiDIY can be exploited to ease/emphasize the transition from a teacher/curriculum-centered school to a student/experimentation-centred education is still an open issue. In turn, this call for the need of exploring how the role of the teacher will change as a result.

The most common view about this change in the educational environment is that this process require teachers to be creative, to find their own resources, which can be difficult and demotivating for some. New contents are available almost everywhere (online courses and resources, shared events and conferences) but changing the teachers' attitude towards technologies could be a hard task. Some of them might not able to use these new technologies, or at least at very different levels (they might know how to use a computer, but in traditional, passive way). The interviewees shared the opinion that this kind of innovation is still an exception, not the norm.

The Flemish Ministry of Education (1) identified *four main requirements for the DiDIY to be integrated in schools: a flexible physical infrastructure, the availability of teachers who can work with these technologies, access to contents, and the ability to fit these new contents in the core curriculum*. All of them are important preconditions to the adoption of digital technologies by school: if only one is lacking, the whole process stops.

Several constraints emerged from the interviews regarding the role of teacher. One issue is that *teachers are afraid of failing in front of students*, as they fear that they (the students) can be more knowledgeable than them. The Estonian Information Technology Foundation for Education (6) outlined that the real problem is the pedagogical program: there are good equipment and funding to purchase new technologies are available, but *teachers need to adapt to the novelty* and this is a difficult task. CoderDojo Wilmslow (22) believes that we should try and pass the idea that it is not

fair to the teachers to think they must have all answers to all the students' questions. Rather, they should feel free not to know everything. That is where the project-based approach to didactic should come in ("*Let's find the answer together*").

The stakeholders interviewed proposed some solutions to these constraints: working to *train teachers* to let aspects of using new technologies in schools not under-represented (8), showing *how to use these new technologies in real contexts* and *showing successful experiences* (22). The training is focused on teachers only, to *help them overcome their "fears" and to feel more confident about using new technologies* (15).

3.2.4 How is school as institution responding to the use of DiDIY?

Today, new technologies have not been fully adopted in elementary and high schools of all the European countries we surveyed, but all interviewees pointed out the need to change. From most of the interviews it is emerged that schools are slow in taking up new things because they must deal with more preliminary, basic problems (connection, old computers). Teachers work mainly individually, and they need to be able to apply IT on concrete contexts and the funding availabilities to renew the schools system seems to be very low.

Frankenstein Garage (14) pointed out that the situation might differ between different municipalities. Indeed, he reported different investment in school renewal according to the availability of funding in each municipality. Furthermore, he noted that, at least in Italy, technical high schools have more opportunities to innovate compared to other high schools, and compared to elementary and middle schools.

However, in all the European countries we surveyed, fab labs and maker spaces organize free courses and workshop for elementary and high school students. The most common courses are related to coding, 3D printing, Scratch, robotics, and Arduino.

In general, they found some difficulties to be part of the education high school system because of the fixed courses. In fact, the shared opinion is that *DIY should be included in schools programs with an institutional approach. i.e. top-down* (11). Indeed, in the current programs' organization there is not enough time for DIY courses, and the activities offered by fab lab, maker spaces, codemotion, eurobot, etc are considered extra curricula activities.

In Portugal, AltLab (19) tried to extend the participation to their meeting and events, but the affluence was low. They entered into *partnership with the local municipality and the teachers*: these latter had to choose the best candidates in their classroom, and a workshop only for those students was organized. These students were more motivated and interested to develop new digital skills and the results were very good.

In Finland, Hackerspace Mikkeli (7) outlined a new promising perspective. They initially struggled to find funding to organize a hackathon, but now it came into fashion: everyone likes to do experiments, and therefore there are more funding opportunities from national no-profit organizations. Some organizations partner with local universities and high schools, and teacher usually positively recognise the participation of students to a hackathon or a similar events.

The Estonian Information Technology Foundation for Education (6) developed one special program on technology literacy. The Estonian Information Technology Foundation for Education worked to help teachers and students learning how to use technologies more. They also support schools in understanding how to purchase technologies such as Raspberry Pi and Arduino. The Estonian curriculum for digital competencies of students is based on the EU standard. Starting from this, they developed a curriculum for every level of their national education (four in Estonia), later endorsed

by the Ministry of Education. They developed practical examples of how to use new technologies in schools for every curriculum, as the objective was for teachers to learn how to use technologies in real life for their subjects. The examples have been written by the teachers themselves and they have collaborated with 45 teachers in a joint effort.

3.2.5 Gender issues

Almost all of the stakeholders interviewed reported that DiDIY courses, events, and workshops are attended principally by men, rather than women. The reasons outlined are different. One of the most common is related to a cultural setting problem: technological and informatics working area are traditionally male-oriented. However, all agreed that this should be changed. In Finland, the Hackerspace Mikkeli (7) is planning to do that in the next year by the so called "*positive discrimination*" toward women, to be sure that there is gender balance in events/meeting. Furthermore, they reported that if courses are attended by half male and half female participants, the tone of the course changes. *Having female teachers may help engaging girls* in these activities. In UK, CoderDojo Wilmslow (22) noticed that the more female mentors, the more girls they get: if they see a female mentors, that is a female role-model they can relate to. The same course taught by male or female teacher deals with different topics, and this gives an added value to the training.

Another point of view emerged from Italy, from the Frankenstein Garage (14), on the gender unbalance reason, is due to curiosity. Indeed, they noticed that *parents let men exploring more "dangerous" games*, for example mechanical tools, drills, constructions and so on. Female children are more protected so they have less opportunities to play with mechanics and electronics.

However, the gender balance increase if the workshop or event is more "open" (16). For example, creating a website that can be more customizable, or design informatics tools, or photograph courses, have more female attendance. Their *participation depends on the subject of the workshop*.

Everyone stated that they do not see any difference in the confidence level with which men and women tackle projects. In fact, girls are very good in collaborating and they are more willing to get to the solutions, being tenacious and patient (22).

The only exception is the IaaC global summer school, where there is gender equality. FabLab Frosinone and Noumena (13) told us that during this event, an intensive two-week course, both men and women have the same participation.

3.2.6 From STEM to STEAM

At present, DiDIY in education is mainly used in close relationship with STEM (Science, Technology, Engineering, and Mathematics) subjects, whereas if other subjects are involved, they have an ancillary role. Our question was focused on the main role of DiDIY in other subjects, such as humanities, arts, and so on, in order to move from STEM to STEAM (where A stands for "Arts").

FabLab+ (2) believes that art is a consequence of the do it your self-process. During the creation phase, everyone should be makers and start creating with Do It Yourself open-minded. Otherwise, without a 3D model, it is difficult to experiment what could be created. The same opinion is shared from Hackerspace Valencia (21), who believes that hacker spaces are not only scientific. In general, artists work with engineers sharing their competences in a multidisciplinary project.

In fab labs, hacker spaces, maker spaces and so on, there are young designers, artist and makers that use technology to make art. FabLab Limerick (11) knows that there is a gap between STEM and

STEAM, therefore their goal is to fill this gap: DIY without art could be boring so they do their best to turn STEM in STEAM through the art.

The Estonian Information Technology Foundation for Education (6) is promoting the use robotics and 3D design to show how to be creative in the engineering design. Estonian Information Technology Foundation for Education works to help teachers and students to use more technologies. During training course, the trainers show how to implement robotics into, for example, a history course, and do not limit their scope to "traditional" subjects such as mathematics or physics.

Indire (12) has the feeling that in high schools there is a strong multidisciplinary attitude bound to individual teacher, instead in elementary schools there is a general multidisciplinary approach in projects development, including scientific subjects and not. In high schools, multidisciplinary projects are extra curricula activities because, considering the school's organization, it is quite difficult to put together different subjects with different planned timing and fixed programs.

3.2.7 Research, careers, labour market

The DiDIY revolution has increasingly made available (and affordable) tools and knowledge to a wider audience, enabling citizens to participate to research activities that would otherwise been out of their reach.

In the research area, barriers between technology and people require an interdisciplinary approach: academic approach is one of the best way to explore an interdisciplinary approach in the society. *If we want to involve kids in research, we should create a safe environment, also from a physical point of view* (11). Furthermore, the relationship between kids' education and making should be done not only using small projects, which give them some real, immediate outputs to see, but rather *the environment in which courses take place should include the results of larger, more complex projects, to create a more stimulating environment, inspire them, giving them the idea that they could do a lot more*. FabLab Limerick is part of higher education institution, so they have courses for adults. They also have courses dedicated to unemployed people. This program is to provide them new skills in digital fabrication, and a certification in design of digital fabrication at the end to the semester. This should provide them a new way to enter in the labour market.

According the Flemish Ministry of Education (1), there is a considerable *rise in jobs for the highly skilled*: engineers, software developers, IT'ers, researchers. There is no doubt that high skilled jobs will become dominant on the future labour market. Furthermore, we can also see that jobs for the lowest skilled (cleaners, etc.) is quite stable. The Flemish Ministry of Education stated that what is important to acknowledge is the dramatic drop in those professions that are in between those two, and that require a middle level of competence: i.e. clerks, office and bank employees, maintenance workers, etc., and it is mostly for this type of jobs that Flemish Ministry of Education trains people in their education system. According his opinion, today, what schools are delivering is the opposite of what the labour market is demanding. Indeed, in the future, some of the current intellectual jobs will disappear: *entrepreneurship, communication, creativity, are the core 21st skills competencies*. The conclusion of the Flemish Ministry of Education is that what we need is an "hourglass" model: broad at the top and the bottom, narrow in the middle. The educational system delivers via a triangle model: very broad at the bottom (vocational education and training, and technical education) and very small at the top (university profiles).

AltLab (19) thinks that DiDIY is creating new careers opportunities. Some new hacker spaces are linked to private companies (i.e., incubator). The research are more attracting is the intersection between society and technological field. FabLab Frosinone (13) believes that DIY is a process to

become a community but it is not a work: the DIY is an open mind state, a collaboration, therefore an approach.

3.2.8 Special groups

The interviewees who answered to this question are only four. Two of them shared the same point of view on the contribution of DiDIY in helping special groups of individuals (e.g., disabled, second generation immigrants, specially gifted), whereas *digital inclusion and assistive technologies can really mean the difference between a successful education or drop-out from school* in these cases. DiDIY as a way of creating a personalized learning might be crucial for pupils at extra risk (1). The biggest advantages of technologies is that they help coping with the heterogeneity of classes, where pupils with special needs are present. *If we can offer additional pathways to those that otherwise would be left behind, they could learn at their own pace*. It is indeed a field where new technologies can be really useful (8). Indire (12) reported that it is necessary to have both technology and inclusive education to get homogeneity in the classroom.

The Estonian Information Technology Foundation for Education (6) has not a special program for students with special needs, because they think they need to be integrated into normal classes. The materials they develop are adapted for all. There are indeed some expert teachers who are dealing with them in particular and they are sharing their experiences through web seminars and conferences.

3.3 Workshops

The overall objective of the workshops is to explore a co-design process for digital DIY, producing guidelines for the European Community and developing a design toolkit, released with a Creative Common license, that will facilitate whoever wants to apply the potential of digital DIY in their own professional field, in order to generate innovation and new competences.

1. *Workshop DiDIY&Education* – exploratory

The primary objectives of this workshop were: to empathize with the context, to identify the principal factors underlying the Digital Do It Yourself, and to propose a challenging design to be collaboratively solved. The participants carried out different activities through a structured path and using methods and tools designed specifically for the co-design and design thinking. The output of the exploratory series of workshops are a series of challenges and a collection of fundamental factors of DiDIY. They represents the input for the generative series of DiDIY & Education workshops.

2. *Workshop DiDIY&Education* – generative

The goal of the generative workshop is to create and build a well-defined concept including the critical factors and responding to the innovative launched challenge.

The idea was implemented with the fundamental factors resulting from all exploratory workshops scheduled in four areas investigated by the DiDIY project (education, employment, legal system and creative companies). Participants were guided by facilitators and they have used methods and tools ad hoc designed on the co-design and design thinking.

The challenge chosen by the participants to work on was "How can we organize and manage an educational community on the digital DIY including the allocation of roles within it?".

3. *Workshop DiDIY&Education* – exploratory and generative

This series of workshops combines exploratory and generative activities in one day. The tools do not change and neither the objectives set by exploration and generative series that have been achieved also in this new series.

The creative flow of the workshop changed, giving the rhythm to the activities. The new goal was to check the changes in activities and tools in a setting close to the real one.

Please refer to D4.7 for the results of the co-creation workshops on DiDIY and education.

4. Conclusion

The main conclusions are summarized below.

1. DiDIY events are attended mostly by people under 40, with scientific-technological/technical-professional background.

2. The shared opinion regarding the maker is that he/she has to be creative.

3. He majority of people who answered to the project questionnaire believe that making something with your own hands is considered as satisfactory, challenging, useful to develop competences, useful to be independent, reducing wastes, and in general a positive activity.

4. DiDIY is seen as an active use of the technology and useful to find a job by the majority of people involved in the data collection with questionnaires; however, a good portion of the people who answered to the questionnaire had negative feelings about it, believing it to be just a game and something good to show off.

5. The feeling toward the Internet of Things is positive for the overwhelming majority of persons. The Internet of Things is seen as an incremental evolution and a revolution.

6. Creativity: The general feeling is that DiDIY is scaffolding a new creativity by putting new tools in the hands of the learners. Problems are solved differently compared to traditional off-the-shelf products.

7. Role of sharing: working in group seems to stimulate creativity (but only in people already prone to it). Furthermore, many interviewees think that DiDIY communities are prompting new connections with people (digitally and/or physical).

8. Learning flow: in these contexts roles are different, students learn better thanks to a closer proximity to the teacher. Motivation to learning is key. These activities tend to be not integrated in the class curricula; rather, they are considered optional/extra activities to be carried out outside school hours (counter example: when made mandatory, students lost motivation, teacher had to choose best candidate, counter-democratization). There is not a teaching flow but reasoning flow ("I don't know the answers to everything, let's find out together").

9. The role of teacher: the key to have DiDIY fully integrated in schools is to train teachers (who might be afraid of failing in front of students). Their role is to organize project-based activities (hands-on activities), to replace the traditional, passive teaching. The traditional roles of teacher and students seem not to be changes, but new competences are expected from teachers and trainers.

10. Role of institutions: the main obstacle seems to be the lack of dedicated funding (where the situation seems to be a bit better for technical school, while primary and middle schools seem to be left out), collaborations (in particular: hacker spaces do not want money for fearing of limitation of freedom), and the initiatives seem to be, in general, driven by individual teachers approaching the spaces, while a top-down, institutional intervention seem to be necessary.

