



DiDIY

**DIGITAL
DO IT YOURSELF**

Policy Patterns

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Executive summary

Digital Do It Yourself (DiDIY) is a new human-centric, socio-technological phenomenon, enabled and rapidly evolving thanks to the widespread social availability of affordable technological tools that support, often through open on-line communities, the low cost prototyping and manufacturing of physical artefacts from digital specifications. This is leading to new scenarios in the roles and relations among individuals, organizations, and society, in which opportunities and threats emerge accordingly.

The DiDIY Research Project (www.didiy.eu), which addressed the Horizon 2020 call for a “Human-centric Digital Age”, studied how DiDIY is: reshaping organization, work, education, research, and creative design; impacting on creative society; influencing legal systems; changing ethics.

These Policy Patterns are one of the fundamental outcomes of the Project. They present recommendations expressed as patterns, that encapsulate and semi-formalise context-specific solutions for particular kinds of problems.

1. Introduction

One of the key distinguishing features of the phenomenon that we have proposed to call “Digital Do It Yourself” (DiDIY) is its decentralised bottom-up flavour, where designs and ideas are freely developed and shared within a community. This way of working does not make much use of central authorities due to its democratic way of working. In a real sense there are no “experts” or generic authority figures, but rather a range of recognised expertise – there is no discernible barrier between people, no professionals and amateurs but rather a continuum of different levels of skill and knowledge. Furthermore, there is no single discipline but a fractal landscape of different skills and areas, each with its own sub-skills and areas and each with its own mini-experts.

As the research team of the DiDIY Project, we thus found ourselves in somewhat of a quandary: we did not want to act as a central authority, making expert recommendations, since that goes against how DiDIY works. For this reason we decided instead to express and develop a set of possible context-specific solutions. These are not prescriptions, but rather merely offer up

solutions to particular problems which readers can adapt as appropriate to their context, or simply ignore. These are not recommendations in the usual sense, but more of a resource. In the spirit of DiDIY we sought to make these open to the critique and development by the community: we hope that these will be added to, critiqued, refined and edited, to become a truly democratic resource.

The format we chose for these partial solutions was that of a “pattern”, which we will now describe. The term “pattern” was coined by architect Christopher Alexander and popularized by his book “A Pattern Language” (APL) in 1977.

“At the core [...] is the idea that people should design for themselves their own houses, streets and communities. This idea [...] comes simply from the observation that most of the wonderful places of the world were not made by architects but by the people.”

The idea of pattern, as proposed by Alexander, has been especially influential in software engineering where design patterns have been used to document collective knowledge in the field. In this sense, a pattern is a general reusable solution to a commonly occurring problem within a given context – not a

finished design but a template for how to solve a problem that can be used in different situations.

“[...] each pattern represents our current best guess as to what arrangement [...] will work to solve the problem presented. The empirical questions centre on the problem – does it occur and is it felt in the way we have described it? – and the solution – does the arrangement we propose in fact resolve the problem? – [...] The patterns are still hypotheses [...] free to evolve under the impact of new experience”.

In this document, our aim is to make recommendations without being overly prescriptive. We provide a “menu” of solution recipes that will work for different kinds of problems and circumstances. These should be concrete enough so that how to apply them in any particular situation should be clear but, at the same time, abstract enough so to be flexibly relevant to a range of circumstances/problems.

1.1 The pattern template

The standard pattern template employed in the realms of software or architecture were not ideal for our purposes, so we have developed a similar one that suits the needs here. This format emerged as the result of trying to write patterns that encapsulated solutions relevant to the DiDIY world. We do not claim this format as the best possible, but simply one that seemed to cover what we needed.

Each of the following Policy Patterns has been structured following such a template. The table below provides the building elements of a pattern and a brief description of them. The first four “slots” describe the core of the pattern: what the problem is, when the solution might apply, what the solution is and what the outcome should be. This is followed by auxiliary information, that gives extra background and information, such as the rationale behind the solution, the significant influencing factors that might impinge, and evidence or examples of the solution, and any of the other patterns that relate to this one.

Basic information	
Title	Word/short phrase for rapid retrieval
The problem is..	Definition of a problem, including its intent or a desired outcome, and symptoms that would indicate that this problem exists
The proposed solution might apply when..	Preconditions which must exist in order for that problem to occur; this is often a kind of situation
The solution proposed is..	Instructions, possibly including variants described in any appropriate way
The expected outcome is..	Result after the pattern has been applied, including side effects. It might include new problems that might result from using this pattern
Additional information	
Rationale	The thought processes that go into selecting this pattern, including an explanation of why this pattern works, and how forces and constraints are resolved to construct the outcome
Significant influencing factors	The various forces or constraints that impinge on the situation and how they interact. Some of the forces may be contradictory

Evidence / Example	Sample applications, solutions and known uses can help user understand the pattern
Related Patterns	Other patterns that relate to this pattern, for example patterns that propose alternative solutions to the same problems, and patterns that might be needed before or after this pattern
Links to further resources	Where, relevant this includes references and pointers to other information that exists on the subject

2. Policy Patterns

DiDIY “not spots”: the uneven geographical spread of communal DiDIY facilities such as makerspaces

The problem is..

Some local areas lack any makerspaces or Fab Labs and so those living there may have no access to DiDIY technology and support through communal making facilities.

The proposed solution might apply when..

A community that is not served expresses an interest in gaining access and can demonstrate that there is sufficient support, engagement, and capability within a local grassroots network.

The solution proposed is..

Support and funding for local makerspaces is made available in under-served areas where there is demand in innovative ways, e.g., through partnerships with existing universal community networks and civic facilities such as libraries, community centres, or schools. Innovative funding partnerships and models

are considered, piloted and supported by local authorities, local enterprise partnerships and other funding bodies.

The expected outcome is..

Better access to DiDIY facilities among a broader public and more even distribution of makerspaces between urban and rural areas.

Other information..

An alternative might be that under-served communities are catered for by outreach and mobile projects from major DiDIY facilities based in urban centres. It may also be possible for established successful makerspace facilities to set up new spaces under their name to enable easier initial opening of new “franchised” spaces based on previously acquired knowledge and established leadership. However, makerspaces are generally very diverse in character and need to respond to local situations and communities.

Rationale

DiDIY community making facilities can provide important

pathways and opportunities for individuals to gain skills, experience improved well-being, and grow creative confidence. They can also potentially provide entrepreneurial and environmental benefits. Communities that want, and can support, access to these opportunities should be supported to acquire them.

Significant influencing factors

DiDIY and making are grass-roots phenomena and should be a response to local need, rather than imposed from outside. Facilities need to be rooted in a strong community with dedicated staff and volunteers to be sustainable. The level of engaged support and the community's ability to sustain a making facility would be a consideration in setting-up new makerspaces.

Makerspaces require substantial commitment and funding for kit, they need suitably adapted premises, as well as requiring considerable organizational input. There are significant costs associated with the need for skilled technicians and staff to enable equipment to be used in safe and productive ways.

Evidence/Examples

Innovative ways to fund artist's studios or other collective working spaces may provide examples. Deliverable highlights case studies of a range of makerspace facilities in the UK.

Related Patterns

Tunnel vision in terms of funders' objectives.

Links to further resources

Creative United (July 2016), Making Space, report into funding artist studios and spaces in London: Executive Summary available at:

https://gallery.mailchimp.com/f460d188717952a71c76f6315/files/Making_Space_Executive_Summary_FINAL.01.pdf

Dellot, B. (2015). Ours to Master: How makerspaces can help us master technology for a more human end. RSA:

<https://www.thersa.org/discover/publications-and-articles/rsa-blogs/2015/11/8-key-take-aways-from-our-new-report-on-makerspaces>

Nesta (2015). Top findings from the open dataset of UK makerspaces: <http://www.nesta.org.uk/blog/top-findings-open->

[dataset-uk-makerspaces](#)

Promoting gender balance in makerspaces

The problem is..

Unequal representation of men and women within makerspace membership. Research indicates that makerspaces are more often attended by men. It would be desirable to have as many women as men taking part in DiDIY activities as this would indicate that the social, learning, creative, and economic opportunities of DiDIY are open to as many individuals as possible.

The proposed solution might apply when..

Makerspaces are more often set-up and led by men and may not have facilities, programs and social activities that are as attractive to women.

The solution proposed is..

Commitment to the awareness and implementation of equal access for women and girls to education opportunities. Within makerspaces a deliberate promotion of greater female participation by developing an inclusive vision which may

include: activities of particular interest to some women, cultural programmes to enable women to feel comfortable within the makerspace environment for example providing access to training exclusively for women, celebration of positive imagery and inspiring examples of women active in DiDIY, encouraging all members to be aware of inclusive behaviour and conduct, promoting equality of access through activities within the makerspace and in how the makerspace is represented in the public domain.

The expected outcome is..

Women and girls will be fully able to access and pursue their making interests. Women and girls benefit from increased social, learning and creative activities and economic opportunities provided by DiDIY. DiDIY within makerspaces will flourish and benefit from diverse projects and programmes that are relevant to all sections of society. Makerspaces serve as an example of equality of access within the wider cultural context.

Other information..

Rationale

This is an effective way of increasing the impact of DiDIY.

Significant influencing factors

Growing awareness of the need to provide equal opportunity to women and girls. Society loses out on potential creative opportunities and solutions if women and girls are less able to access DiDIY.

Evidence/Examples

Some makerspaces have made a commitment to equality of access as demonstrated through leadership programme and projects. For example: coding for girls, inspiring female role models, physical environments that encourage collaborative working and skill sharing.

Tunnel vision in terms of funders' objectives

The problem is..

Potential funding bodies often have specific targeted objectives in terms of their funding remit (e.g., youth employment, or innovation) and only fund partner organisations, facilities or projects that fall 100 per cent within their dedicated remit. These do not map well onto DiDIY spaces / projects. The dynamic of makerspaces / Fab Labs is that they work in a multi-dimensional manner, with the synergy coming from the achievement of many kinds of goal simultaneously.

The proposed solution might apply when..

Makerspaces want to engage in local re-generation and socially beneficial activities, for example, with disadvantaged or specific target groups, and require outside funding to fulfil this need and carry out this work.

The solution proposed is..

Funding bodies make special arrangements that recognize communal making facilities and DiDIY making projects are

valuable sites for socially beneficial outcomes they may be interested in, from entrepreneurship to well-being, and that makerspaces often meet many disparate and integrated community needs, working, for example, inter-generationally and with a variety of community participants and groups. Partnerships between funding bodies with different but overlapping objectives are set-up, for example bringing together local consortia of university, commercial, school and craft groups and so on. Alternatively, specific funding bodies could be set-up that specialize in promoting makerspaces recognizing their integrated socially beneficial outcomes.

The expected outcome is..

Funders become more open to providing funding to facilities that are less than one hundred percent dedicated to their specific outcomes.

Other information..

A step towards the solution may be that research is undertaken that explores the value of integrated communal making facilities in the context of specific streams of public funding for social

benefit. Research could potentially develop a perspective and methodology that enables funders to account for specific outcomes within a wider context, and therefore become more open to outcomes and measurements of success that form part of a broader range of targets.

Rationale

Makerspaces potentially provide an integrated and community route to addressing a range of local and environmental problems and where they are doing socially beneficial work they should be eligible to attract public funding, if appropriate.

Significant influencing factors

Makerspaces often have significant volunteer and community engagement and can be sites for community cohesion and improvement. A vibrant mixed community ethos of sharing and knowledge transfer is often part of their success. They are generally not set-up to fulfil a single measured objective or as a dedicated service for a single external funding body. Whilst they may depend on voluntary engagement and support they also need significant funding and professional expertise to operate in

a safe and productive way. They often find it difficult to find a financially sustainable business model from membership fees alone.

Evidence/Examples

Deliverable “Social impact of DiDIY” (D5.2, www.didiy.eu/public/deliverables/didiy-d5.2.pdf) reports on case studies of makerspaces in the UK.

Related Patterns

DiDIY “not spots”.

Links to further resources

Creative United, (July 2016), Making Space, report into funding artist studios and spaces in London: Executive Summary available at:

https://gallery.mailchimp.com/f460d188717952a71c76f6315/files/Making_Space_Executive_Summary_FINAL.01.pdf

Dellot, B. (2015). Ours to Master: How makerspaces can help us master technology for a more human end. RSA:

<https://www.thersa.org/discover/publications-and-articles/rsa->

[blogs/2015/11/8-key-take-aways-from-our-new-report-on-makerspaces](#)

Nesta (2015). Top findings from the open dataset of UK makerspaces: <http://www.nesta.org.uk/blog/top-findings-open-dataset-uk-makerspaces>

Generating income from courses at makerspaces

The problem is..