11. Gender: it is noted the presence of an imbalance towards the male gender with regard to the involvement in DiDIY initiatives in general, with the female presence increasing only in art-related activities (where the different goals in terms of pragmatics/utility might play a role). However, the main problem seem mostly limited to the initial involvement of girls: once

they are in, they tend to remain. Some stakeholders are trying to counter-balance the situation by organizing dedicated camps for girls, whereas a slight facilitator seem to be the presence of female role-models (female mentors). However, the main problem seems to be the cultural background (which could be traced back to childhood).
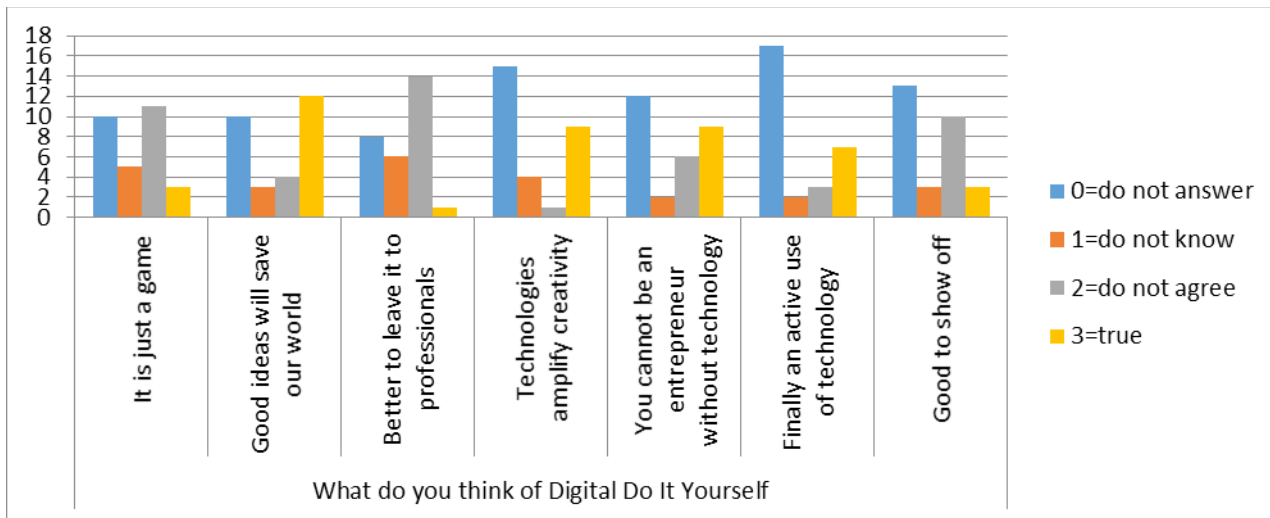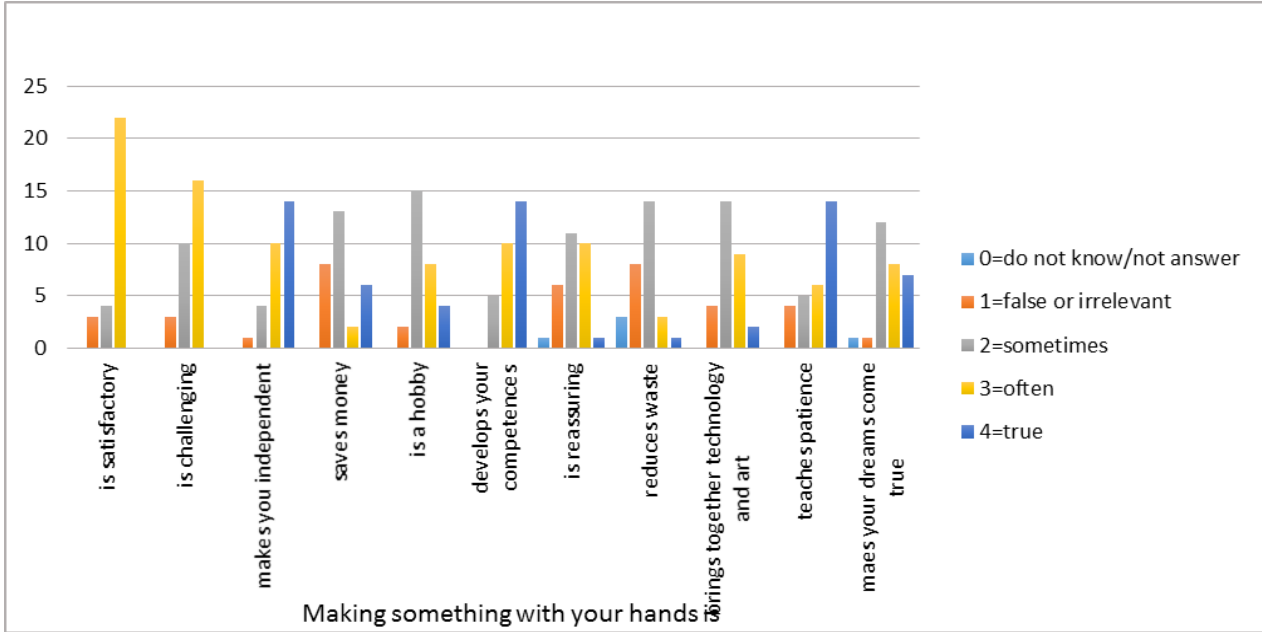
12. STEM-STEAM: the distinctions seem to be blurred, in particular in design-related activities. Indeed, art seem to be perceived as strongly to creativity and hence to DiDIY as such.

13. Research-careers: the feeling is that there is a considerable rise in jobs in technological area, for example in software development and IT research.

Limitations: the administration of questionnaires took place during events related to the Do It Yourself phenomenon, therefore the data collected through respondents might have been biased by their previous knowledge and attitude toward DiDIY. Similarly, the information collected through semi-structured interviews was obtained only from those people who agreed to be interviewed: these are be persons who, for different reasons and at different title, are already involved in the maker movement and/or interested in DIY technologies. The implications of the results are discussed in D4.5, "Strategic plan".
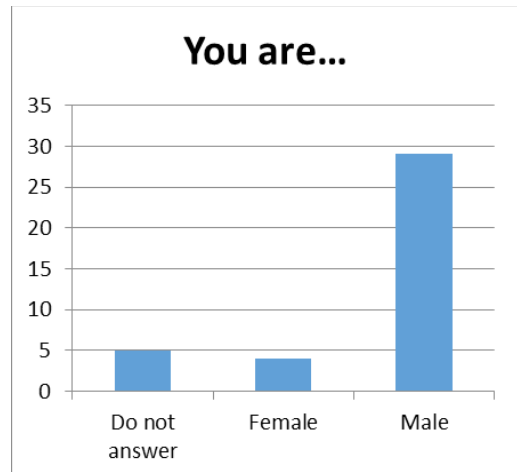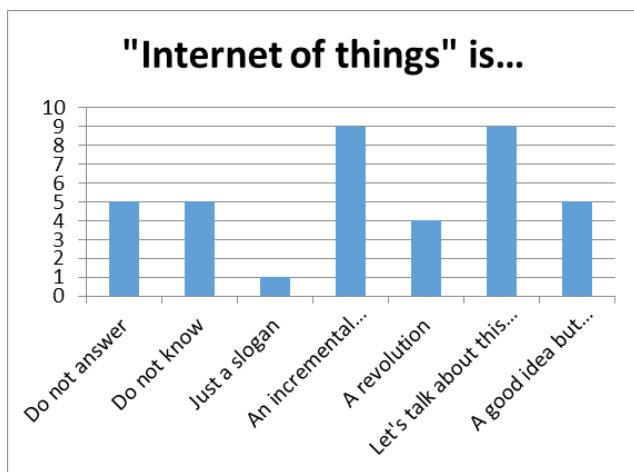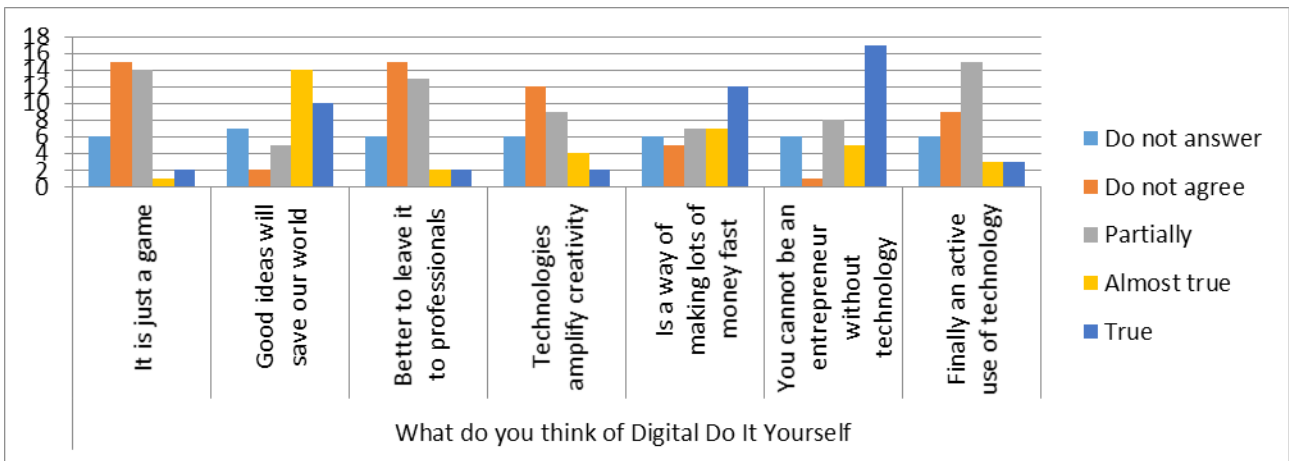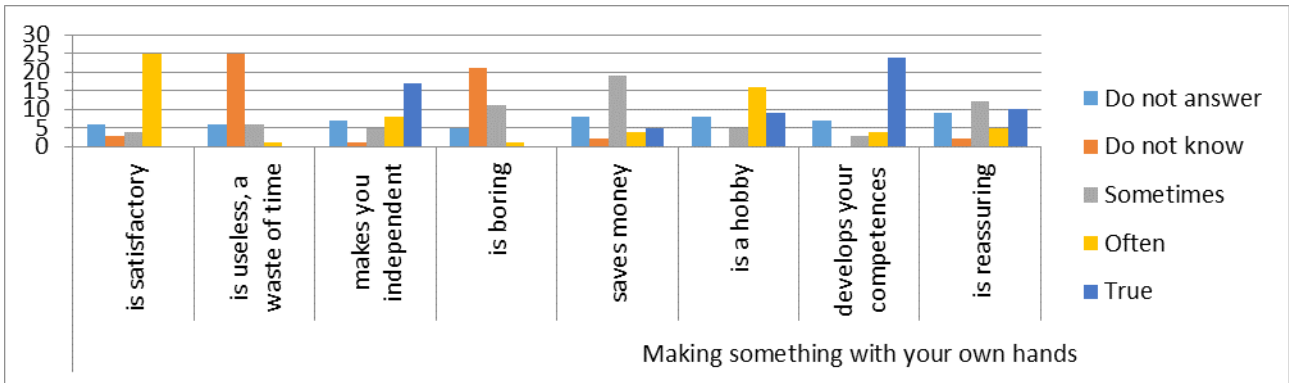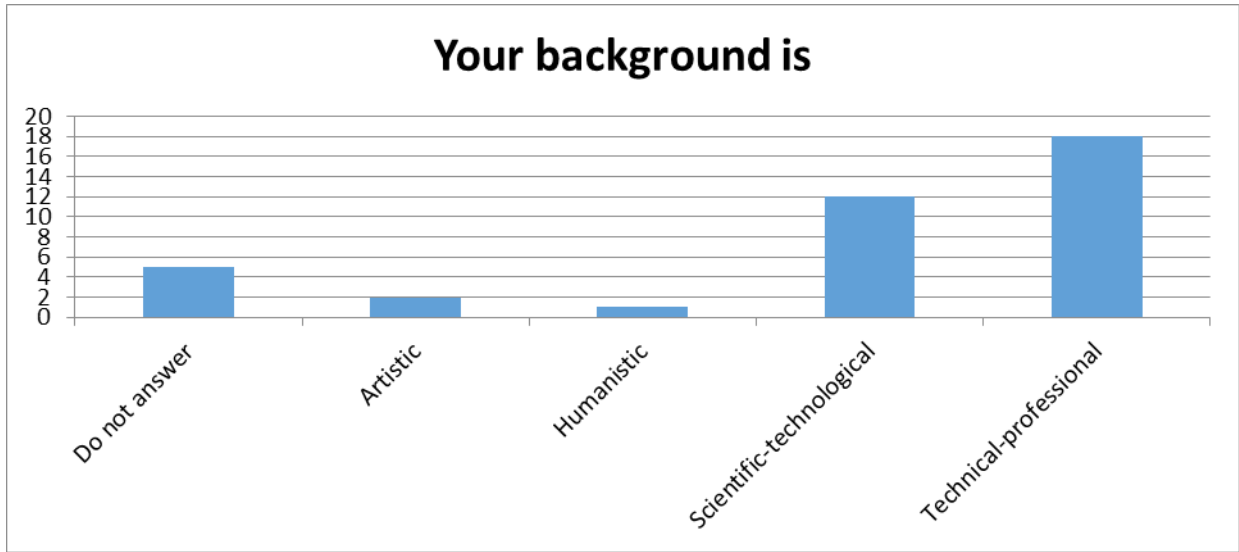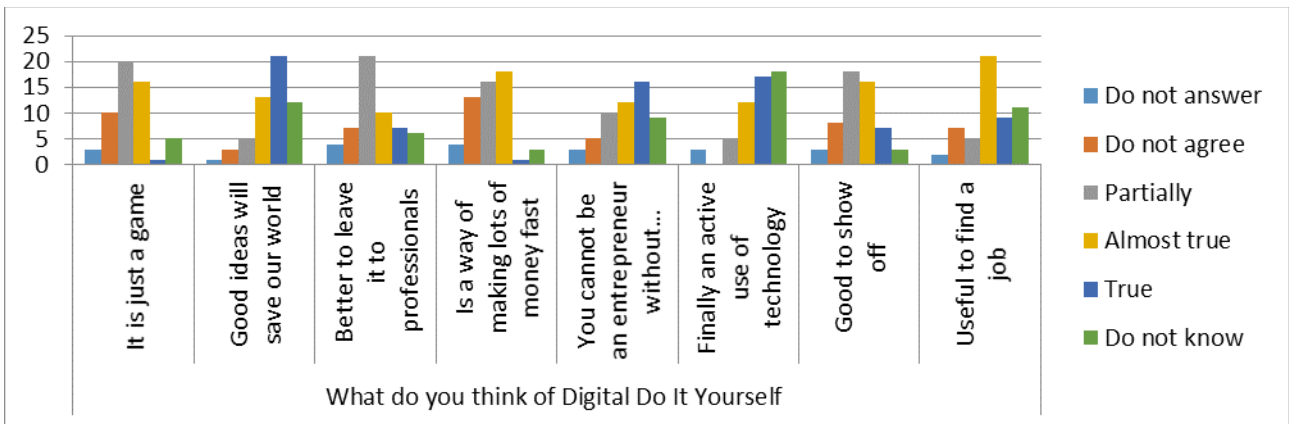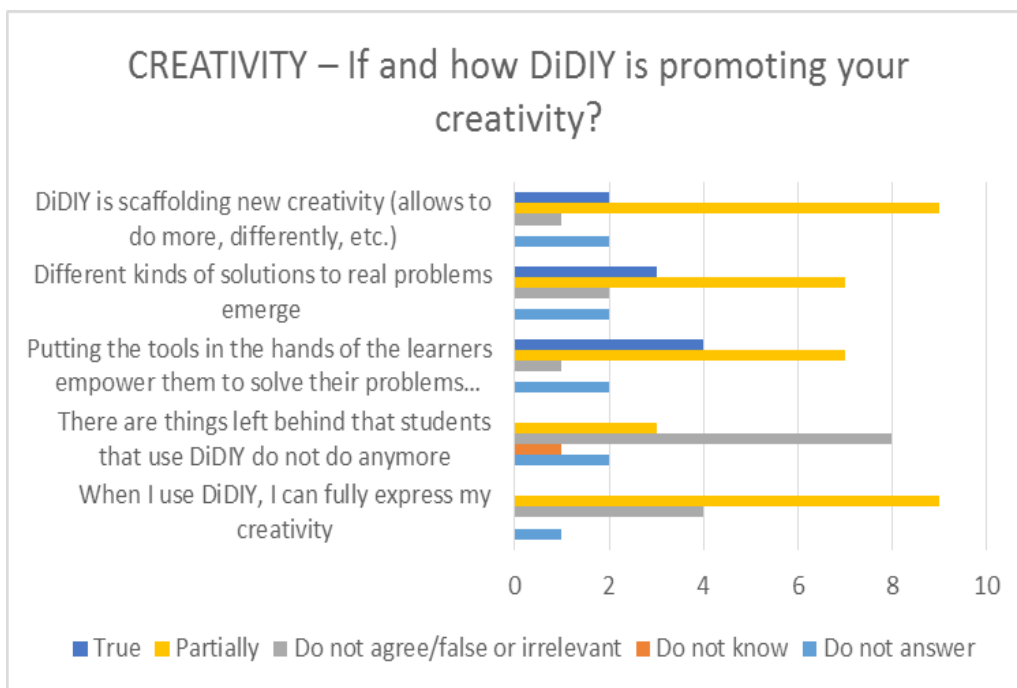
Annex 1: Results of the questionnaires

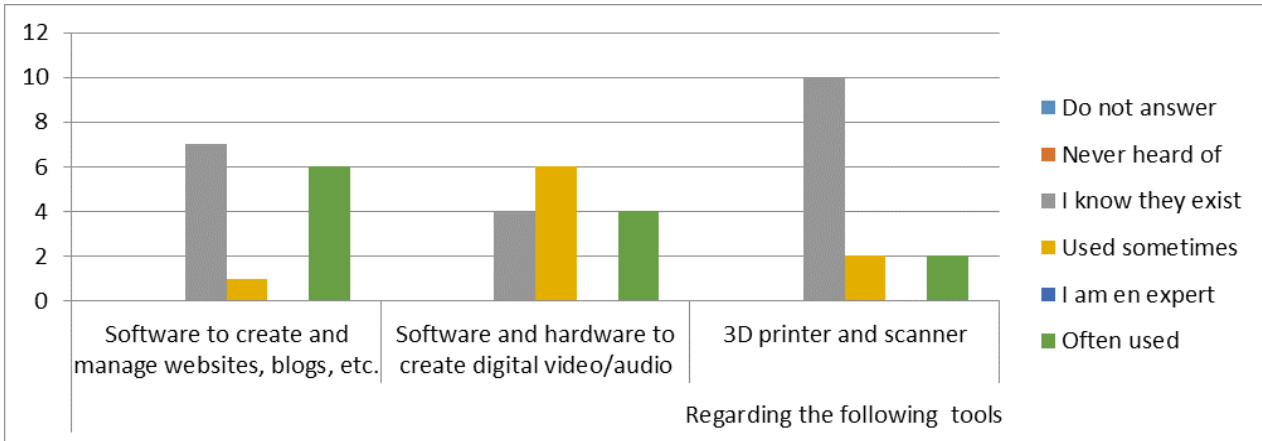### Results of questionnaire 1

Results of questionnaire 2

Making something with your own hands

What do you think of Digital Do It Yourself

"Internet of things" is…

You are…

Your background is
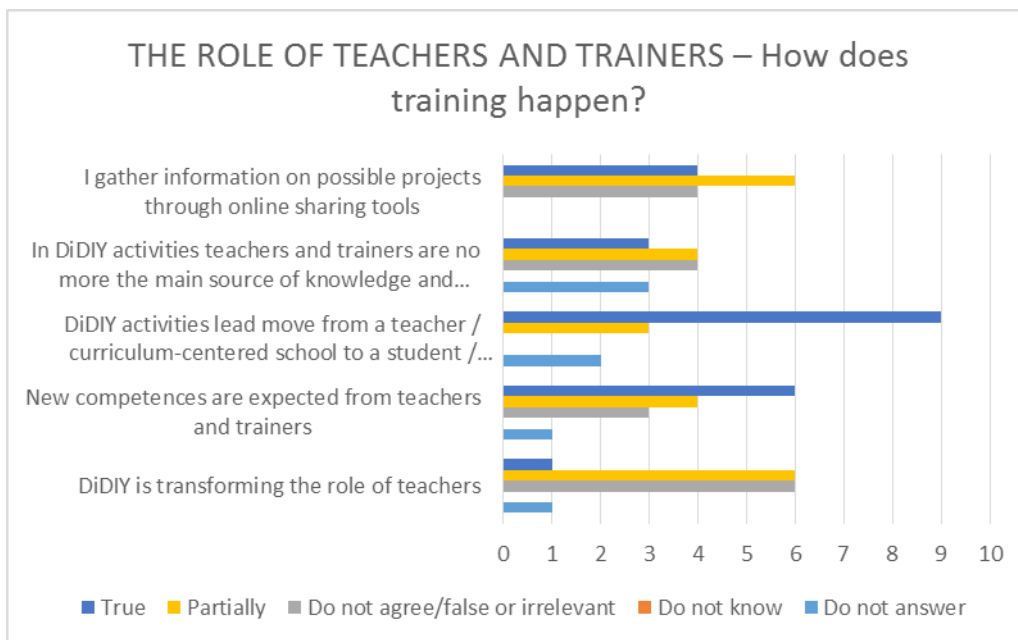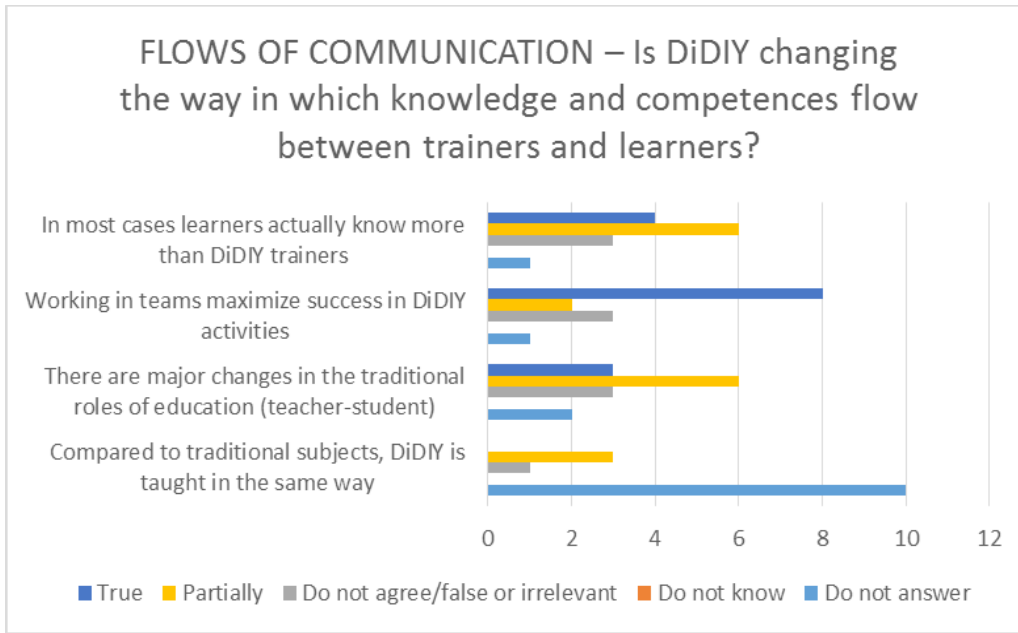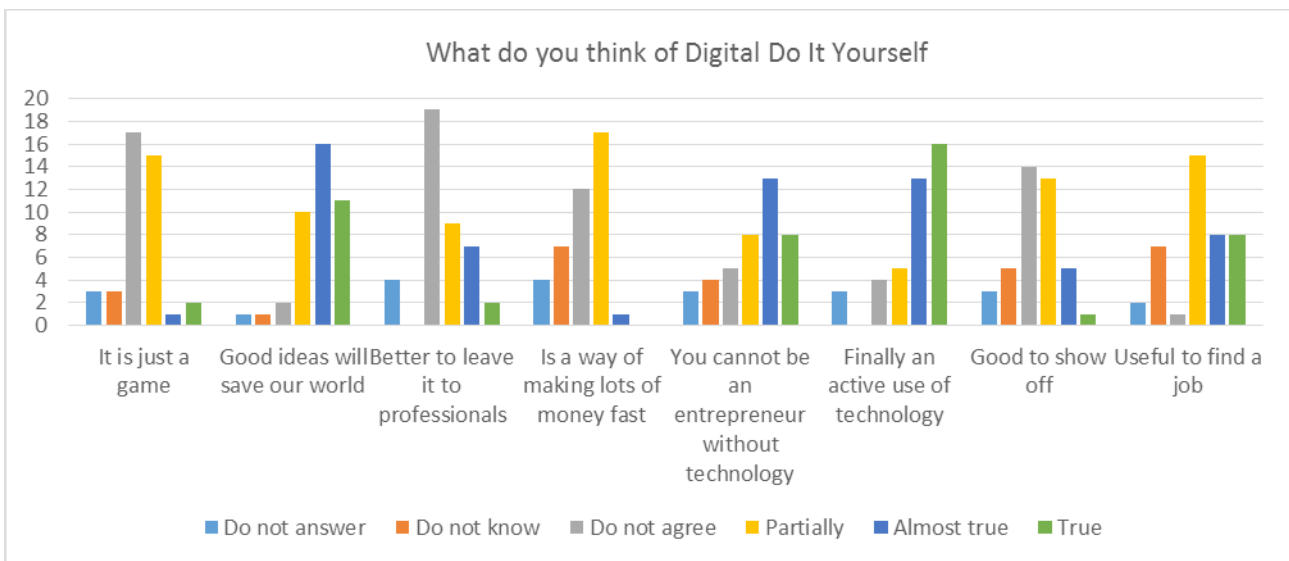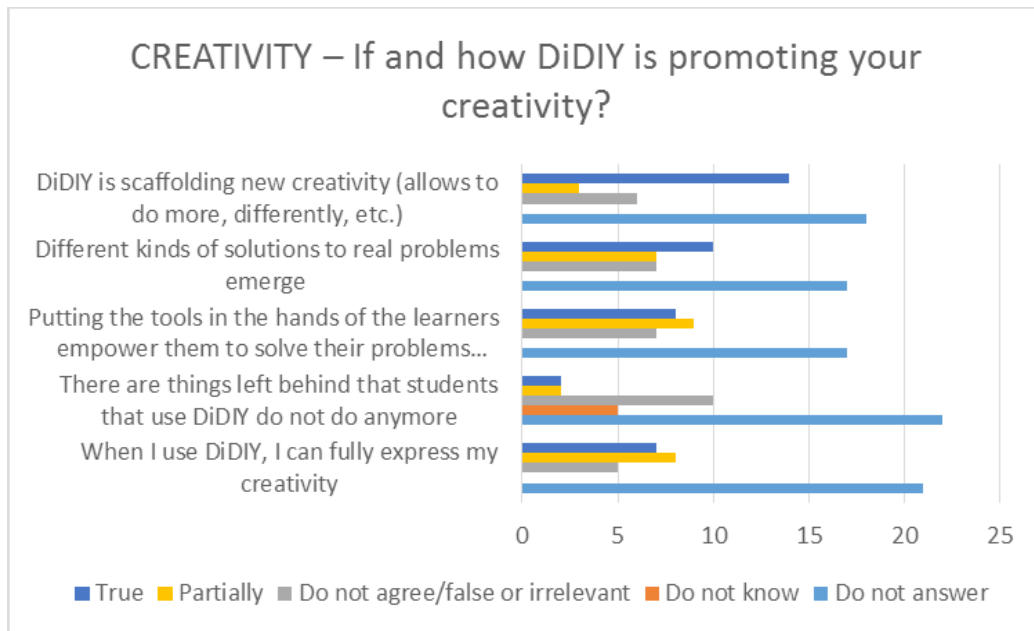

Results of questionnaire 3

FLOWS OF COMMUNICATION – Is DiDIY changing the way in which knowledge and competences flow between trainers and learners?

In most cases learners actually know more than DiDIY trainers

Working in teams maximize success in DiDIY activities

There are major changes in the traditional roles of education (teacher-student)

Compared to traditional subjects, DiDIY is taught in the same way

■ True ■ Partially ■ Do not agree/false or irrelevant ■ Do not know ■ Do not answer

THE ROLE OF TEACHERS AND TRAINERS – How does training happen?

I gather information on possible projects through online sharing tools

In DiDIY activities teachers and trainers are no more the main source of knowledge and…

DiDIY activities lead move from a teacher / curriculum-centered school to a student /…

New competences are expected from teachers and trainers

DiDIY is transforming the role of teachers

■ True ■ Partially ■ Do not agree/false or irrelevant ■ Do not know ■ Do not answer

Results of questionnaire 4

"Internet of things" is…

CREATIVITY – If and how DiDIY is promoting your creativity?

FLOWS OF COMMUNICATION – Is DiDIY changing the way in which knowledge and competences flow between trainers and learners?

THE ROLE OF TEACHERS AND TRAINERS – How does training happen?

SHARING – How important is sharing in your DiDIY activities?
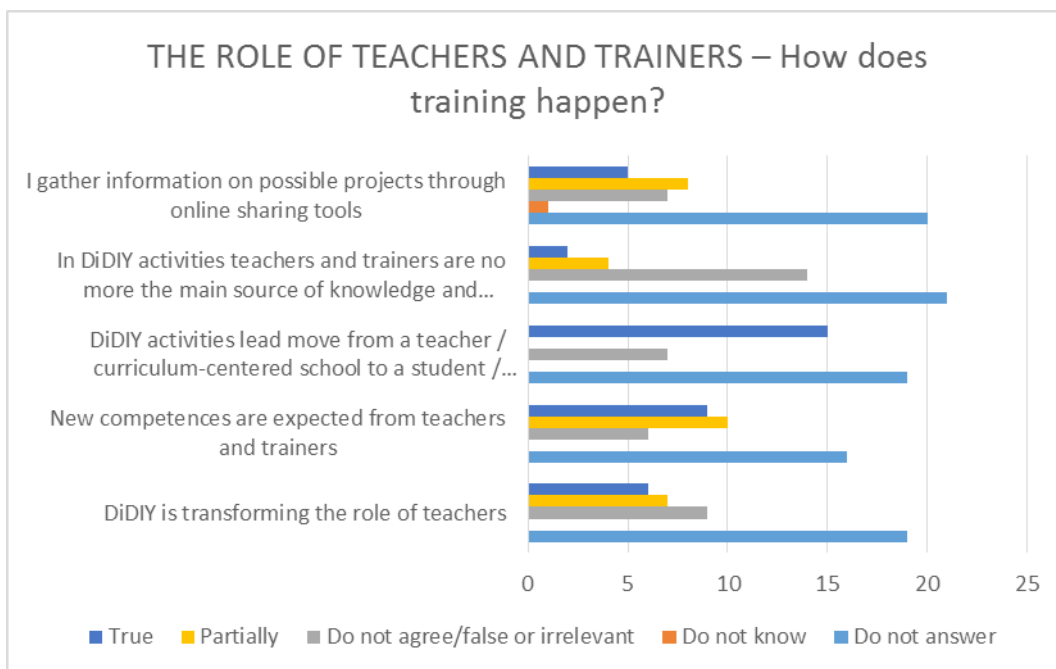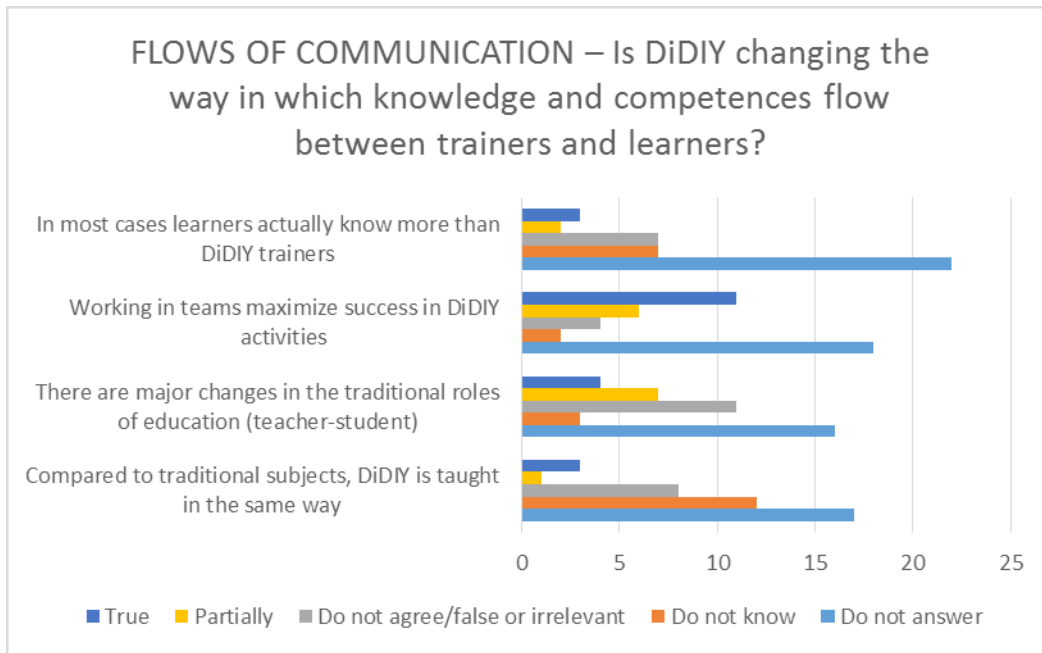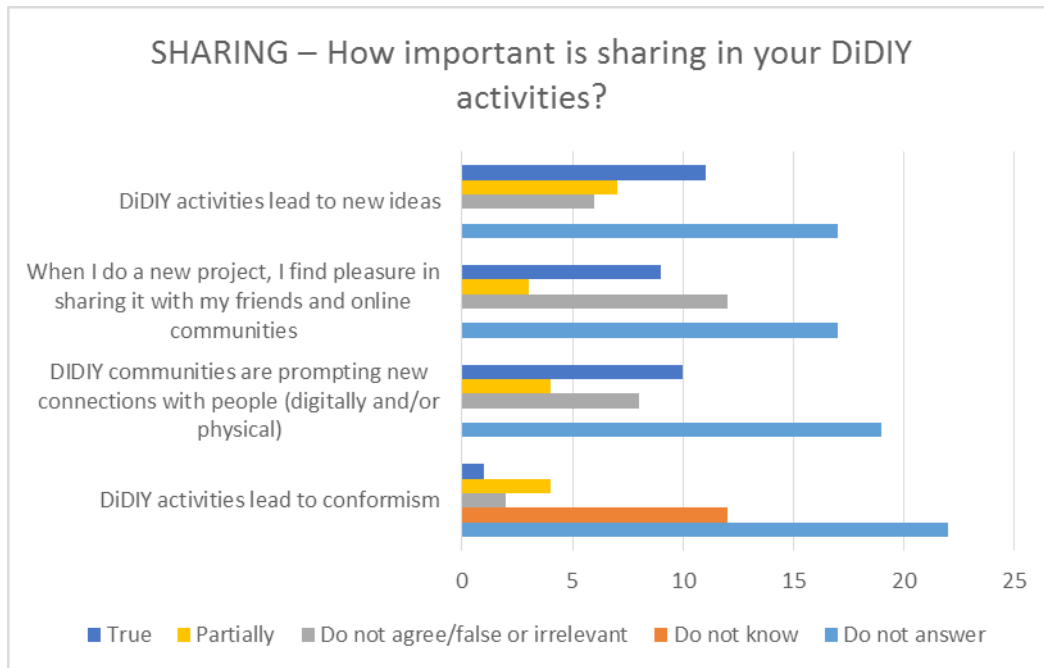
Annex 2: Topic guideline for semi-structured interviews