How to get makerspaces to be economically viable.

The proposed solution might apply when..

Makerspace management is interested in developing one strand of activity as a commercial venture. There are people who work in the makerspace who are sufficiently competent and are available for running courses. Good facilities exist for running courses. There is demand and not too much competition in the local context.

The solution proposed is..

Running paid courses using the resources of the makerspace.

The expected outcome is..

Generated income contributes to make the makerspace economically self-sufficient. Running courses is quite time

consuming and can use space and facilities needed by regular members.

Other information..

Rationale

Makerspaces generally have people with expertise and the resources can be under utilised. There is interest in learning how to use these tools, which provides an opportunity for generating revenue from running them. Involving new people through courses may drive membership. How far can commercial activities be accommodated within the DiDIY ethos?

Significant influencing factors

Competition for internal resources among members. Improving competences possibly generating new projects. Contributing to the local economy by providing access to training.

Related Patterns

Alternative patterns include: Consultancy; Cafe; Individual programmes; Hosting public events; Hiring facilities for

corporate events; Public money through grants and awards;
Incubator programmes.

Closed format school teaching

The problem is..

Traditionally school systems focused on the improvement of teachers' abilities in content delivery rather than in their ability to improve students' learning abilities.

The proposed solution might apply when..

As the 21st century (digital) society is rapidly changing, schools are less able to transfer contents apt to remain useful during the whole student/person's lifetime; hence, what society should ask schools is less content transfer and more support to the students' development of learning abilities.

The solution proposed is..

A cultural shift is needed to recognize DiDIY and new technologies not only as a mere practical tool, but also, more importantly, as an opportunity to improve the (digital) culture of the society.

Several possible complementary solutions are available, e.g., learning weeks for teachers; helping teachers to learn how to

access existing resources, also via appropriate policies implemented by school principals.

The expected outcome is..

A more student-centred education, leading students to flipped classroom set-ups, based on self-education / student empowerment paradigm.

Other information

This pattern relates to situations strongly related to national cultural specificities, so that we can expect significant differences in different countries.

Rationale

In this rapidly changing social and technological context, learning abilities are much more important than in the past, but schools are usually unable to cope with this. “Education and training can only contribute to growth and job-creation if learning is focused on the knowledge, skills and competences to be acquired by students (learning outcomes) through the learning process, rather than on completing a specific stage or

on time spent in school”

Significant influencing factors

Benefits obtained by the traditional paradigm, which produced significant improvements to society (in particular mass scholar education), in some cases seem still outweigh the expected benefits of the new paradigm. Not surprisingly, school is a complex, inertial system, starting from the hard change of support teachers in learning how to reconsider their educational role (consider the basic difference: teaching teachers how... vs supporting teachers in learning how...): it would be DIY “from the teachers’ side”. Students’ evaluation has been modelled on the basis of the school-as-content-transfer institution framework so far, so that teachers lack ways to evaluate students as DiDIYers (assessing students’ attitudes or skills is much harder than assessing their knowledge of contents – or their ability to repeat contents; a provocative case: is it better a right answer obtained in a wrong way – say, a purely mechanical and a-critic procedure –, or a wrong answer obtained in a smart and creative way? – would, e.g., OECD PISA framework fit in this?).

Evidence/Example

Initiative such as RoboCup (www.robocup.org) and its junior version (RoboCup Junior) has revealed over the year a remarkable potential in promoting robotics and AI research, offering to the public an appealing challenge. The RoboCup Junior is a “project-oriented educational robotics activity for students, with a focus on providing a hands-on, scaffolded environment where learners can grow by expanding their knowledge of, sparking their curiosity about and increasing their comfort with technology”.

Related Patterns

Assessment of skill-based education.

Anti-pattern: teaching digital technologies and tools in the traditional, content-focused way, as the adoption of digital entities in education would be sufficient to solve the problem.

Educational systems' inertia in embracing new forms of education

The problem is..

Despite the example of best practice and the successful experience of some schools, some teachers still appear reluctant in adopting new educational approaches based on the so-called DiDIY paradigm, which could benefit young generations of students.

The proposed solution might apply when..

This could be partially due to the teacher's "fear" for new technologies, or for "not knowing enough" to use them with students.

The solution proposed is..

Work needs to be done locally, at the school level, to make school deans aware of the need for school teachers and educators to expand their knowledge and skills in order to be able to include digital tools and new technologies as effective educational

approaches.

At the same time, school policy makers (teachers' unions, national ministries of education, etc.) need too to be made aware of the need to invest resources into teachers' training.

The expected outcome is..

By making teachers more self-confident in the use of such tools, they will be more prone to adopt them in a creative way, to fit their pedagogical needs and those of their pupils.

Other information

Teachers need to be empowered in their role of educators with respect to new technologies and digital competences. As a significant share of teachers still appear to be unable to attend updating courses due to lack of time outside school shifts and to the necessity of self-sustaining costs, they are not recognizing the added value of such new educational approach.

Rationale

In those contexts where students, families, and the society as a whole are asking for updated school curricula that can match

the need to use new (digital) technologies in an efficient way, i.e. making the younger population able to exploit efficiently new technologies for the job market and for personal use, developing a proactive attitude toward them.

Significant influencing factors

New technologies and new learning environments are already entering schools.

Evidence/Example

Although there seems to lack a coordinated top-down coordination of training and high educational activities for teachers, in most EU countries, manuals, guidelines and training workshop are starting to appear for the benefit of school teachers, managers, as well as for other stakeholders involved in education outside classrooms (museums, associations, etc) to plan and conduct the laboratory activities making use of digital technologies.

Related Patterns

Old assessment schemes for new learning environments.

Old assessment schemes for new learning environments

The problem is..

DiDIY-related activities are hardly included in school curricula because no standard assessment schemes are available yet.

The proposed solution might apply when..

One of the main hurdles to the widespread adoption of new educational attitude towards (digital) technologies is the practical and self-centred nature of DiDIY.

The solution proposed is..

Teachers should be actively involved in re-thinking the old assessment schemes in order to take into accounts new skills such as “digital literacy”. By defining competences in terms of learning outcomes and broadening the scope of tests and exams, assessment can be modernize to support learning.

The expected outcome is..

Equipping students with the right skills for the job market of today and tomorrow and for a competent use of new technologies for an effective citizenship (problem solving, critical thinking, and collaboration).

Other information

Outside school, individuals should also be able to have their skills assessed, validated and recognized, providing a skills profile for potential employers. Information on the quality and quantity of skills across the population will allow authorities to better map potential shortages and focus on areas with the best returns on investment.

Rationale

“What can be assessed often determine what is valued and what is taught”. This means that, when lacking recognized assessment procedures, activities falling outside the scope are often left behind.

Significant influencing factors

Assessment of competences towards assessment of abilities and knowledge?

Evidence/Example

The Centre for Educational Research and Innovation (OCSE) has pointed out the need of aligning evaluation and assessment frameworks with the desired pedagogical change. National guidelines are welcome to identify subject specific objectives related to the use of digital technologies, developing tools for benchmarking digital skills and other key competences.

Related Patterns

Educational systems' inertia in embracing new forms of education.

Finding resources to implement DiDIY in schools

The problem is..

Schools lacking of the sufficient resources to offer DiDIY-related activities to students.

The proposed solution might apply when..

In medium-size cities, the number of Fab Labs and maker spaces is constantly growing, providing accessible resources (in terms of equipment and know-how).

The solution proposed is..

School staff should be made aware of the possibility of setting agreement with local resources (such as Fab Labs, coder dojos, and makerspaces) and open the schools to the local area, with mutual benefits.

The expected outcome is..

Strengthened connection of schools with local territory, higher

motivation of students in engaging in DiDIY-oriented activities.

Other information

Lacking a specific training on new technologies and digital literacy hamper the ability of teachers and school manager to recognize and exploit the full potentialities of such tools. This leads to teachers having to self-finance their own permanent education, often using their own free time to attend them.

Rationale

In spite of the willingness of the more motivated teachers and school managers, finding resources (in terms of time and money) can be hard, especially in those contexts where funding for education are limited.

Significant influencing factors

Deans to allow teachers to train in DiDIY (through local resources) and facilitate the access of teachers to networks.

Evidence/Example

Some best-practice examples include the mutual benefit shared

by those schools, which collaborate with local DiDIY space. The “do ut des” approach (a commutative contract whereby something is given so that something may be received in return) sees teachers and schools share their professional competences regarding didactics or content-specific knowledge in exchange of practical training on new technologies for them and their students.

Related Patterns

Educational systems’ inertia in embracing new forms of education; students’ resistance in adopting a novel attitude toward learning.

Students' resistance in adopting a novel attitude toward learning

The problem is..

Students inertia in adopting a proactive approach to learning.

The proposed solution might apply when..

Students' attitude towards learning is limited to the completion of assigned activities and oriented, at best, to “get a good mark”, failing to acquire the ability to find their own customized solution to their potential future problems.

The solution proposed is..

Strengthen the connection of schools with the local resources, allowing students to engage in goal-oriented activities leveraging on new digital technologies to tackle real-life problems.

The expected outcome is..

Opening the schools to the local resources can help students

appreciate the potentialities of new technologies in a real, practical environment.

Other information

By working with local Fab Labs and makerspaces, students and teachers can appreciate the practical connection of education with their lives and their community. This can boost motivation and engagement of students and, at the same time, can help teachers recognize the benefit of such a new educational approach.

Rationale

Despite being “advanced users” of the most common new (smart) technologies, students and young generation fail to appreciate the real potentialities of new technologies in terms of opportunities to “learn how to learn” successfully, as a by-product of applying new solutions to real-life problems. The ability to think critically, take initiative, problem solve and work collaboratively will prepare individuals for today’s varied and unpredictable career paths.

Significant influencing factors

Schools deans and managers play a pivotal role in opening the school to the local territory.

Evidence/Example

Besides engagement schema such as those successfully implemented in the project-oriented activities of initiatives of RoboCup Junior or First Lego League, school or class projects collectively agreed with students in collaboration with local fab labs or maker spaces can help motivating the students in changing their learning attitude.

Related Patterns

Old assessment schemes for new learning environments.

Lack of attention to ethical aspects in the new learning environments

The problem is..

Digital literacy cannot come without honest considerations of the ethical implications on the use of new technologies.

The proposed solution might apply when..

Alongside the beneficial ones, new technologies come with a number of harmful potentialities. This is not due to their own nature, but rather to the potential human creativity, which, if not directed by good ethical consideration of mutual benefit, might lead to counterproductive results.

The solution proposed is..

Ethical aspects of the use of new technologies should be consider as a topic for discussion and teaching with students of all ages. Among others, their ability to use the internet safely and responsibly.

The expected outcome is..

Students and young generation will be trained to: protect their privacy and online reputation and respect those of others; improve their confidence in their ability to use the internet to protect themselves against online bullying, spam and junk mail; judge the reliability of information found on the internet; identify online sources of reliable information; use information found on the internet without plagiarizing.

Other information

Tackling issues such as ethical implication of DiDIY activities can be considered part of a broader prospective including teaching and the open discussion in class about moral and ethical implications of the use of new technologies.

Rationale

Not all schools or class curricula include teaching ethical behaviour. Nonetheless, it is self-evident the importance and usefulness of such skills for a full participation of young generation to the social citizenship. Basic ethical behaviours may include kindness, equality, trust, and mutual respect. Now

that technology is so intertwined with how we learn, ethics relating to the use of new technology needs to be added and continually revisited.

Significant influencing factors

Synergies with teachers and educators in the field of social sciences (history, sociology, philosophy, law, etc) can be helpful in planning round table discussions on the topics of social implication of DiDIY technologies.

Low participation of female students to the DiDIY movement

The problem is..

The number of female students in STEM-related activities is proportionally low.

The proposed solution might apply when..

Gender issues exist in society and culture in general, and the DiDIY community is none the less. Equal access to for female students to technology oriented studies and career paths is recognized as fundamental to drive societal change.

The solution proposed is..

Female role models (such as IT female teachers, or Fab Lab educators) seem to attract and, more importantly, retain the attention of female students. A broader and more active participation of female professionals in the educational process should be supported. Engaging tools such as LittleBits, developed by a female entrepreneur, appeal to both girls and

boys and can help to disrupt the traditional association of electronics and technology with male students.

The expected outcome is..

Equal access for women to DiDIY technologies, spaces and communities, in and outside school.