Thanks for taking the time to read this document. With your help we will be able to better assess the status of the DiDIY phenomenon in Europe and its impact on education and research. There is no need for you to address all the questions and points at once: we leave to your judgement the selection of those topics and questions that you feel more appropriate for you to answer.

DiDIY and Education

DiDIY is related to a new generation of students already immersed in new technologies ("digital native"), as well as to the adoption of new pedagogical tools and approaches for the benefit of general/adult learners in acquiring new skills, abilities, and ways of thinking. Thanks to the Internet, we also see learners much more involved in exchanging information and knowledge over the web than ever before. Students are learning much more in these informal environments, making education become less institutionalized and more personalized. Students are thus moving from "consumers" to "producers" of knowledge. Educational institutions are now competing with a more fluid concept of learning, that takes place mainly outside the class and in recreational spaces.

Some research questions

- **The role of sharing** Thanks to the widespread and affordable access to the Internet and the growth of the free software and open source and open hardware movements, pupils work on common projects and share working spaces with their colleagues-friends. Does this lead to new ideas or to conformism? Does DiDIY emphasize individualism? How can the roles of individuals be shaped in DiDIY-related learning processes?

- **Learning flows** Students also share the same working spaces with teachers, thus making it harder to predetermine the flow of communication. How is communication and sharing reshaping student-teacher and learning/teaching flows? How does the learning process happen during "make to learn" activities? Who are the stakeholders involved and which is their role in the process (teacher, students, educators, DiDIYers, etc)? What are the similarities with learning flows that happen in other fields (e.g. in companies)? Which formats/contexts for these learning flows facilitated by which tools and led by which roles are the most successful?

- **The role of teachers** How can DiDIY be exploited to ease/emphasize the transition from a teacher/curriculum-centered school to a student/experimentation-centered education ("flipped learning")? Is DiDIY also transforming the role of teachers accordingly? How? What new competences are expected from them? (these questions need to take into account that DiDIY educational activities are also related to environments different from schools – such as labs, museums, robotics academies, etc. – and educators that are not teachers). Is this transition always a desirable outcome? What do teachers need to engage with this and dare to take that step? Do we need to set up spaces where the learners take the lead and demand support from other learners and teachers when they need it? Does the additional excitement that DiDIY can bring to STEM subjects sometimes come at the cost of distorting the way a given discipline is taught?

- **How is school as institution responding to the use of DiDIY?** It has been argued that schools as institutions could have greatly benefited from the computer age, but was somehow reluctant to do so (Papert, 2005). Will DiDIY have better chances to allow for

major changes within the educational system, also taking into account the concurrent existence of multiple forms of DiDIY aimed at substituting schools, such as MOOCs? Are there Governmental funds to help schools acquire DiDIY technologies? Is there need of curricular reform? Is there need to have support from the management? How is the governance model affected? Do teachers get the space, freedom and support to experiment with these different educational methodologies and technology? Which is the level of awareness and commitment at management level to a vendor-neutral technology strategy?

- **DiDIY in education and gender issues** How is gender of individuals related to the attitude toward DiDIY? Could female leadership in DiDIY help working towards a more balanced situation? Does it help remove the masculine image of the relevant disciplines? Or does it simply make the relevant disciplines more exciting in the eyes of some people, including some women?

- **From STEM to STEAM** At present DiDIY in education is mainly used in close relationship with STEM subjects (and if other subjects are involved, they have an ancillary role). Is there a main role for DiDIY in other subjects, such as humanities, arts, etc., so to move from STEM to STEAM (Science, Technology, Engineering, Arts, Mathematics)?

DiDIY and research

DiDIY is related to individuals who, outside traditional research environments, engage in research activities by virtue of the widespread availability of affordable new technologies and open access knowledge, while, at the same time, it refers to the reshaping of the concept of scientific research itself as free from traditional institutional constraints. DiDIY research laboratories are emerging as an alternative to academia research. The DiDIY revolution has increasingly made available (and affordable) tools and knowledge to a wider audience, enabling citizens to participate to research activities that would otherwise been out of their reach. Research outside universities is typically carried out in two different settings:

1. industry-based laboratories: the size of these facilities might differ significantly, from big enterprises to small start-ups. Research is typically well focused on a particular issue. Gaining an economic revenue is a key aspect of this activity;

2. open labs: typically organized by associations of citizens. Open-source principles and knowledge sharing are usually encouraged. Self-reward and the sense of belonging to a community are the key reasons for people to participate. Without the need of formal qualification or strict procedures, this closer contact between citizen and research might create fertile ground to innovation. By changing the idea of who can do science and what science is, this new research setting have the potential to improve the long lasting difficult relationship between scientists and society.

Some research questions

- **How is the age of individuals related to their possible attitude toward DiDIY?** Is the fact that at the moment DiDIY is exploited in learning and research mainly by young people contingent to the current "DiDIY culture"? May DiDIY effectively exploited as a driver in learning also of adults, and in the case how?

- **Special groups** How can DiDIY help special groups of individuals (e.g., disabled, second generation immigrants, specially gifted) getting more (or less) involved in research activities?

- **DiDIY and research careers** If, and how, is DiDIY affecting the research careers of young researchers?

- What are the main **differences** between traditional and DiDIY-enhanced research?

- Which are the **motivations** and strategies behind decision to use one option or the other?

- Which are the **research areas** that are attracting most researchers from the DiDIY world?

- Who is **responsible** for the scientific validation of DiDIY-enhanced research?

Annex 3: Reports of the interviews

No.	1. Flemish Ministry of Education & Training
Date	June, 1st 2016 – h.2.00 – 2.40 PM CET
Country	Belgium
Interviewee	Mr. Jan De Craemer (JDC)
Role	Coordinator of the ICT and digital media policies at the Flemish Ministry of Education & Training
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

JDC – Coordinator of the ICT and digital media policies at the Flemish Ministry of Education & Training. Will speak only with regard to the Flemish part of Belgium. Main focus of activity is on the technical and digital media impact on education. Works mainly as policy advisor on themes as infrastructure, curriculum, network of school. At present, there are many initiatives going on.

"The school of the future" project

"The school of the future" was a past project coordinated by the Ministry, which analysed the trends and efforts in a prospective approach in order to build a better model of school (not only as didactics and pedagogics are concerned, but also and mainly the physical architecture of the school). The projects interviewed teachers and students, and also asked parent; the main question was: "What would it be the learning of the future?".

The project identified 12 trends and proposed an architectural model of school based on the suggestions and the pedagogical idea gathered. Today those trends are quite common, but 4-5 years ago were quite innovative. There have been attempts to build that kind of school, although unsuccessfully (it was probably too early in time): now people are asking to implement such ideas. Today, the idea of school is still that of long corridors and lot of classes: in fact, we identified the need of a more flexible environments, taking mobile technology into account (app economy, bring your own device policy at school level – which implies no need of computer rooms). The project studied equipment such as digital whiteboards and 3-D printing (mainly in technical and art schools). Also, serious gaming as a new way of learning, which is slowly coming into the schools despite the evidence of their benefit.

We found that teachers still tend to strictly follow the handbook, albeit today the availability of trusted resources makes no reason to do so: we now have digital archives and games, as well as many apps for different age-range.

We identified four main requirements for school: a flexible physical infrastructure, the availability of teachers who can work with these technologies, access to the content, and the ability to fit this new content in the core curriculum. All of them are important precondition to the adoption of digital technologies by school: if only one is lacking, the whole process stops.

Current situation in the Flemish area

We found great differences within each single school: there might be single school' teams willing to adopt the new trend, but lacking a reliable infrastructure at the school, making it unfeasible. Moreover, each teacher can always decide not to use these new resources, being not willing to abandon the old way of

teaching. In fact, this process require teachers to be creative, to find their own resources, which can be difficult and demotivating for some. Content is available everywhere (LEGO, Microsoft, mine craft, associations), but teachers feel they have to add them on top of what there are used to do.

School and labour market

School, especially in vocational and technical setting, need to work with 3D printers, and the reason is labour market-driven. We see a considerable rise in jobs for the highly skilled: engineers, software developers, IT'ers, researchers, … There is no doubt that high skilled jobs will become dominant on the future labour market.. We also see that jobs for the lowest skilled (cleaners, etc.) is quite stable. What is important however is that we see a dramatic drop in those professions that are in between those two, and that require a middle level of competence: i.e. clerks, office and bank employees, maintenance workers,… and it is mostly for this type of jobs that we train people in our education system. Today, what schools are delivering is the opposite of what the labour market is demanding. We need to consider that, in the future, some of the current intellectual jobs will disappear: entrepreneurship, communication, creativity, are the core 21st skills competencies. The conclusion here is that what we need is an "hourglass" model: broad at the top and the bottom, narrow in the middle. Our education system delivers via a triangle model: very broad at the bottom (VET and technical education) and very small at the top (university profiles).

Students as producers of knowledge?

We see that learning is in fact changing, and it is more focused on the differentiation and personalization of the learning environments. Students want to decide what and how to study. Lots of tools are already available, but there is some important concerned about this trend. In particular, what kind of impact might this have on school organization, and how could be effectively implemented. Personal learning is important, but it is not clear how to provide enough structure to this learning. Strong pupils might be able to perform in such new way, as they might have enough discipline to develop their own learning strategy and path, but other might need more structure. There is a pilot study on 50 schools now on-going on this project which implies individual learning plan, digital toolbox with adapting materials, communication tool, bring-your-own-device policy, e-portfolio as a mean to assessment, and new way of evaluation.

Pupils with special needs

Need to focus attention on one specific issue, which is often forgotten: pupils with special educational needs. For this students digital inclusion and assistive technology can really mean the difference between successful education or drop-out from school. DIY as a way of creating a personalized learning might be crucial for these pupils who are at extra risk.

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No.	2. FabLab+
Date	July, 13th 2016 – h.9.30 – 10.30 AM CET
Country	Belgium
Interviewee	Mr. Yves Molenaers - YM
Role	Director of the FabLab+

Interviewer	IDV

IDV – Introduction of the DiDIY project and the role of informants in data collection.

YM – Director of the FabLab+ (Antwerpen), a university-independent laboratory where designer, makers, and in general all people could create new models and products. The religion of the fablab is to be open and independent, surviving using the production of design products.

The role of sharing

The sharing plays an important role in a place like a fablab. We are creating a "sharing economy": we are encouraging people to share own machines and competences in order to produce other machines and tools for everyone.

An open vision leads to new ideas and products that might be produced in a challenging environment, where there is a sharing of tools and competences.

Learning flow – The role of teachers

We are organizing events and courses on digital fabrication for professional purpose because, today, there is the need to develop new competences to be part of the professional evolution in the technological world. We found some difficulties to be part of the education high school system because of the fixed courses, but we have a relationship with the faculty of architecture of the UL University where we teach 3D art and modelling.

Furthermore, we also offer the possibility to a small group of artist to learn about the digital art. In particular, how to use digital fabrication as tool for building objects or for artistic research.

We would like to introduce the 3D modelling in the educational system because we think that there is a big challenge between the enthusiasm and the maker level: the learning flow is changing and new competences are needed.

There is a small village near our city and we are helping them to build a fablab using existing old machines and digital fabrication on leather and materials of design. In this case, the teacher is useful only in the early stages. Do it yourself is part of their national identity therefore they could use their expertise as artisans.

How is school as institution responding to the use of DiDIY?

Here in Limerick, there are no opportunities to receive funding by the institutions or by universities.

We build partnerships with some private organizations and foundations. We have a partner that gave us a 3D printer. There should be more participation by institutions to promote these kind of activities.

DiDIY in education and gender issues

I think that gender is more related to the study's background rather than attitude toward DiDIY. Indeed, there are few women engineers and many women designers. In my first course on the 3D modeling, there were only woman and they were very interested therefore the DIY is balanced in gender issue.

From STEM to STEAM

During the creation phase, everyone should be makers and start creating with Do It Yourself open-minded.

Otherwise, without a 3D model, it is difficult to experiment what could be created. Art is a consequence of the do it your self-process.

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No.	3. WhiteSpace
Date	September 15th 2016 – h.08.00 – 09.00 PM CET
Country	Belgium
Interviewee	Bart Derudder
Role	Volunteer at WhiteSpace
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

BD – My involvement in Hackespace "White Space" (WS) of Gent started about two years ago: at the time, WS was undergoing a sort of turnover in the generation of volunteers. I joined because I was interested in contributing by organizing events, such as conferences, as I myself enjoy going to conferences where I like networking and following talks of friends. I started by inviting some of them to give some talks at WS on topics such as security, IT in general, and special programming languages (indeed, the content of such events really depends on the person who volunteers).

The average age of the people attending our association is around late twenties, with some spikes of younger and older people. As for the motivation behind their involvement, I would say that they mainly join to hacker something, to learn attending workshop, and to socialize by attending weekly meetings. Secondarily, people join to simply to have fun and some people come only for networking, to meet peers who share the same background and the same interests. There is also a minority of people moved by "nostalgia", that is, people previously involved in WS who cannot attend any more for personal reason but who do have maintained personal connections.

The WS workshop is equipped with some standards machining tools (we used to have a 3D printer, but it is currently under fixing): drilling mills, electronic lab, measuring equipment and welding machine, as well as chemicals to make your own boards.

We are an independent association, as we decided to move forwards without external funding bodies on which to rely. This is a strategic decision, as we want freedom to set up our agenda of activities.