Other information

It is also important to increase understanding of the career pathways followed by STEM graduates.

Rationale

In STEM-related activities (both at school and beyond), women are still far behind in terms of percentage of graduates and/or employees.

Significant influencing factors

A more holistic change at the societal level is needed. Nevertheless, careful promotion of DiDIY for all may help to lead change in the currently unequal fields of digital technologies. According to the Microsoft survey “Why Europe’s girls aren’t

studying STEM”, there are five major factors driving girls’ interest in STEM: female role models, practical experience and hands-on exercises, teacher mentors, real-life applications, and confidence in equality

Evidence/Example

Women in 3D printing (womenin3dprinting.com).

Related Patterns

Students’ resistance in adopting a novel attitude toward learning.

Avoiding being sued for patent infringement

The problem is..

Avoiding the possibility or merely the fear of being sued for patent infringement can be a barrier for creatives. This may be because they did not know that key technology was patented or that the IP is not open and they have not the financial means to license the technology.

The proposed solution might apply when..

In the process of design one can consider existing, openly published designs or solutions and adapt or build on top of them.

The solution proposed is..

To check the available existing designs in open design platforms and adapt those designs for one's needs. If one creates a fully new design, that cannot be linked to any existing design (which is really hard generally), then make sure to publish it in such platform so that it becomes "prior art" and no one should be able to patent it. This is called a Defensive Publication.

The expected outcome is..

A growing body of open (source) designs that cannot be patented, or should not be able to be patented, as they constitute “prior art”.

Other information

Rationale

Patents may have been created to help encourage innovation, but instead they regularly hinder it. The US Patent Office, overwhelmed and underfunded, issues questionable patents every day. “Patent trolls” buy too many of these patents and then misuse the patent system to shake down companies big and small. Others still use patents to limit competition and impede access to new knowledge, tools, or other innovations. It’s no wonder that small businesses and individual inventors find it almost impossible to make the patent system work in their favour, often leaving them without any defence against competitors with giant patent arsenals and litigation budgets (www.eff.org/patent EFF about patents).

Searching patent databases to check whether patents on one’s

idea or design exist is typically very hard, not the least due to the intentionally vague wordings of those patents, as the patent attorneys seek to maximise the possibilities of using their patent. Prior art (en.wikipedia.org/wiki/Prior_art) in most systems of patent law, is constituted by all information that has been made available to the public in any form before a given date that might be relevant to a patent's claims of originality. If an invention has been described in the prior art, a patent on that invention is not valid.

There are also patent pools, where patent holders pool their patents together to avoid legal attacks and protect their openly shared work. The Open Invention Network (www.openinventionnetwork.com) is such a defensive patent pool and community of patent non-aggression which enables freedom of action in the GNU/Linux ecosystem.

Defensive publication (www.defensivepublications.org), which is endorsed by the USPTO as an IP rights management tool, are documents that provide descriptions and artwork of a product, device or method so that it enters the public domain and becomes prior art.

Significant influencing factors

The patent system is not effective for most individual designers or small and medium sized companies. Sharing designs collaboratively through open design platforms permits to foreclose the possibility of patenting.

Evidence/Examples

The Open Business Model case studies of the our Project (www.didiy.eu/blogs/introducing-didiy-d63-open-business-models) have documented 14 cases of open source hardware technologies that demonstrate how viable economy ecosystems can thrive without patenting and with sharing knowledge openly and freely.

Related Patterns

Use design sharing platforms.

Designer in DiDIY

The problem is..

Through DiDIY practice untrained people are able to design what they need. The role of designer is therefore questioned and needs to be reshaped.

The proposed solution might apply when..

In the last few years new figures (DiDIYers) and new spaces for creativity and innovation have emerged, (i.e., Fab Labs and creative labs). The people involved in the DiDIY practice may increase their self-confidence and empowerment by developing new skills and knowledge. They use any available technology enabling them to craft what they want create. They are part of a tangible shift in the design approach and are, at the same time, democratizing the role of the designer.

The solution proposed is..

In the DiDIY scenario designers' outcomes are not finished products traditionally intended but solutions that enable the user and allow for adaptation, also called "enabling solution".

Designers could lead, guide, provide scaffolds, or offer a clean slate to DiDIY practitioners, by: supporting them as collaborators or facilitators according to their creativity level. As collaborators, designers bring an equal contribution into a project shared with DiDIYer. As facilitators, designers support the development of the project drafted (or defined) by the DiDIYer; leading or facilitating creative process of making, especially within the digital social innovation phenomenon frame, also by developing (co)design-driven tools; creating devices (such as 3D printers, parts and toolkits) globally distributed to facilitate DiDIY tasks, that may compensate the lack of manual skills of the DiDIYer; setting global networks of DiDIY amateurs and professionals who enact on a local level.

The expected outcome is..

The DiDIY phenomenon bring consequences on both the design discipline and professional practice.

Research in design evolves creating new fields of study interesting for the discipline development. For professionals new work opportunities are opened.

Facilitate artisans access to DiDIY

The problem is..

Many artisans could be more productive, create new kinds of unique artefacts, on demand or not, or simply stay in business, if they could rent for their work, only when they need them, the machines of a Fab Lab or a makerspace. However, local laws or regulations in many places prohibit the Fab Lab / makerspace owners to offer such services to artisans and other professionals, who use them in their for-profit activity.

The proposed solution might apply when..

The use of DiDIY machines (3D printers, CNC mills, laser cutters, etc..) to automatically manufacture (very) small quantities of certain parts of her products may be the only way for an artisan to make those products economically viable, and therefore to stay in business.

The solution proposed is..

Define conditions under which it would be legal for artisans to rent space and machines in a Fab Lab to perform part of their

for-profit activities there (or to send their employees to do the same).

The expected outcome is..

More possibilities for artisans to create unique products, or small batches of products, that is more possibilities both for artisans to keep their existing activity running, or start new businesses. Another expected outcome is more possibilities for Fab Labs and makerspaces to be economically viable, by widening their “customer base”.

Other information

Rationale

For-profit coworking spaces, that rent desks, internet access and other infrastructures to freelancers, are becoming more and more popular. In their current form, however, they are almost always limited to office workers, not to artisans who need digital manufacturing services for their for-profit work.

If artisans had the same opportunities as “office” freelancers, that is the possibility to legally work, at least part time, in

“shared digital manufacturing” centres, they would have more business opportunities. At the same time, work of this kind, that today may be done “in black” in certain Fab Labs, may emerge, and thus widen the tax base.

Significant influencing factors

Regulations and laws that require artisans to work always and only in a dedicated, fully certified space of which they are the only responsible maintainers, severely limit the possibilities described above.

Evidence/Examples

Obstacles to Digital DIY (and risks from it): notes from Rome:
www.didiy.eu/blogs/obstacles-digital-diy-and-risks-it-notes-rome

Obstacles to Digital DIY: notes from Bruxelles:
www.didiy.eu/blogs/obstacles-digital-diy-notes-bruxelles

Helping SME to understand the technological possibilities of DiDIY going beyond the technological virtuositities

The problem is..

Companies did not have correct information about the potentialities of new technologies and do not always have the mindset to understand this in depth.

The proposed solution might apply when..

Companies need to innovate with new knowledge linked to the new technologies and the new generations. In some cases, for the company, technology must not be the starting point but a means to generate innovation in a responsible and ethical way.

When we talk about innovation in the industrial field, we mean a change that is not only generating improvements, cost optimization, turnover and better performances, but is also developing competitiveness.

The solution proposed is..

An openness of companies towards the world of DiDIY allows the possibility of becoming aware of the possibility and potential offered by this phenomenon and to understand which innovative aspects to take into the company, how to integrate them and which to keep outside.

A solution is that companies' workers connect with Fab Labs, maker spaces, hacker spaces, etc., i.e. places which enclose the spirit and the attitude of DiDIY, through paths of immersion in the context that allow the working attitude to carry out the potential of the phenomenon.

In addition, as these places are very close and sensitive to changes in society, by attracting a network of people who take part in and actively create change, they perform above all the function of a litmus test for the companies on what is happening in the area and on the evolutions that take place in the social fabric.

The expected outcome is..

SMEs become able to enhance Europe's competitive edge on an international level. Companies get closer to new ways of self-

learning, work and project management typical of the digital environment.

Other information

Rationale

External know-how points, such as Fab Labs, Makers Space, Research centre, are very important for the growth of companies, which can decide to start a new form of collaboration keeping outside some skills instead of bringing them inside.

Companies own and preserve specific tacit and local knowledge that are often linked to manual skills and craftsmanship, fundamental in the DiDIY practice. It is, therefore, important to understand how to enhance them through digital technology.

How to foster DiDIY through collaborative tools

The problem is..

Although there are now many different collaborative tools available, it is difficult to use them to foster DiDIY or apply it strategically due to a lack of specific guidelines available. It is also hard to get training to use them and to find the right collaborators.

The proposed solution might apply when..

Public and private organisation can apply the fundamental features of DiDIY or be inspired by the phenomenon to improve a service or a strategy, to innovate some working modality, to activate new forms of collaboration, and also to solve social, environmental and even political challenges. Collaborative tools might be used when there is a large amount of data that would be best dealt with through a structured process with a collaborative and empathic approach, or when it is necessary to gain knowledge from different specialists involved in a project.

The solution proposed is..

The use of a specific toolkit and guidelines that can immerse people in the social and cultural context of DiDIY by fostering collaboration both with peers and with experts. Guidelines provide inspiring scenarios as challenging areas to possibly work on that are opened by the phenomena of DiDIY.

The expected outcome is..

Fostering creativity, generate innovation and winning ideas through the use of DiDIY in different fields.

Local institution (private and public), small medium enterprises, large organization, local hub, Fab Labs, makers and DiDIYers can have benefits from the toolkit.

Other information

Rationale

The toolkit and guidelines is a powerful means for accessing and making explicit people's (also tacit) needs, desires and aspirations for the construction of new possible futures that rely on the DiDIY fundamental features.

Evidence/Examples

Digital DIY co-design toolkit and guidelines

Co-creation Toolkit by WAAG: co-creation.waag.org/tools

Playbook Open Care by We Make: playbook.opencare.cc

Related Patterns

Designer in DiDIY. How to help people to apply a strategic design approach to technologies.

How to help people to apply a strategic design approach to technologies

The problem is..

People and organisations in different fields often want to use digital technology as a tool to develop ideas without understanding the real benefits that technology could bring to their idea.

The proposed solution might apply when..

People want to start and solve a challenge in their own specific field through a collaborative action, generating innovation. People are curious to know how digital technology can support their own organization or project.

The solution proposed is..

Offers creative techniques, methods, tips, and worksheets to guide people through a structured design process that gives a voice to communities and allows their desires to guide the creation and implementation of solutions. A DiDIY co-design

toolkit leads people to apply a strategic design approach to the use of digital technologies of production and sharing which become only a means to activate new innovative opportunities and ideas.

The expected outcome is..

Train people to collaborate in a structured way by following a specific design process to generate innovations through DiDIY. Allow people to be able to apply a strategic approach to digital technologies.

Other information

Rationale

It is possible to apply co-design in a creative work session where participants are invited to interact by generating ideas collaboratively. Through co-design activities people can work collaboratively, triggering their creativity, and enhancing their visions of possible futures. This cultivates a deeper understanding of each other, their real needs and desires, leading to real benefits and a wise use of digital technologies.

Evidence/Examples

DiDIY co-design toolkit and guidelines.

Related Patterns

Designer in DiDIY. How to foster DiDIY through collaborative tools.

How to make money with DiDIY open machine designs

The problem is..

Many people are not aware of how people can make money with DiDIY, while there are interesting cases that show how you can do that, while still sharing the designs and project documentation even to a level that others are able to replicate it autonomously.

The proposed solution might apply when..

People are willing to do things differently and consider exploring what alternative business or sustainability models are being used by successful DiDIY communities.

The solution proposed is..

To develop an open business model approach, where knowledge is shared (through an adequate licensing policy), revenue is not based in patents or copyright licensing, at least a considerable amount of the development work is shared by peer producers (“collaborative making”) and governance is participatory and/or

allows replication. These four elements are the four pillars of an open business model approach and can be found in many commons-based open community projects.

It is therefore of interest to explore existing cases and draw lessons from how these have become sustainable.

The expected outcome is..

To construct a collaborative community where people can freely contribute and have the means to sustain themselves.