We do not have direct contact with the national educational system. We do have some indirect contact with the secondary educational system, in the person of one former PhD student now teaching at the local university, and two current PhD students. It has happen, but it was an isolated event, that one high school teacher organized and gave a workshop targeting high school students (aged 17-18) with the aim of helping them in the choice of their university courses.

The didactic approaches adopted during our workshops is very variable and really depends on the attitude and decision of the person organizing it. Most of them are "hands-on" meeting where, after a very brief introduction, we as a group start working on a common project (for example, programming a server). We only require a fixed format of interventions for WS annual conference, for which we require people to prepare work and slide (to ensure a high quality presentation).

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No.	4. InitLab
Date	September 14th 2016 – h.09.00 – 10.00 AM CET
Country	Bulgaria
Interviewee	Mr. Vasil Kolev
Role	Member of the Board of InitLab - The Hacker Space in Sofia
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

VK – I am part of the Board of HackerSpace. Among my duties, I contribute to the approval of the planned events in the space. This year will be contribute to the organization of Openfest (www.openfest.org), a conference dedicated to free open source software.

I also work at the Sofia University in the Department of Mathematics and Informatics, where I used to teach some courses related to new technologies (facultative courses). The university has been relying on students, at least for the past 20 years, to deliver some additional courses because it is not always easy to find staff with the required level of update.

The InitLab Hackerspace of Sofia welcomes students (university and high school) and professionals. In general, they are people interested in dealing with IT at different level. The age-range is 18-35, and some of them are now teaching at the university (electronics). We have a core group of people, steadily attending meetings and events and contributing to run the space, and people coming only occasionally for the different events.

The Initlab started its activities about 6-7 years ago, when some people saw the website hackespace.org. They then decided to start meeting in a room at the university, and then moved out after about one year. I joined in 2012-2013. I was teaching at the university at the time, but I decided to move to the Hackerspace, where I found a more interesting teaching environment.

We as a group meet at least once a week. There we organize events for people with no previous experience (this month we had two of such meeting). The number of people attending this meeting depends heavily on the type of event: there might be 1-5 people, other up to 30 people. Preparation for open fest up to 50 people.

As for the relative percentage of attendees by gender, I would say that 80% is male and only 20% is female. As for the reason of this distribution, I would tend to say that women are more involved in other activities outside the hackerspace ("they have a life"), while men tend to devote more time to this, where this is what is needed to enter in the full "hacking mentality". We do contribute to the balance by organizing every year a two-day event related to the Rail Girls initiative (www.railgirls.com).

I believe that we, as Hackerspace, are too small to have an impact on the local educational system: just for scale, there are no more than 300 people moving around this hackerspace in a whole year, in a city of 1.5 million people. We just provide a way for people to learn new things, which is peer-to-peer, self-directed and self-taught.

People get to know our courses via social media (FB, mailing lists, etc.). For more advanced courses, we ask people to sit an entry test. For example, we now have a course running every Saturday in the afternoon, system administration course, IRSP: it is a very hand-on course, and it will last 3-4 months, the aim is to configure all services. The lesson usually starts with 15-10 min of introduction and set-up, then everybody connect to the server via a shared terminal. Everybody contributes by giving ideas on what it should be done

and make his part of the configuration, how to set up a real internet provider. We call this "learn by doing".

Other people organize 2-hour courses with break in the middle, some are video-recorded and uploaded on the archive, some on Youtube (https://va.ludost.net/index.php/Main_Page).

In Bulgaria there is a very well-known organization delivering IT courses outside the traditional educational system, which is Software academy (http://softuni.bg/). It is quite common to have parallel education organizations which can deliver certificates at the end of the courses, with no legal standing, but that can be re-used for work after high school.

As for the traditional educational systems, there are few schools able to keep the pace with innovation in the IT world in Sofia. For example, a well-known high school of Mathematics provides specific courses and classes for gifted children to prepare them for competition. These classes have been open for at least 10 years, and I can say that are quite close to the idea of hackespaces, that is, a place to make children work in workshops, from microelectronics to anything computer related.

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No.	5. DIY Praha
Date	September 6th 2016 – h.9.30AM – 10.30 AM CET
Country	Czech Republic
Interviewee	Hank Duke
Role	Owner of DIY Praha
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

HD – I am the owner and operator of DIY Praha, my girlfriend and I are stakeholder in the business, we have been operating for the past 4 years as limited liability company. It all started in Stockholm, where I had a building company: in 2010 I became familiar with the Maker movement, and then I moved to Prague. The tools we started with were the one I used in my workshops in Stockholm, then we moved to a larger facility. It is a private company, but we want to move to a membership model and we will soon be organized as non for profit organization. The commercial company will nonetheless remain to provide services against payment, but the teaching part which takes place in the workshop will remain for free.

The aim is to have a community of people interested, even if not active. We are now moving toward model resembling what most maker spaces started from. We would like to see a more autonomous community of members that hopefully will be able to drive the organization: they will have to identify what they will be interested in expanding, and the decisions will be to be independent from the opinions of the stakeholders, and based on the most popular tools and the kind of projects people want to develop.

We start working with digital tools because this is what people asked for. Considerable investments are required, at least for the scale of production. 3D printing is limited by the tools that we can afford. We are starting now to getting involved in the digital component of DIY, before we mostly outsourced what we needed, we have just installed first laser cutter and recently we had the first workshop on Arduino. The majority of the projects we developed is related to furniture, we have a lot of young designers or makers that

use our workshop for their business, but also some casual members doing projects for their home. Our workshops used to develop on 300 square meters, now we have 1000 square meters at our disposal and one of the thing we want to do is to bring digital tools such as laser cutters, CNC cutters and 3D printer into it for light professional projects, no for large production. Reconstruction, remodeling, furniture making: my workshop ethic reflect that trade.

The age range more active in our group is that spamming from 25 to 35. The majority of people working here on regular basis has a background in design, some come from technical schools (metal or wood working), there is also a couple of engineers, and only one is student (carpenter). We have some students coming to our classes (sawing, welding, textile, screen printing) but generally they don't continue working on project.

I think that the EU model generally start as community, often thanks to public funding and using public spaces, and then move toward where I started. From my experience, in the US maker spaces are more technical, "TechShop" which can be big economical operations (based on the amount they have to invest) funded by venture capitalist as a way to funnel their startups in a collaborative space. They do have membership and classes, but a significant amount of their income come from start-ups. We have worked with some start-ups, doing some prototype, but it is not in our scale, nor in our scope. Our venture is not market-driven, but rather come from the desire to see things made. I think we are operating in a kind of "post-modern capitalist": we are not interested in the accumulation of wealth, but rather we believe that businesses must operate to create interesting things, to engage people in something they like to do.

I would summarize the main motivations of our members as follow: 1) for few young professional makers, reasons are economic: coming here they do no need to invest in the tools (we basically rent space based on time) and they find a good environment. 2) for non-professional, people aged 25-35 whose job is working on a desk with computers in abstract fields (economic, IT programming), they come here to get away from that and to start working with hands, to find the sense of actually making something real, to see a finished product.

We did have some experiential education, but mostly as outdoor activity (ski, kayak, rescue, etc.) and we believe in creating an environment to develop a skill or knowledge. But I'm not gamer and I am not engaged by screen: I see what people do with digital technology, design, sketch up, illustrator, and I support the attitude. So far, the workshops we organized were about the tools we operate in our workshop, textile (sewing, basic joining), furniture, and metal working (basic welding). This fall we will start Arduino, then once laser cutters online we will incorporate.

We are working with a design school in Prague, where there is a teacher who wants to start a printing and multimedia class. So far we have had limited contacts with local schools: one of the challenge is being in a multi-lingual setting, and having a lot of programs that do not support English, so that there is a language barrier. However, the major problem is having young kids in a workshop: schools are reluctant, they are not comfortable with this setting. We do have classes for young children, but they come accompanied by their parents, so that there is an individual responsibility.

The majority of our members is male, I would say that there is a 60 to 40 male to female ratio. Differences to the type of working, always women in welding classes but maybe 80-20, sawing is the opposite. My experience in the Czech republic is that the culture is still quite conservative, but I cannot say if this is a bias of the cultural norm.

We are always in the outreach mode to work with other Maker spaces, so happy to share our contacts.

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No.	6. Estonian Information Technology Foundation for Education
Date	June 1st 2016 – h.2.00 – 3.00 PM CET
Country	Estonia
Interviewee	Ene Koitla
Role	Member of the board – Estonian Information Technology Foundation for Education
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

EK – The Information Technology Foundation is a governmental, non-profit body. We promote the use of information and communication technology in education. We help schools learning how to use ICT in the learning process and how to implement better IT curricula. We don't work directly with students but rather with schools. Today in Estonia technology in schools is not a reality. There are in fact some teachers and principals working in this direction, but it is not common.

The role of teachers

In the last years we have seen a big influence of technology in our life, but limited to gaming and entertainment, and not actively involving the education system. In this sense, our target is to work with teachers (the problem is not the pupils). We need to keep in mind that our teachers have an average age of over 40, and that they might not able to use technology, or rather they might be able to use it but at very different levels (they might know how to use a computer, but in traditional, passive way). Changing their attitude towards technologies is a hard task. They themselves need to be mentored, and we at HITSA are trying to show how to use these new technologies in real contexts, showing successful experiences, mostly via training course for teachers – not on how use computers per se, but teaching in the environment. It takes time, are we there is still a long way to go.

STEM/STEAM

One special program we developed is focused on technology literacy and how to implement it. We are promoting the use robotics and 3D design to show how to be creative in the engineering design. We do actives to help teachers AND students to use more technologies. The point is that they must work together. Also, we practically help schools to acquire technologies such as Raspberry and Arduino.

During training course, the trainers show how to implement robotics into, for example, a history course, and do not limit their scope to "traditional" subjects such as mathematics or physics.

The Estonian curriculum for digital competencies of students is based on the EU standard. Starting from this, we developed a curriculum for every level of our national education (4 in Estonia) which was later confirmed by the ministry of education. We developed practical examples of how to use new technologies in schools for every curriculum, as the objective was for teachers to learn how to use technologies in real life for their subjects. The examples have been written by the teachers themselves (we have collaborated with 45 teachers in a joint effort).

One of the problem is that teachers are afraid of failing in front of students, they fear that they (the students) can be more knowledgeable than them. Teachers need to adapt to the novelty, but it is a difficult task.

The real problem is the pedagogical program, as we already have good equipment (it is not a problem of

funding to acquire new technologies). We have developed different learning programs for school deans and principals on how to use ICT and technology.

Special groups

We don't have a special program for students with special needs, they need to be integrated into normal classes, the materials we develop are adapted for all of them. There are indeed some expert teachers there who are dealing with them in particular and they are sharing their experiences through web seminars and conferences.

During the year we organize every week a web seminar with experts or teachers introducing new technologies or topic. All teachers can take part and webinars are recorded. We coordinate a small network of 20 teachers who write articles, give interview, and share experiences that we then upload on the web portal, in the "school life" section (also, we make use of media channels such newsletters, FB, etc. to share good examples).

In Estonia there are about 15.000 teachers and we believe that each of them has been used some technology at some point, but that the percentage of teachers actively using technology today is about 30%.

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No.	7. Hackerspace Mikkeli
Date	October, 7th 2016 – h.13.00 – 13.30 CET
Country	Finland
Interviewee	Mr. Lampi Mikko
Role	Founder of Hackerspace Mikkeli
Interviewer	IDV

IDV – Introduction of the DiDIY project and the role of informants in data collection.

LM – I'm inside the maker movement from 5 years. I hosted hackathon and two years ago I founded the Hackerspace of Mikkeli. There are only six hackerspace in Finland and Mikkeli is the smaller city with a hackerspace. Since Mikkeli is a small city, we have a different approach. We try to involve citizens to create technologies as a hobby. We have a partnership with the local university and the teacher usually give an award if the student attends a hackathon.

IDV – How is school as institution responding to the use of DiDIY?

LM – We organize free courses and workshop for elementary and high school students. For example, in elementary school we teach them how to use Scratch, but in general we teach robotics, 3d printing and coding. We also had workshop on Arduino.

At the beginning, it was very difficult to find some funding to organize hackathon but now is a trend: everyone would like to do experiments therefore there are more funding opportunities from national no-profit organizations.

Instead, the hackerspace no not take money because it is independent for ideological reason. The members

of the hackerspace give a contribution each month.

IDV – The evolution of the learning flow between teachers and students

LM – During our workshop, the students are enthusiastic to learn building something. I'm not a teacher therefore I do not know how is changing the learning flow, but I know that students of 11 years old can stay focused for 3 or 4 hours and this is incredible considering their age. I think they are motivated in this kind of learning.

At the beginning of the workshop, there are some teachers to help understanding the development of the project but, after that, the students are independent.

IDV – How is school as institution responding to the use of DiDIY?

LM – We organize free courses and workshop for elementary and high school students. For example, in elementary schools we teach them how to use Scratch, but in general we teach robotics, 3d printing and coding. We also had workshop on Arduino.

IDV – Gender balance

LM – There is more attendance of men rather than women. This is a cultural setting problem because the women are very good in programming, often better than men.

We are investigating this in CODE project, a national project, and we noticed that the participation of women to technology events is related to the cultural background. For example, if there are people from Belgium there will be more women attending the event.

In our project we are investigating how provide motivational mechanism to involve more women.

The results of our project will be ready by the end of June 2017.

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No.	8. Friedrich-Alexander-Universität
Date	June, 8th 2016 – h.2.00 – 3.00 PM CET
Country	Germany
Interviewee	Paul Held
Role	Head of Unit, Institut für Lern-Innovation, Friedrich-Alexander-Universität Erlangen-Nürnberg
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

PH – At the Institute for Learning Innovation we have been working in the field of learning, new technologies, and media for the last 30 years, and since 1985 we have been involved in many EU projects, INTERRED projects, and many others. We provide services to university and we develop and assess management systems. We provide pedagogical and didactic advice on how to use different tools and platforms, and we also develop existing platforms technically further, if teachers come with new idea we

help them implement it, and we stay in steady contact with the university. Research and developing and analysis, target group from young children to adults, prisoners, teachers, handicapped. Chances for new learning approaches in many fields.

The role of sharing

As with this idea of content production, I would be cautious saying that pupils are now more content-producers than before. Rather, I believe they do it at the same rate, but maybe in other forms, and certainly sharing has become more easy. But in general, I think that the motivation to do it is very limited overall, (why should they, if not required?) because, as with the general population, very few people are interested in providing services to others for free. Students, I think, have others priorities, rather than producing content.

As for the tendency to conformism, I think it very well applies to anyone in schools. Depends on the single self-esteem: if the pupil is strong enough to defend her/his own ideas, it might propose/impose her/his opinion, otherwise she/he might feel comfortable in adapting (it's a question of psychology, not of technology). The novelty is not in producing but rather in sharing: in fact, there is too many information already available on the internet. Sharing can be limited to the class, depending on the teachers, or in very small communities, but not to a wide community (of no interest). I believe we now see less creativity overall, but an increase ability to reuse works done by others, to reduce one's workload.

In general, the youngsters have a predominant interest in their own spare time interests: even if technology might be one of their hobby, they will actively bring it in the class only if useful for themselves, but will not actively involve others. I believe that the idea that pupils can teach the teachers is quite an illusion. Pupils do not know the didactics aspiration of the teacher, do not know which approaches are the best for the subject to teach; most importantly, their knowledge is not systematic, and it is only defined by the day-by-day use of the technology. The so called "digital natives" are helpless when asked general question about technologies, they do not know what they are using. Rather, we should train the teachers, not about ICT in general but about ICT as specifically applied to their particular subject, they have to learn in a systematic way. I support the idea that teachers continuous training should be mandatory.