Other information

Rationale

Using an open or free licensing policy, or at least extensively use free and openly licensed works could be considered challenging as one suffers the risk of being replicated. Instead of seeing this possibility as a threat, it can be conceived as a strength: community members often feel more inclined to contribute voluntarily to a project, where its leaders cannot exclusively exploit these voluntary contributions, but all, in principle, have the same rights. When the projects work and tools are properly

documented and published under free licenses, then all members basically have the same rights. If the way a community is governed doesn't satisfy a sufficient part of the community, this part may consider to replicate or fork the project and continue under an other name. This is usually not a desirable outcome, as the energy is split between two communities instead of one, but its mere possibility forces project leaders to carefully listen to their users and keep them happy.

Significant influencing factors

Designing an organisation along the four pillars of an open business model requires a participatory, co-creation methodology. Such model seeks to align the interests of potential participants in order to maximise the potential collaboration and contributions.

Evidence/Examples

The Open Business Model case studies of this Project (www.didiy.eu/blogs/introducing-didiy-d63-open-business-models) have documented 14 cases of open source hardware technologies that demonstrate how viable economy ecosystems

can thrive without patenting and with sharing knowledge openly and freely.

Related Patterns

Use design sharing platforms.

Minimise ecological impact of DIY activities

The problem is..

Many DiDIY activities increase the amount of plastic, electronic products and other dangerous products which are hard, or sometimes impossible, to reuse or recycle.

The proposed solution might apply when..

In all DiDIY activities, unless there are local regulations that forbid processing of certain materials (e.g., melting plastics) or require special authorizations.

The solution proposed is..

Raise awareness of how polluting many DiDIY materials and techniques are. Actions of this kind include: invitations to minimize production of DiDIY products made with non recyclable components (“3D-print responsibly!”); provide information, both in online platform and in actual makerspaces and Fab Labs, about which raw materials (e.g plastic filaments) are more polluting than others; raise awareness of the many types of DiDIY that do not involve at all plastic and other

hazardous materials, or any form of 3D printing in the first place. Examples: manufacturing of wood products, knitwear, and can reduce overall ecological footprint by producing spare parts, or otherwise repairing and reusing many products; support recycling of plastic and other materials directly in the Fab Labs; promote collection of the same types of waste from the local community, for the same purpose.

The expected outcome is..

Reduction of the amount of waste caused by DiDIY, especially of the most toxic kinds. Reduction of overall pollution, minimized health risks for both DiDIYers and general population. Contribute to raise awareness of the general problems related to waste production and management.

Other information

Rationale

Many DiDIY products are experiments, not intended to be used for a long time. Pollution by plastic, and in general production of unnecessary waste, are huge problems for society, and DiDIY

may make it even worse. On the other hand, DiDIY may give a meaningful contribution to reduce the magnitude of those problems. The solution proposed here goes in that direction, and at the same time helps to promote awareness and use of DiDIY.

Significant influencing factors

Use of polluting materials, and environmental impact in general, did not receive enough consideration in the first period of large adoption of DiDIY practices.

General negative attitude, still present in large parts of society, towards recycling, repair and reuse of “old” products.

Increased availability of materials, tools and knowledge to practice DiDIY without using hazardous substances, or to practice it specifically for repair/reuse purposes.

Organizing an educational community of DiDIY

The problem is..

Teaching can no longer be understood solely within the school system, but it is fundamental to speak of an ecology of the educational system, understood as the set of components that intervene and impact education and the relationship between them.

The proposed solution might apply when..

The “educating community” include in it not only the school, the educators but also the family, the local area of reference, therefore the neighbourhood or, better, the city. Thanks to the spread of digital technologies, the distances in the area are shortened and the possibility of action of education by formal and informal experience has extended. Today the educating community goes well beyond the borders of the city: e-twinning, access to the Internet, the use of devices extends out of all proportion the possibility of contact, recognition and learning.

The solution proposed is..

Inside school, teachers become designers of strategies, seen as resources to identify materials, information and opportunities outside the scholastic context. Building up this community becomes indeed a new skill/objective for the teacher.

Outside school, the city becomes the fabric of relations in which the Fab Labs, makerspaces, etc and the makers and experts of technology become teachers, bringing students closer to the real world through the development of significant and concrete projects and activities.

The expected outcome is..

Diffuse educational training taking place inside and outside school, online and offline.

Other information

Rationale

Making creates a supportive community of trainers and learners that can leverage the interests and skills of each member of the group towards shared goals. This concept is based on the

practice of taking an active part in building up an educational ecosystem, in which sharing, collaboration, co-planning and, more in general, the activities that unite the community, are qualifying factors.

Realistic building codes and safety requirements for DiDIY spaces

The problem is..

The great majority of existing norms about manufacturing as a professional activity are de-facto written (intentionally or not) and practicable only by high-volume, full time production facilities. For example, a modern DiDIY wood processing machine may be as simple and cheap to build and operate to be sustainable even if it only processes very limited quantities of wood, maybe just working a few hours per week. Existing rules, however, may acknowledge and classify it exactly as a much larger machine, used full time in the assembly line of a large factory. Occasional use of that machine in a Fab Lab, that is, would still require safety spaces, surveillance procedures, mandatory filters and exhaust pipes for toxic substances, usage exclusively by certified professionals etc.. that are only really necessary, or in any case economically affordable, when processing many thousands of cubic meters of wood every year. Those volumes are much, much higher than what a DiDIY common space (e.g., Fab Lab, makerspace, etc) may ever reach,

or want to reach.

Consequently, DiDIY spaces are forced to either use certain DiDIY machines illegally, or not use them at all, because doing it legally would be too expensive or onerous (e.g. be forced to have a certified supervisor on site, every time a DiDIYer wants to use the machine), without any real safety-related reason to do it.

The proposed solution might apply when..

Whenever a DiDIY common space (e.g., Fab Lab, makerspace, etc) has the know-how and economical means to build, install, maintain, and offer to its members any sophisticated DiDIY machine that would be too expensive for a single DiDIYer to own by herself.

The solution proposed is..

Define realistic building codes and safety requirements for DiDIY spaces, that still guarantee the safety of the machine users, but imposing more relaxed constraints, that are consistent with the actual operating conditions and production volumes of those machines, instead of those of full time, high volumes production inside large factories.

The expected outcome is..

Much more possibilities of collaborative advanced DiDIY.

More possibilities for DiDIY spaces to be economically self-sustainable, by renting more machines to more DiDIYers.