It is necessary to teach to pupils the so called "digital sovereignty". Even if they grow up in digital environment they are not able to cope with the broader consequences of technologies uses (i.e. the memory of the internet, how long will be my info be found in the future, or 20 years after my death). We should teach them the problems of ethics, which kind of info put in the network, if it is ethically ok contribute to the so called "shitstorm", how does it feels for the person in its target. We should focus on the moral aspects of using the network. In this sense, technologists might not be the best teachers, in fact they are rather "blind", they know how to use the technology but they do not have the best background/competencies to reflect on it. My opinion is that teachers in ethics, language, social life, and religion are the best to give different prospective on the use. Need to link the use of technologies to more general considerations.

Innovation has to have objectives, as innovation "per se" does not mean anything. A caveat: we can estimate only 5 years later if a technology was of interest. Virtual cities and "Second life" gained an enormous hype few years ago and now they have completely disappeared. What was the added value of these new developments? If we talk about "Internet of things", I can see how it is supporting the production cycle in the industry and the new roles of employs, but on the other hand the influence to school has been minimal so far, as it is outside of the reach of schools. Schools are slow in taking up new things: in fact, they must deal with more preliminary, basic problems (connection, old computers). In my class of economics I can discuss the internet of economy 2.0 but not influence the school itself: just a topic like many other.

At the Institute, we work for the training of teachers and we can see how all this aspects of using new technologies in schools are very under-represented. There might be few seminars, but schools are not able to cannot teach how to use new technologies for the purposes of the single subjects. We use internet from 1989

but it took decades before the current day-to-day use, and same will probably apply for the introduction of these new technologies. If universities are too slow in training teachers, we cannot expect teachers to do that themselves. It ends up, like is happing today, that it all depends on personal engagement. It is not a wave yet: states do not spend enough money for teacher training, and teaching approaches remain old fashioned. It will not change rapidly.

How is school as institution responding to the use of DiDIY?

The school system in Germany is organized top-down: this incentives to innovation must come from governments, as the curriculum for teacher training (handbook) is fixed. If new technologies don't show up it will not be available for the teachers. Depends on how schools are organized from country.

Special groups

The biggest advantages of technologies is that they help coping with the heterogeneity of classes where pupils with special needs are present, where we see different level of competences. Here, the real impression is that if you can offer additional pathways to those that otherwise would be left behind, they can learn at their own pace. It is indeed a field where new technologies can be really useful.

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No.	9. The Cube
Date	August 31ˢᵗ 2016 – h.10-11.00 AM CET
Country	Greece
Interviewee	Stavros Messinis, The Cube – SM
Role	Founder of The Cube
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

SM – I am the founder of The Cube in Athens. The Cube is a physical space located in the center of Athens. It is a community of startups, a technology space, and it is also meant for education (the SOLE project: Self-Organized Learning Environment) for the benefit of refugee children (from Iraq, Iran, Kurdistan). We do also organize a CoderDojo as an informal programming club for children.

We have been active for the past last 4 years. We recruit children by means of word-of-mouth campaigns, our is an open environment with no application nor selection. The approach to education is project-based: we give children the facility, we group them in 3-4 and provide the tools (computers): they have 2 hours to research the subject and then we ask to present their finding. The topics are not specific but might be related to societal issues, and we propose open-ended questions. The results might greatly vary (some are quite deep, some more specific) and we want them to focus on the actual activity, not on the result, we want them to work in team and learn how to structure the work. We generally begin at 10 AM, we set a challenge, we discuss it and then we work as a group. Examples of topics might be "Why are bees important?", "Why is the sky blue and sometimes red?", "What does it take to reach the moon/to build a bridge?". The questions can be simple, but answers can vary, so that at the end children will effectively teach each other when presenting their findings. Our sessions generally run in morning, we work three months during the summer

targeting refugee children who are not in school.

How is the schools as institution responding to this kind of initiatives?

SM – I think that our next step is to talk with Greek Ministry of Education, to try and understand how to encourage more teacher in using this kind of approach. It might start as an experimental phase, and I do not think it will happen any time soon, as Ministries tend to be not so agile as we are. We are independent, we can decide at the very last moment what to do, and it happened in the past, we can structure our sessions based on the audience. Our approach is very flexible and it is based on audience feedback.

Experience with teachers

SM – We did had teacher come and experience the project, some came to get to know the CoderDojo better, and we also trained some teachers in STEM-related activity (Arduino, Code Bender, Scratch, etc.). but we did not work with organizations, only with single individuals.

The problem of assessment in this project-based approach to education

SM – I think that the assessment could be done by peers and by means of self-assessment. What you need to do is to provide a rubric at the beginning and at the end of the course/sessions, and ask them to assess themselves or the others. I believe that the assessment should not be test-based, but more more knowledge-based and discovery-based. Our classes are made of kids aged 6-16. I think that the success of this kind of initiatives can be seen as a reaction to the deficits of the current education system.

"Flow of information" in classes

SM – In my experience, I saw that every time there is a "leader" that emerges (without a leader the group cannot perform), so we encourage children to emerge in this sense. Creativity is less related to group activity or leader, but the environment allow them to be creative because there are no constraints. Of course, we do set limits, encourage them to follow the guideline and not be disruptive. Communication is done through translators, we cannot dictate content, we can only ask questions, when they present we do not understand.

The Greek school system flooded with problem, the contents delivered are very specific and do not prepare children to the modern life style. We need to consider that when they will start they career, in 12-16 years from now, perhaps they will be ready for university, but then the problem is only postponed, even the university is not preparing them for the job market. In Greece the choice they can do in terms of faculties is based on the grades they got from school: this means that they might have the attitude to access an engineering school but not the specific grades, while they could access the faculty of child psychology, ending up wasting time for themselves and the society.

We found great inspiration in terms of educational approach in some interesting talks on the TED platform (Ken Robins, Sugata Mitra, etc.).

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No.	10. CoderDojo Nafpaktos
Date	August 29th 2016 – h.11.00 AM – 12.00 PM CET
Country	Greece

Interviewee	Iraklis Markelis
Role	CoderDojo Nafpaktos
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

IM – I am an IT manager in school, and an informatics teacher. I try to engage with all the technologies, and to work with kids in labs, besides classroom. I approached the CoderDojo because I wanted to do something more with the kids, I wanted them to be more creative with programming and with programming logic. With this in mind, I approached to the CoderDojo and created a lab of programmers in Nafpaktos.

So far we have been able to organize only a two events. Unfortunately, at the moment everything is on the shoulders of one single person (activities, worksheets, etc.) and I have not been able to find any volunteers for the CoderDojo. I had encountered some difficulties with mentors and the organizational staff in this town. The materials is very good and very well organized and the procedure is very clear and helpful. But it needs a team, I didn't have it and I want to create one. At the University of Patras I found students willing to work as mentors, able to work with Arduino and Raspberry pi. They meet in a room called "Pi space" where they gather to share ideas, they have a lot of free times, they create their own security systems. Very good space for kids to be inspired. Some showed up and helped, but after the second event everyone disappeared because they moved or had other commitment.

I also needed help with funding, as after the first two events we ran out of resources.

We started a series of lessons to work with Arduino boards. Last year we worked on some activities with LEGO and Arduino. We created the materials for two labs/events, but still there is much to be done, on the Internet there are so many materials that it gets confusing at times. This year I decided to work with 3D design, and this is something I will also bring to my school: it will be probably some diorama project to create 3D models of buildings of the town of Nafpaktos. I have already created some slides and moving forward.

In the school where I work we have a very good lab with a very good infrastructure, which gives the ability to kids to grab technology, see chips, boards, and motherboards. Kids love it, and my job is to destroy the myth they have in mind about computers: there is nothing magic inside, it is very simple stuff put together, nothing to be afraid of or dangerous, no rocket-science. It is a private schools, and I teach in the general school for kids 13-17/18 age (gymnasium). I think that the Greek public school is great, there are no major problems, there are PCs in all of them. Unfortunately, not many teachers are trying to find the funding to create labs in schools. School managers do not know how much important is to introduce new technologies, they are not informed enough and the seminars they take are superficial, no real information. I do not think that the school managers are to blame, also teachers have the responsibility to find funding and be creative.

I think that today 50-60% of the teachers are using these technologies. Some do not have the infrastructure, some do not know about them, some do not want to know. Some are afraid to engage with new things, they are afraid of criticism, to do something wrong in front of the kids.

The key element in new technology is Internet: this is where kids always find new stuff which opens their minds. I created some lessons using GIMP, an open source program for digital editing of photograph on the topic of pop-art: the aim was to have kids inspired by pop art (applicable to other artistic movements, of course) and let the kids try to find new ways to edit photos. It really surprised me to see how creative they were, this experience helped me correct my working sheets (it forces the teacher to make the best working sheet). These improvements helped me create new and better materials (I incorporate their questions). I ask them what they want to do.

Right now in Greece the final exam from gymnasium to lyceum has been removed, albeit we still need to follow the guidelines from the Ministry. For example, the last time the exam needed to touch the Logo programming language (and it was very difficult to find material to work and test in Logo). I believe that exams kill the education: I can do labs until my students are 16-17 years old, then I need to prepare them to give national exams (Turbo Pascal and basic programming).

As for the engagement of female students, I believe that the teacher can play an important, as he/she has the responsibility to make them more comfortable and believing in themselves. I think that girls still think that programming or engineering is basically a work for males, but it is my duty to make them understand that every time they make a mistake they have another opportunity, that we cannot be always right, not even the teacher. Students correct me, and this is good, the message I want to deliver is "let's try to make it right together". I believe that this is when boys try to make girls feel uncomfortable, a kind of school-version of the business world, I try to fight this, I try to make girl more confident, give them the opportunity to be wrong, to make error, to pass the message that the magic of programming is that you make every error you like and then you correct it. Near 70% of the students in my classes are girl: they have a unique attitude, they are more creative programmers. Most of the programs we are using today are made by male programmers, but it is becoming clear that the market is saying that we need more female programmers.

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No.	11. Fab Lab Limerick
Date	July, 11th 2016 – h.11.00 AM – 12.00 PM CET
Country	Ireland
Interviewee	Mr. Javi Buron Garcia
Role	Founder and director of Fab Lab Limerick
Interviewer	CB

CB – Introduction of the DiDIY project and the role of stakeholders in data collection.

JBG – I am the founder and director of Fab Lab Limerick, born 4 years ago from the University of Limerick. We have a strong network with other fab labs, that we strengthen through meetings and events. The fab lab was born without an initial funding. We started assembling machines during a semester's course with my undergraduate students at the University. Now the Fab Lab is partially funded by the University of Limerick, while the other funding comes from external works, local municipality also contributes to the project by leasing the space. Our office is not inside the University's main campus but right in the centre of the city, so as to reach out for the population and to work with school and citizens, involving them in training, research, and communication.

Do you work with children?

JBG – Our main goal is showing digital fabrication technologies to a wide group of people. We have summer camps, Easter camps, and Christmas camps for children, where a teacher helps them to discover different kind of DIY technology. We use a student-centered and project-centered approach: the projects have activities in digital fabrication and making included in the training.

Do you collaborate with schools?

JBG – We used to show demonstration in primary e secondary schools but without a structured program. In Ireland, there is not a defined program that involved DIY in the schools like in the UK. We are working to define a way to introduce teaching DIY in the schools programs but our opinion is this should be done with an institutional approach. i.e. top-down. Indeed, in the current programs' organization, there is not enough time to introduce DIY courses and I believe that the government should change this. In general, our Fab Lab collaborates with single teachers, in a customized way: it's the teacher who approaches our organization to seek for a specific training course. We have a good connection with local schools and we organize training courses on different items, from digital fabrication to prototyping.

STEM – STEAM

JBG – Our team's background is mainly from the architectural school, so we are trying to increase connection with art. We work a lot with artists. We recognize the importance of this job and we know that there is a gap between STEM and STEAM. Our goal is to fill this gap. I think art is very important. My previous experience in a media lab gives to me a critical thinking on DIY. DIY without art loses its ability to raise important questions, to be expressive and creative and to be relevant in society so I do my best to turn STEM in STEAM through the art.

Question on the role of sharing

JBG – The new trends in education, such as project-oriented training, are important and good. I think we are too optimistic in making because is trendy: making is important but thinking is important too. We should have a critical think of making. Indeed, there is this general opinion in kids on making everything but I think that an ethical point of view on distributed manufacturing, recycling and so on, should be kept. In our Fab Lab we work on open assembly activities to enhance individual qualities. Each person is good in something and other in different activities.

Is DiDIY changing the role of the teacher?

JBG – In my experience, design schools have changed the role of teachers few years ago. Our staff is already engaging with our students so this new kind of teaching environment is not new for us. They interact with students, creating a dynamic environment. We should bring this experience in a new environment, such as in higher or elementary schools. The concept of learning is in the interaction.

Question on the involvement of male/female

JBG – That is a big challenge. For some reasons, right now technology is mostly male-oriented, but this should be changed. We are planning to do that in the next year by the so called "positive discrimination", to be sure that there is gender balance in events/meeting, like a discrimination but positive for woman. For example, we saw in our courses that if we have half-and-half participants, the tone of the course changes. Furthermore, having female teachers may help engaging girls in these activities. The same course taught by male or female teacher deals with different topics, and this gives an added value to the training.

Question on research

I am involved in academic research in digital fabrication for architecture, such as ultra-low cost digital fabrication structure. We are interested in developing a hybrid space in which expert research could happen in the same space than cultural and educational activities. For example if we just have a space made for teaching kids they will tend to work in small, entry level things great to get started but not so good to inspire them. By combining all these type of users under the same roof each one (kids, researcher, entrepreneurs, artists…) can make impact and inspire to each other.

Furthermore, the relationship between education and making in kids should be done not only by small projects, which give them some real, immediate outputs to see, but rather the environment should comprise the results of larger, more complex projects, to create a more stimulating environment, inspire them, giving them the idea that they could do a lot more.

Do you have courses for adults?

We are part of higher education institution, so we have courses for adults. We have 1-day courses, but also longer, such as for a weekend. We also have courses dedicated to unemployed people. This program is to provide them new skills in digital fabrication, and a certification in design and digital fabrication at the end to the semester. This should provide them new job skills to enter in the labour market.

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No.	12. Indire
Date	June, 21st 2016 – h.10.00 – 11.00 AM CET
Country	Italy
Interviewee	Mr. Giovanni Nulli
Role	Researcher at Indire
Interviewer	CB

CB – Introduction of the DiDIY project and the role of stakeholders in data collection.

GN – We already know the DiDIY project and we are happy to collaborate each other in common research areas of interesting. We had some previous contacts with Ab.Acus and we are interested in knowing the evolution of the project and the evolution of the school system that it is a wide and diversified reality.

Sharing

The "sharing" concept is related not only to the DiDIY but also to the technologies, such as coding and robotics, behind the concept of "media space". In this context, the school is moving fast, in that kind of realities in which innovative technologies have been recently introduced.

Negli istituti tecnici sono un ambito professionalizzante, la situazione è diversa. This means that anyone who moves in space of these technologies tends to do so in line with what it is proposed by makerspace: in fact we can say that the professors are literally fascinated, they have an imprinting that comes from the outside. We can see the parallelism with the problem-solving techniques and working-group: these technologies amplify this way of working. In general, around 10-20% of teachers were "innovators" (first ones introduced the computer, working with videos, etc.): teachers always want to do more.

Indire tries to innovate. We believe that we should work more than at individual school level.

Role of teachers

The relationship between teacher and student is changing. Now the work strategy is for specific projects, in order to solve a given problem, and the teacher role is changed: he/she is the creator of the situation, his/her task is to build a new environment and making sure that the student moves across each environment (not

only at physical level, but also in terms of organization of the lesson). During lessons, not the teacher but the problem is central. DiDIY means choosing what building.

This technology revolution is wider than the previous ones. The school has an inertial nature (at bureaucratic and administrative level), and shift to innovation at school level means moving toward the autonomy, where the director is increasingly determinant. Indeed, in many innovative schools, the innovation is bounded to the director, which actively promotes it. An efficient internal communication and the teacher's motivation are needed to be innovative.

Many teachers are realizing the strategic importance of education at national level. If the director works in this way and he/she manages to create this communication between innovators and undecided, the school starts to move. On the other side, there are the family and the environment: a good director makes communication to the external world (for example, to get funds), and if there is a good communication with the outside, school becomes an active and recognized institution, attracting not only public funds.

Crucial to this kind of innovation is the connection with the local FabLab (already done by some schools), leading to the possibility of training for teachers and students, and extra curricular activities.

The limit is the curriculum structure: all activities of the school have to be reported to curricular activities, and even if they are interesting but they do not fall into the curriculum, they remain outside. Innovative activities currently work best if they are half-curricular (the teacher can use them for evaluation) and they do not steal time to class activities, although some tension persists because they are not completely internal. Innovative teacher goes beyond the curriculum.

The secondary school allows more flexibility in the curriculum activities but there still is the graduation exam that it is always the same: the Ministry asks for innovation, but, at the same time, it does not give a way for teachers to use such innovation as an evaluation tool.

The National Guidelines are not requirements: the text is accurate but interpreted, it does not give stringent guidelines and indications on how to move. However, these guidelines do not give a clear push towards a specific direction (as in the case of teaching expertise), which means that the innovator can make the innovator, and the conservative can be conservative.

La struttura in sé non favorisce né impedisce. Il problema è che manca una spinta centrale e chiara verso l'innovazione. Questo in effetti è in linea con l'idea italiana di scuola, in quanto la costituzione protegge la libertà di insegnamento del docente come professionista, libero di interpretare l'innovazione come meglio crede; chi non vuole aderire perché non le considera iniziative valide può farlo. The problem is that it lacks a central and clear push towards innovation. This in fact is in line with the Italian idea of school, as the constitution protects freedom of the teacher as a professional teaching, free to interpret innovation as he/she believes. Who does not want to join because it does not consider them valuable initiatives can do it.

The Law 207 gave a push towards innovation, with major funding. However, the curriculum is the same. We have not forget that Italian schools are large structures (we cannot compare them, for example, to the Finnish school, much smaller): we speak of schools with thousands of students and a single director.

We see a lot of activity in the Italian school, many teachers and leaders who are trying to figure out how to move, but we think that in the first cycle of the school this phenomenon could take root even better than in the secondary.

The Italian school does not have a very high OECD assessment, but it is improving at the primary school level; indeed, it is one of the best in the world. Teachers work in a collegial manner, and work involving many children. They tend to get involved in innovation, an attitude decreasing with the rise of educational levels.

Teachers, like children, want to get their hands dirty. There were experimental projects 3D printing in primary schools: the teachers react very well, they tend to leave their comfort zone more often than teachers of secondary schools. The reason can be traced to many factors: in the secondary school the teacher feels more responsibility to prepare the student to maturity, at the university, and at work, the strong pressure they have compared to teachers in primary schools.

To change the way we do school we have to start from the bottom: coding and 3D projects start from childhood. Children understand how the system works (an object has to be designed and then there is the production). It is true that video technology (tablets) do not give the opportunity to develop fine motor skills, but DiDIY technologies can do it (robotics).

Students with special needs

We do not talk to specific students with disabilities but we talk about inclusive education, because if teaching is good, it is for everyone. This not only affects the structuring of the physical spaces. If learning is set correctly (and for some forms of disability, it must have special attentions) there is no delay in the class where there is the student with disabilities, regardless of the technology. The technology helps but is one of many components. If the class works in groups, solving specific problems, each student can have a role, which is related to his/her inclinations.

STEM – STEAM

In the first school, it does not make sense to talk about this difference, as the projects are always organized around themes, and always include scientific and not scientific subjects. It would be interesting to see what happens when you get a student or teacher with this background in high school, in classes where this approach is not yet rooted. In fact, in the secondary schools we see a strong disciplinarity tied to individual teachers, including extra-curricular activities. It is very difficult to achieve an interdisciplinary projects, and the evaluation is even more difficult. These projects are usually undertaken as optional, and as for technical schools, they end up during hours of laboratory: the activity remains confined to the laboratory, and it is mono-disciplinary.

A teacher has generally 18 hours of teaching, and the time dedicated to extra-curricular activities is voluntary-based; indeed they are unpaid hours. The directors have the tools to help these teachers, but the school today is still a place where these things are a plus.

Some possible solutions

One of the last calls of the Ministry has allocated funds for the purchase of equipment to create "the creative and digital atelier" (from Malaguzzi pedagogy), and it also includes the presence of a digital innovator in each school. It give the financial instruments not only for the "creative and digital atelier". Since 1999, in Italy there is the school-based autonomy: the school must have its own internal projects, needed to respond to these calls for funding opportunities.

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No.	13. FabLab Frosinone - Noumena
Date	July, 20th 2016 – h.16.00 – 17.00 CET
Country	Italy

Interviewee	Aldo Sollazzo
Role	Founder of Noumena and of FabLab of Frosinone,
Interviewer	IDV

IDV – Introduction of the DiDIY project and the role of stakeholders in data collection..

AS – I am an architect and a researcher. I am the founder of Noumena and the FabLab of Frosinone, I collaborate with the FabLab Paris and Barcelona and I am the director of the IaaC global summer school, an exchange program involving eight countries in the world.

Noumena works with the IaaC and the University of Barcelona in three main areas: design, research and education. In particular, we test advanced methods for the design and the development of different environments.

Role of sharing

AS – We organize research events that are open to everyone, from adults to students of all ages, each time with different themes. We have for example a course on biology and 3D printing.

I also personally take care of directing the global summer school, which consists of an intensive two-week training. This year's theme was the city and how to adapt the new materials to create new environments. We believe it is important to bring the research outside academic environment, creating a collaborative research and using different brain to get the same goal. During this event, there are different cultures and different lectures, local and global, are organized.

In addition, we have the Reshape project for the development of a platform including the designers participating in events related digital fabrication topics.

Learning and role of teacher

AS – We share search process through dedicated platforms: we like to consider students as collaborators. Currently there is not so much space for students so we are trying to generate knowledge reusable and accessible to everyone: a revolution is taking place, there are no boundaries between professions.

In the learning process, there are languages that we must speak: it is not an area of research problem but the problem is the language. Use DIY tools is a process to be part of a community and to be what we are, but it's not a career. I believe that the DIY is the end of an open mind process, created to be able to match each other.

Gender issues

AS – We have a good percentage of female participation that is necessary to give another type of contribution and sensitivity to the events. In IaaC global summer school there is gender equality.

How institutions respond to DIY

AS – There are enough funds, but if you have the right channels you can manage it all by yourself, without using institutional funding. I think everyone must be updated on new technologies through masters and training courses.

School curricula should include scripting lessons to give inspiration to young people.

We can do everything with the new technologies, but the most fascinating part is the imagination, giving the

possibility to increase mental flexibility.

We currently have a course to FabLab Academy and we are trying to make it an institutional course. If we will succeed, it would be amazing.

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No.	14. Frankenstein Garage
Date	September, 6th 2016 – h.12.15 – 13.15 AM CET
Country	Italy
Interviewee	Mr. Andrea Maietta
Role	Co-founder of Frankenstein Garage
Interviewer	IDV

IDV – Introduction of the DiDIY project and the role of stakeholders in data collection.

AM – Since 2011, the Frankenstein Garage organizes training courses, workshops and events to spread the maker culture in Italy. Initially, it was born with the idea of opening a fab lab in Milan, but the project has changed over time due to a simple consideration: the best way to make an impact is to help people to have an impact.

For this reason, we provided training courses and events and conferences, and we also wrote "The Maker's Manual" (which was also produced as an international version for Media Maker), a practical and concrete text we hope will be of help to those who want to enter in the wonderful world of the maker. We also wrote the "3D printing – complete Guide", the most comprehensive manual created for people that want to meet the 3D printing or want to deepen their knowledge.

From 2014, we are editor of the Made for Makers of Edizioni LSWR, a series collecting the experience of makers who want to share their knowledge to help other makers to take this wonderful journey or (re) discovery the maker process.

The role of sharing

In the first group lesson, people talk to each other just to feel comfortable. In fact, it has been shown that if you start talking from the beginning in a group meeting it is easier then to socialize. Only in this way people know each other and work well together: each one puts a piece of knowledge and only if they worked well together, they continue to do it in other lessons.
Obviously, there are those who emerge in the group more than others, but the collaboration is important. I noticed that in this way it is easier to learn because it is not a teacher to give a lesson but it is the person next to you. Moreover, this is also useful for those who explains: explain to a colleague just how to do something helps to understand how much you understood that topic.
In both cases, both for those receiving help and for those providing help, the esteem improves, because the help does not come from a teacher but from a friend, and because the general feeling is that everyone can be teacher for someone.

Learning flow – The role of teachers

I go for training courses in elementary and secondary schools and sometimes high schools.

We also have courses for adults. The goal is to disseminate basic knowledge: our courses are used to give the bases and to involve people persuading them that they can do it. We have basic courses of electronics, programming, 3D, Arduino; we also teach scratch in primary and secondary schools to create custom games. Creating by yourself your game is more challenging and rewarding. I believe that learning is more effective and long lasting when you fully understand what you studied by putting it into practice and creating something.

How is school as institution responding to the use of DiDIY?

There are not enough public funding to schools for the adoption of new technologies and training of teachers and students. There are sporadic cases of municipalities that decide to allocate funding for some schools, but this is different from municipality to municipality. In technical schools the situation is better than in other schools. In fact, they are investing in technologies, but mainly because there are finding provided by the families of the children (school fees).

As you go down with age, it gets worse. At the institutional level, there were some talks on digital agendas and new technologies, but in practice, they were not accomplished for lack of material of suitable training. The current situation is not uniform: it differs from case to case, considering the economic situation of the families of the students (they are often the first source of funding).

For this reason, my courses are free of charge.

DiDIY in education and gender issues

Children and adults are subjected to an increasingly large amount of data and information. Therefore, it is needed to train them to have a critical reading of these data and not a superficial view. The goal of Frankenstein Garage is to provide the instruction for the use of digital technologies as basic logic behind them.

Equipping people of problem solving, learn to ask ourselves why, think using our brain, is the base of DIY. I noticed that there are more men during our courses and I think is because men are more curious than women in this area: the girls cannot play with tools, drill and generally dangerous objects during childhood. This means that they are less likely to choose engineering courses, so there are less passionate women of new digital technologies. However, a woman definitely has a sensitivity and empathy different from man then it is important to involve them as much as possible.

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No.	15. WAAG society
Date	**September 7th 2016 – h.2.00-3.00 PM CET**
Country	Netherlands
Interviewee	Karien Vermeulen
Role	Head of the Program of the Creative Learning Lab of the WAAG society

Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

KV – I work as Head of the Program of the Creative Learning Lab of the WAAG society, an Institute for art, science and technology. As institute, we research technology in society by playing with them, by creating and engaging people, and by democratizing technology. We want to make sure that the technological development involve people in creating their own environment, we seek the individual's empowerment through technology.

The creative learning lab focus on the role of technology in education, and our goal is to understand how to help teachers and children to use new technologies to improve their learning experience. We know that children are intrinsically motivate in learning, and we believe that they can use technology to do so. In our initiative (for example, the informal programming sessions that we organize on Monday and Wednesday afternoon) we don't have a fixed programme, but rather we let them learn on the go, interacting with other people. I think that the experience we have seen in FabLabs (www.fabschool.nl) is very useful with regard to the learning process, not only in term of digital literacy but also of attitude toward learning.

We do have also some programs focused on teachers only, to help them overcome their "fears" and to feel more confident in using new technologies. We try to present technologies as something nice that they can enjoy using: they need to start learning again, which is not always easy, and to come to feel more comfortable with the idea of not knowing everything. At the end they adopt our attitude: "I don't know, but let's find out together".

We do have a platform for maker education (www.makereducation.nl), a Dutch platform where we bring together schools and makers, with a voucher system for life-long training. We do also organize social events (pizza session with teacher, or after dinners). We also have an intense programme dedicated to teacher (https://waag.org/en/news/learning-making-ten-recipes), the "Teacher Maker Camp", a 4-day programme where teachers and educators can find the time, the space, and the tools (good machines) to help them get to know these technologies. During the camp, the Waag faculty support the teachers and give inspirational workshops. The key factor for success is time and motivation (people have time to make something they really want to make). Our aim is to present them with the idea that "making" can be fun and that it is possible to overcome problems with technology. There is a whole world online where they can find tutorials and materials, they have to have the success experience themselves before teaching children, they need free time to work on their own project, so that they get really motivated to fix it, at the end showing what they did.

The setting is informal. It is different from the workshops we organize to learn how to use machines: the main focus here is to help them enter the DIY mentality, organize their own learning, so that in the coming years they can get up with the new technology coming over. It is striking that there are so many things already been made online, but that people continue re-design. We have hard time convincing everyone to document and share their projects, but only few are interested in sharing. Teachers feel their project not so interesting. But we think this is a crucial moment, for student in particular, to document their process and share their results is very educational: make pictures, publish them, and reflect on them, is essential. In the Maker movement, people share also their failure, but everyone need to be chased a bit. For children is the same, or even worse: documenting is not that interesting as doing and making.

In the Netherlands there are a lot of makerspaces working on their own, and there is also some competitions between them, we tried to cooperate for a long time, once every two months we meet, but it is not enough. The real turn happened some time ago: we asked Sylvia Martinez (http://sylviamartinez.com/), a guru in the education and Fablab field, to come and give a Master class. We then grasped the momentum to start working together. She said the situation was perfect, and that we only need to act, drafting a manifesto and

find a member Parliament willing to endorse it.

I think that the further step need to be taken at the national level, perhaps following the Danish example: in Denmark there is a university-based organization (at the Aarhus university), where a lot of research is being carried out, and fellow programmes are available. Thus, the key elements to bring this forward would be: "playground" with teachers + teacher programs at university level + national lobbies.

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No.	16. CoderDojo Rotterdam
Date	The Netherlands
Country	September 1st 2016 – h.5.00-6.00 PM CET
Interviewee	Tiemen Waterreus
Role	Mentor at CoderDojo Rotterdam
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

TW – The CoderDojo Rotterdam has been active for 4 years. The initiative started from me and Christian Vermeulen: we found idea on the Internet, we wanted to take part but at the time it was based in San Francisco only and there was nothing in the Netherlands. That's how we decided to start: Christian asked me to help and I have always been very enthusiastic about it.

Our first Dojo was attended by 9 kids, the two of us were the mentors: I think it was a great success. Now we try to organize one event on the last Saturday of every month (except December). Today our Dojos are attended by at least 14 people now, and we had to set a limit for 30. We had to have a waiting list in some cases: we tried to organize meeting twice a month, but it was too much as everything is run by volunteers (there are 10 volunteers in Rotterdam at the moment).

I believe that if the aim is to make kids explore their creativity, the CoderDojo approach works better than the traditional educational system. We actually started off in that way. Our first dojo was a traditional lesson: it worked, but we realized it took a lot of preparation and that we could not act as teachers, given that we did not have that background. We then decided to split the dojo in two: half of the group would have worked in an "open" set-up (we would have given them the materials and let them do by themselves), while the other would have worked in a "traditional" fashion. We found this really helpful, as the younger kids or those who are new to the dojo are not really autonomous yet, they need at least some kind of support at the beginning, also because they are used to the traditional teaching approach.

The first Dojo a kid attend is almost always in visual programming. Then the workshops tend to be more advanced: we tackle HTML or other programming language. All kids work on the same subject/project in each dojo, and collaboration depend on what they are doing: we try to encourage them to ask their mate first, then another one, and only after the mentor. The materials we develop are meant to be used by 4 people at the time, so that they have to do team work. Mentors are always in the background, and we try not to interfere with kids creativity: we are there to help if the get stuck.

Other activities we organize includes code combats (playing a game by writing code), which is very

programming-oriented. But we also have some workshops on TinkerCAT, the child-version of AutoCAD, to design projects in 3D, and Scratch. We also present kids with a lot of different programming language (Javascript, PHP, Java).

At the moment our CodorDojo is meant only for kids (6-17), and we have to reject application from adults (teachers included). Some schools have been emailing us to ask to organize dojos in schools, but so far we have not been able to organize anything because all of us in CoderDojo Rotterdam work during the week. If someone ask, we solve by forwarding to them to other dojos outside Rotterdam. I know that there are some schools which have their own dojos within though.