Other information

Rationale

Current laws and regulations see and create little or no intermediate space between occasional, private hobbies and professional manufacturing, which can afford, and objectively needs, very complex and expensive safety procedures. This leaves DiDIYers and common DiDIY spaces much less room to operate and innovate, without any objective need for such constraints.

Significant influencing factors

Existing norms and laws, at all levels from EU to city building codes, that do not take into account any manufacturing activity between private hobbies or, e.g., home maintenance on one side, and full time, for-profit manufacturing on the other.

Evidence/Examples

Obstacles to Digital DIY: some notes from Veneto:

www.didiy.eu/blogs/obstacles-digital-diy-some-notes-veneto

Obstacles to Digital DIY (and risks from it): notes from Rome:

www.didiy.eu/blogs/obstacles-digital-diy-and-risks-it-notes-rome

Obstacles to Digital DIY: some notes from Greece:

www.didiy.eu/blogs/obstacles-digital-diy-some-notes-greece

Sharing Without Licensing

The problem is..

By default, the author publishing something on the Internet has exclusive copyright. Sharing without licensing can therefore make copying/using that work illegal, even though the author might have had the intention to allow others to reuse his/her work.

The proposed solution might apply when..

There is a culture of informal sharing in makerspaces / Fab Labs. So when someone publishes a work on a blog, they do not necessarily add a licence.

The solution proposed is..

Increase knowledge of licensing: makerspaces should adopt a policy of informing their users about licensing options / recommend particular licenses for particular types of works / recommend using established platforms like Thingiverse or Instructables that enforce the use of one of the predefined licences.

A concrete licensing policy for a makerspace could be as follows. If contributing to an existing work, make sure your contribution attributes the original authors and uses the same licence, especially if it is a copyleft (www.gnu.org/copyleft/copyleft.html). For new works we recommend the following.

For software, use the GPL: www.gnu.org/licenses/gpl.html.

For content and general documentation, use the CC BY-SA: creativecommons.org/licenses/by-sa/4.0/legalcode.

For design documents, use the CERN Open Hardware License: www.ohwr.org/licenses/cern-ohl/v1.2.

For databases, use CC0: creativecommons.org/publicdomain/zero/1.0/legalcode.

The expected outcome is..

No more illegal sharing; empowerment with respect to licensing rights; possibility to build a business with an open business model based on shared work.

Other information

Rationale

DiDIY oriented spaces have the intention to share knowledge; while exclusive copyright would by default forbid sharing, a free licensing policy assures legal sharing and the possibility to build a thriving ecosystem. Such policy allows people to generate income based on the shared knowledge.

Significant influencing factors

Lack of knowledge of licensing and legal aspects of copyright in general. In addition, there might be wrong understanding of copyright, e.g., if I do not add a copyright notice, I assume everyone can freely use it (which is not true).

Evidence/Examples

The IRNAS Institute uses such policy for their open source hardware projects like the GoodEnoughCNC: irnas.eu/license.html.

Related Patterns

Use design sharing platforms. Legal knowledge sharing. All Rights Reserved.

Links to further resources

Read the Legal Report from this Project.

Use Design Sharing Platforms

The problem is..

The creative designs developed by many individuals and groups are not captured in a form so it could be found and re-used by others.

The proposed solution might apply when..

People are willing to share their design contributions with others.

The solution proposed is..

Organise co-creation workshops where people get to know a range of design sharing platforms, how open/free licensing works and learn to work as part of a community, enabling others to replicate and contribute back to their project.

The expected outcome is..

More people share their designs and become part of a networked co-creation ecosystem.

Other information

Rationale

Sharing one's designs requires understanding the ecosystem; it requires one to see that many people make small contributions to a bigger whole, where one builds on top of the work of others, through networked collaboration; to understand how free and open licensing work to share one's work and protect authorship; to understand how to make money and the nature of open source business models.

There are many platforms that encourage people to organise in communities and share their designs in the form of a commons. Such platforms generally provide for recognition of authorship, choosing the open or free license of one's choice, to see who or how many people download or reuse a particular design and in general they encourage collaboration.

Significant influencing factors

The co-creation workshops can help to go through the various concepts, get to know the existing platforms and study cases of successful open source hardware or open design communities

and products.

Evidence/Examples

The Open Business Model case studies (www.didiy.eu/blogs/introducing-didiy-d63-open-business-models) of this Project have documented 14 cases of open source hardware technologies that demonstrate how viable economy ecosystems can thrive without patenting and with sharing knowledge openly and freely.

Links to further resources

The Free Knowledge Institute maintains a list of Sharing Platforms with a comparative of their main features, see wiki.freeknowledge.eu/index.php/Design_Sharing_Platforms.

The DiDIY Project

The **DiDIY Project**, active from January 2015 to June 2017, was carried out, through a multidisciplinary team (www.didiy.eu/project/people), by an international consortium of seven partner institutions (www.didiy.eu/project/partners):

LIUC – Università Cattaneo (IT, www.liuc.it), a university established in 1991 by the Industrial Association of the Province of Varese

University of Westminster – Communication and Media Research Institute (UK, www.westminster.ac.uk/camri), a world-leading centre for media and communications research

Ab.Acus srl (IT, www.ab-acus.eu), a company whose mission is to design and develop technologically advanced products and services

Manchester Metropolitan University (UK, www.mmu.ac.uk), the largest campus-based undergraduate university in the UK, with an emphasis on vocational education and employability

Free Knowledge Institute (NL, freeknowledge.eu) a hub that, since 2007, has coordinated several international projects in the

areas of Free Software, Open Standards, Open Educational Resources, Access to Knowledge

Amerikaniko Kollegio Anatolia (GR, www.act.edu), a non-profit educational institution with a comprehensive undergraduate curriculum in Business, Business Computing, International Relations and English

Politecnico di Milano - Dipartimento di Design (IT, www.dipartimentodesign.polimi.it), a scientific-technological university funded in 1863, which trains engineers, architects and industrial designers.

The goal of the Project was to produce well-grounded models and guidelines to support both education and policy making on DiDIY, intended as an ongoing phenomenon that, while surely enabled by technology, should be driven and shaped by social and cultural strategies, not technology.

You are welcome to join the public DiDIY blog (www.didiy.eu/blog) and to browse the documents presenting the results of the research activities (www.didiy.eu/project/results).

For any other information, or to know more about the DiDIY Project, please fill the form at www.didiy.eu/contact.



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