Indeed there are less girls than boys, but there are some, and I think this is a good sign. I think that their participation really depends on the subject of the workshop: if it is more "open" it attracts more girls. For example, creating a website that can be more customizable. However, other workshops are less customizable and a bit more technical: in that case, we have less female attendants. We are not actively trying to get more though, as we believe this needs to happen organically, without pressure, we do not want to put emphasis on this.

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No.	17. DOK Delft
Date	September 12th 2016 – h.4.00PM CET
Country	The Netherlands
Interviewee	Judith van der Stok
Role	Advisor Marketing & Communications, DOK Delft
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

JS – DOK is a public library in the city of Delft, I work there as responsible for marketing and communication. Lately we understood that the library needed to shift its focus and now the target group we are focusing on is more 0 to 14 years old. We decided to develop activities to play and learn, so we searched and found CoderDojo on the Internet, which was an already proven success story. We then decided to use it and to apply it in Delft. Here there is a good technical university. We started one year ago organizing three meetings on Saturdays, a sort of pilot project to see how many people were interested: it worked well, so we decided to continue. My role is organizing and get the volunteers together, and make sure children can get the ticket online, set the programme for the day.

We tried to involve some student volunteers from the university, but it didn't really work, probably because they focused on their study. Our current volunteers are already programmers themselves, they are all professionals.

The library works a lot with local schools, there are contact and communication, but not the CoderDojo itself. We use the national CoderDojo site, based in Rotterdam, and people interested can find us searching for the Delft chapter, we are also active on Twitter and FB. However, we already have some contacts with interested schools and the library is planning to offer some workshops.

We differ from traditional school in the sense that we don't have a curriculum, we are not focused on the development of the child altogether but only on sparking the interest, making them enthusiastic. We show them how programmers think and how computers work. We divide children in groups, depending on the programme, 10-15 minutes information session, then they are left free to explore the technology.

Last time we had two groups of three children, we asked to make a html page, most groups came up with different subject (Minecraft, animal, and gaming), they tend to conform to the group interest. Mentors are very involved, asking questions, while other tends to stay more stand in the background. We started with 10 children and 3 volunteers and now, depending on the amount of volunteers available, we have space for 24 children.

We have eleven volunteers, we network on WhatsApp, and Google drive and we use 'Slack'. We meet once every month. The content of sessions can vary: from programming Webpages, to Scratch, to programme robots (Ozobot), Dash and dots. Last session was "unplugged": children brought their laptop and we wrote a programme to move a live robot (owned by one of the volunteers). We taught them the binary calculation, to write "a secret language".

As for gender, I would say that we 40% girls and 60% boys, the age goes from 8 to 12.

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No.	18. First Lego League Scandinavia
Date	Settembre, 13th 2016
Country	The United Kingdom
Interviewee	Ms. Nina Sievertsen
Role	FIRST LEGO League Scandinavia
Interviewer	IDV

IDV – Introduction of the DiDIY project and the role of informants in data collection.

NS – The non-profit foundation FIRST Scandinavia manages FIRST LEGO League in Scandinavia Since the start-up in 2000, FIRST Scandinavia's purpose has been to give children and young people good training and empowering experiences with the technical and natural sciences, and thereby contribute to more pupils choosing a scientific education. Over 200 000 children har participated in our activities and received inspirational teachings in Newton-rooms and through participation in FIRST LEGO League. FLL teams work with three parts: science, technology and marketing.

The role of sharing
The project are in different areas. For example, this year the theme was animals. In particular, the children had to find a problem on how animals interact with humans, and solve it.
The core values in this event of 8 weeks were:
- We are a team.
- We do the work to find solutions with guidance from our coaches and mentors.
- We know our coaches and mentors don't have all the answers; we learn together.
- We honor the spirit of friendly competition.

- What we discover is more important than what we win.
- We share our experiences with others.
- We have FUN

During the 8 weeks they involved people of the entire community and also elderly people to build bags and material useful for the development of the project.

I think is this a great opportunity for children to learn new technical and social skills and to have the possibility to learn from each other.

Learning flow – The role of teachers

I think that it is important that the kids get the experience with this «hands on» project. Not because we necessarily want all kids to be engineers and scientist, but to let them know what they don't choose when they are applying for higher education.

The FLL kids start working with the project:

- without having any answer
- they have to identify the problem before they can solve it
- they have to think creative
- it's their own project
- they have to collaborate with others
- they have to seek information
- they have to plan and organize so the work

At the end of the 8 weeks they developed new skills in a funny way.

DiDIY in education and gender issues

There is gender balance because they are students from schools.

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No.	19. AltLab
Date	September 8th 2016
Country	Portugal
Interviewee	Mr. Ricardo Lobo
Role	AltLab
Interviewer	IDV

IDV – Introduction of the DiDIY project and the role of informants in data collection.

RL– AltLab is a collective dedicated to independent research and experimentation in alternative media. Community-based and community-building by nature, it seeks to promote active participation, knowledge sharing, and collaboration among individuals such as artists, programmers, engineers, hobbyists, scientists, and all those who wish to freely explore creative and emancipatory uses of technology. Just like many other hackerspaces which have emerged all over the world in recent years, AltLab has also been founded on the notions of software/hardware libre and the belief in collective independent platforms for open and active

knowledge-sharing and experimentation.

At the beginning of this organization we organized workshop on open source technologies, digital and audio/imaging tools. After an initial assessment, we realized that it was not enough. Therefore we get the idea to set up weekly meeting to help people collaborating each other and developing something.

The role of sharing

Portugal is quite different from other European countries. The digital movement is important but people from Portugal cannot understand this opportunity: they think that hackerspaces are like universities, with teachers and students. Therefore, during our courses they are not independent because they attend as students. We are trying to change this culture improving the knowledge of different kind of environment, where it is possible to share knowledge and work together.

Learning flow – The role of teachers

We are creating a more dynamic environment to create a more stimulating environment for the participants in our courses. However, we noticed that if we leave them free to take choices and discuss about problems and solutions, than they leave our course. Our intention is to give questions and not answers but it is difficult: people do not want to be in charge of tasks and they do not understand this new knowledge framework.

One of our solutions to this problem is creating a project-flow: if they do not collaborate each other, the flow is stopped and the project cannot go on. This method is slower but more deeper because they have to understand the functioning of what they should create.

How is school as institution responding to the use of DiDIY?

Our courses are for adults (more than 25 years old). We have some collaboration with high school but it is difficult to create interest in students in our activities.

Indeed, we tried to give the opportunity of an optional participation to our meeting but the affluence was very bad. Therefore we created a partnership with the municipality and teachers: the teachers chose the best candidates in their classroom and we organized a workshop only for that students. These kind of students were more motivated and interested to develop new digital skills and the results were very good.

However, it is very difficult to find funding in Portugal. Few municipalities are giving funding to organizations but, in this way, hackerspaces are not independent any more. Indeed, they could be used as library or living laboratories of the city.

DiDIY in education and gender issues

There are more men that females because there are more men that are involved in the engineering field. However, in photography courses there is gender balance. Last year we organized a code-camp only for women and the affluence was good.

DiDIY and research careers If, and how, is DiDIY affecting the research careers of young researchers?

We have some PhD in digital media. We think that the DIY is creating new careers opportunities. Some new hackerspaces are related to a company (incubator): they learn from each other.

Which are the research areas that are attracting most researchers from the DiDIY world?

The research are more attracting is the intersection between society and technological field.

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No.	20. INTEF
Date	June, 7th 2016 – h.9.30 – 10.00 AM CET
Country	Spain
Interviewee	Felix Serrano
Role	Spanish National Institute of Educational Technologies and Teacher Training - INTEF
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

FS – INTEF comprises two main fields of activities:

1- Technologies for education, made up of five major projects:
   a. Digital culture plan for the schools;
   b. High speed connectivity;
   c. Interoperability in academic data among the 17 Spanish autonomous regions;
   d. Digital content: open education resources following the UNESCO' standard. A database of 100.000 educational contents, licensed under creative common license, is available and usable by any teachers in the world, comprising a catalogue of digital textbooks that connects the producers and the consumers;
   e. Digital competence for teachers (this partially overlapping with the other field of activity, see below), developed based on the standard EU papers about digital competencies for citizens, which we are adapting to the teachers profile – connection between training and technology
2- Teaching training: we provide online and blended advanced courses (basic courses are provided by the autonomous regions), that is, complementary training materials, mainly about digital and innovation, i.e. MOOCS for digital competencies.

CB – The evolution of the learning flow between teachers and students

FS – The way people communicate is evolving and today' students have to be prepared for the world of 21st century; this means they need to learn something more than the traditional curriculum. It is possible for pupils to create and share content and teachers need to do an effort to introduce this new knowledge in schools, which we recognize is a very important skill for the future. However, this is still not very common in Spanish classes. Today Spain has about 650.000 teachers: we could estimate that probably only 5-10% of them are actively involved in this kind of innovation. This kind of activities are still the exception, not the norm. And we are now working to understand how to introduce this effectively in the classes. The transformation of the education field should go in parallel with the transformation of the society.

CB – Have you observed any commonality with the changing in the communication flow what is happening in today's companies?

FS – That might happen, but I believe it depends on the kind of company: traditional companies might not be experiencing radical changing in this sense, but new, international companies, attentive to communication aspects, might do.

In general, tools, being them highly technological or not, should not be the focus. The point is how teacher are using these resources. There are many – some teacher might want to use technology, others might not. The important thing is keeping up to pace with innovation and keeping on experimenting. The continuous enhancing of education follows three simple steps:

1- Design the process the of teaching
2- Apply this new design
3- Test its efficacy and modify if necessary

CB – How is school as institution responding to the use of DiDIY?

FS – Today, the introduction of new technologies in schools is still not fully applied in Spain. But this needs to change, and schools already working in this direction must not be an exception. We need to do a jump, to move from the single teachers doing so to whole school and the school system.

As INTEF, we are actively involved in this sense. On May 24th 2016, we organized the conference "Digitally competent Educational Organizations" with the aim of presenting the Digital Competence Framework for Educational Organizations designed, determine the current situation regarding digital competence of educational organizations at the international, European and Spanish levels; analyse the impact of the digital transformation of educational organizations in the current and future education; discuss proposals to advance the implementation of digital competence in educational organizations.

CB – What are the main problems hindering the adoption of new technologies in schools?

FS – Teachers are mainly working individually. They need to be able to apply IT on concrete contexts. We have enough IT resources, but there is a need for more organization and communication.

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No.	21. Hackerspace Valencia
Date	September, 20th 2016 – h.17.00 – 18.00 AM CET
Country	Spain
Interviewee	David Hernández Ruiz
Role	Hackerspace Valencia
Interviewer	IDV

IDV – Introduction of the DiDIY project and the role of informants in data collection.

DHR – Hackerspace Valencia has 3 years and around 20 members. We work on different own projects and we collaborate with organizations organizing activities for students and children.

IDV – Role of sharing

DHR – There is a block in the sharing. It is not so simple to create a shared environment. In US, they are trying to patent software but this does not make sense. We are trying to make our projects free and accessible for everyone (free of licenses).

IDV – The evolution of the learning flow between teachers and students

DHR – The learning flow is becoming a reasoning flow. Indeed, learning is not any more an imposition, or "I don't care if you do not understand". In this new environment, there always is someone ready to explain and help people with some problems in understanding a concept, and people are more motivated to understand their errors and the real functioning. We organize an event each month getting involved people as teachers and people who want to learn. They work together and they learn from each other.

IDV – Gender balance

DHR – In our events, there is not gender balance: on average one woman on twenty. This is due to the smaller participation of women to this kind of technological activities.

IDV – How is school as institution responding to the use of DiDIY?

DHR – We have a collaboration with organizations not whit schools. In our events for children, we teach them how to print and test circuits. However, these kind of activities are quite expensive and there is not economic support from our institution. The primary schools are not focused on this innovative movement but we would like to collaborate with them. Indeed, we just created brochures with courses dedicated to schools.

We have collaborations with universities and fablabs.

IDV – STEM to STEAM

DHR – I do not believe that hackerspaces are only science. We have designers and in DIY, in general, there are many artists. Artists work with engineers sharing their competences in a multidisciplinary project.

IDV – What are the main differences between traditional and DiDIY-enhanced research?
DHR – The main difference is related to the possibilities to bring a prototype of own research to events and conferences. I'm not talking about the possibility to print something with the 3D printer (that it is old), but I'm talking about electronic controls and new interfaces and games.

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No.	22. CoderDojo Wilmslow
Date	September 6th 2016 – h.10.30 AM – 11.30 AM CET
Country	The United Kingdom
Interviewee	Rob Currant
Role	CoderDojo Wilmslow
Interviewer	CB

CB – Introduction of the DiDIY project and the role of informants in data collection.

RC – I am the so-called "champion" of the CoderDojo Wilmslow, I am the main responsible, and I also contribute as mentor. I volunteer in monthly events for kids aged 6-16, and this is actually how I got involved in the movement.

The CoderDojo is entirely run by volunteers, some of them are parents interested in technology. All our

activities take place outside schools (we are proud of not being a "school", and that our activities fall out of an official curriculum). Learning is project-based, we encourage kids to think creatively, whereas the involvement of adults is mainly related to arranging and organizing the dojos, and help kids with problem solving, but only if required.

Trying to expand and open more dojos in the UK.

The biggest difference with traditional education is the environment in which learning takes place. Also, we are not governed by curriculum and schemes, so that kids are free to explore, they can try coding and then can change when they don't like it. Kids learn are their own speed, they select the technology they want to use or explore, and mentors need to be there to facilitate the process, but not to guide it. The only constrain is the number of different technologies we can offer. We do not provide certification nor official qualification, our is a game-based type of learning ("tinkering" is the right word). We are not there to replace school or compete with it, but rather we want to offer an accessible and disposable way of learning new things. Kids really respond well, they are self-motivated. For example, we had these two brothers, one of which had a mild form of dyslexia and was struggling to remember the alphabet: his teacher gave him a series of letters to bring home, to try to shape them on the shape of an arch. The two of them decided to make an app out of it, to "gamify" this physical game. They produced a very good app, good for anyone. We provided the technology, they found the solution.

It's easy for kids to get into software and hardware, the entry cost are very low nowadays, there a lot of good imaging app. First time a kid come to the Dojo we generally offer 2-3 sessions of guided learning and we provide some hand-outs (on Scratch, Java, HTML). Then we move kids to address their own initiatives as soon as we can, some of them might start right off during their first session, while for some others (a minority) we need to provide more structure and hand-outs, and guide them a little bit more throughout the first steps. We believe that even the most unmovable can be moved, and we see that over time some of them start thinking that they might do something different, or new. However, this second group tend to self-select out of these initiatives, probably because of the environment, which encourage the first attitude toward learning.

We do see a gender issue and we believe that there is a barrier in getting girls involved in the first place. But, interesting enough, when young girls get involved in the Dojo, we do not see any difference in the confidence level with which they tackle projects. In fact, we see that girls are much better in collaborating, while boys are better in showing how good they are; at the same time, girls are more willing to get to the solutions, they tend to be more tenacious and patient, while boys tend to stop as soon as they hit a barrier, preferring to change the problem then finding the solution. I would say that our CodorDojo has a 50-45% of female attendance. We noticed that the more female mentors we have, the more girls we get: if they see a female mentors, that is a female role-model they can relate to.

We do have a lot teachers interested who approach us. Some want to send their kids, but most of them want to learn about the technology. Unfortunately, a lot is reluctant to come at weekends, because it's their only free time. I have run some dojo inside the schools, as a teacher training session. The typical situation is that of a teacher, responsible for the IT curriculum, who has heard about us from a parent or another colleague. Teachers are generally worried they don't have the skills to implement the a CoderDojo-type of activity, they lack the confidence. In fact, I believe that we should try and pass the idea that it is not fair to the teachers to think they must have all answers to all questions of all students. They should feel free not to know everything. That is where the project-based approach to didactic should come in ("let's find the answer together").

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