Digital DIY – Education and Research

Welcome to Digital DIY and the Challenges for Education and Research

This module has the following learning objectives:

1. *Get an understanding of the "learning by building" educational method;*
2. *Get an overview of the educational approaches that make use of DiDIY;*
3. *Present a map of the current initiatives and activities at the European level leveraging the potential of Digital DIY for educational purposes;*
4. *Focus on the challenges brought by the introduction of DiDIY-related technologies in education and research.*

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"Learning by Building"

With a natural mastery of the art of self-directed learning, children have much to teach adults about creativity and innovation. When students are making something, the object they create is a demonstration of what they have learnt to do, providing evidence of their learning. The opportunity to talk about that object, to tell a story about it, is a way to learn, while at the same time teaching others. This learning strategy is one of the positive aspects of the maker movement to education that John Dewey, a psychologist and education reformer, called the "learning by doing" approach.

Example:
KitHub designed to empower young innovators
http://dmlcentral.net/blog/howardrheingold/kithub-designed-empower-young-innovators

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Methodological Approaches Applied to DiDIY – Real Life Examples

DiDIY in education is currently being used in many different ways. From the pedagogical framework concerning the the use of DiDIY in schools to the policies expressed by high-level politicians regarding education, this module will explore the uses of DiDIY in the different methodological approaches applied in real life education institutions, from holistic experiences to more specialized ones, and also taking into account some special groups that have benefitted from DiDIY

education.
Example:
Mathematical impressions: printing 3-D models
https://www.simonsfoundation.org/multimedia/3-d-printing-of-mathematical-models

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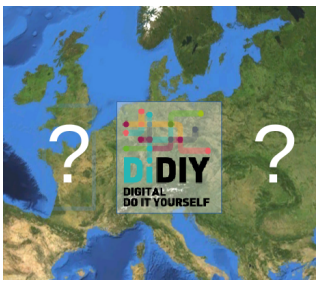
The European "Research Space and Agents" of DiDIY



This module aims at creating a map of the European educational and research institutions as well as DiDIY cultural movements, which are currently making use of DiDIY-related technologies for educational purposes. We will provide examples of the different agents implicated in the application of DiDIY-related technologies in European education and research (e.g. students, teachers or researchers from different disciplines and countries).

Example:
RoboCup junior
http://rcj.robocup.org/index.html

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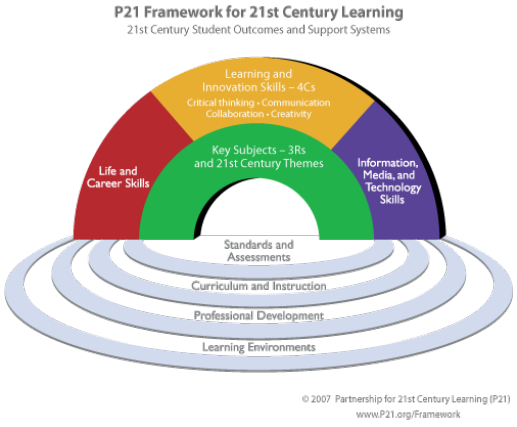
Infusing 21st Century Skills into the Education System



In 2006 the European Parliament adopted a European Framework for Key Competences for Lifelong Learning (2006/962/EC). The modern concept of competence - often called 21st century skills - comprises not only relevant knowledge and skills, but also a range of personal qualities and the ability to perform adequately and flexibly in well-known and unknown situations. Creativity, one of the most valued 21st century skills, is all about the ability to make things, whether physical or virtual. Engendering creativity will require blurring the boundaries between disciplines and between formal and informal learning environments. The current digital DIY phenomenon represents an opportunity for the engagement of a wider audience in the development of 21st century skills. A number of researchers and educational leaders see in digital DIY the potential to engage young people in personally compelling, creative investigations of the material and social world (Vossoughi and Bevans, 2014). Furthermore, this will democratise tasks and skills previously available only to experts (Blikstein, 2013), expanding participation in STEM fields.
The development of 21st century skills does require an ad-hoc education system, which bases learning on creativity, tinkering, exploring, building, and presentation (Constructionism theory, Papert, 1980).

Example:
The partnership for 21st century skills
http://www.p21.org/

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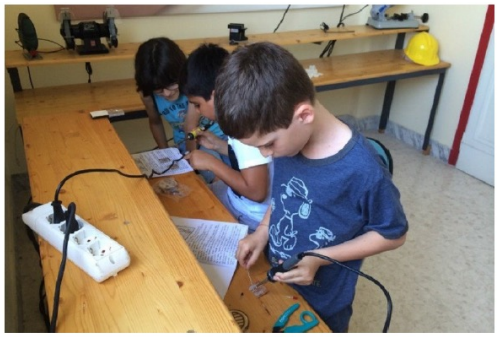
The Challenges of DiDIY in the Educational Framework

Technologies are entering the educational field at a fast pace. With that, a number of issues need to be tackled:

- National education systems and schools take risks when investing in rapidly obsolete technologies;
- Technological education needs to include the development of adaptive, foundational skills in technology and computation. In particular, capabilities to empower people to manipulate the medium to their advantage and to handle unintended and unexpected problems when they arise;
- In order to maximise the benefits of DiDIY in education, coordination among all stakeholders (museums, schools, teachers, etc.) is needed, as well as more support for teachers (e.g. ad-hoc training and documentation on DiDIY technology);
- Digital technologies and social media allow students to learn from each other in informal settings anywhere and anytime. Learning institutions are thus starting to compete with learning that takes place in recreational spaces;
- The ethics of DiDIY need to be part of the learning experience of the young.



Example:
"Download this gun": 3D-printed semi-automatic fires over 600 rounds
http://arstechnica.com/tech-policy/2013/03/download-this-gun-3d-printed-semi-automatic-fires-over-600-rounds/

FURTHER RESOURCES

Books:

- ✓ Papert, S., (1993). The Children's Machine: Rethinking School in the Age of the Computer. NY: Basic Books.
- ✓ Gardner, H., (1983). Frames of Mind: The Theory of Multiple Intelligences. New York: Basic Books.

Articles:

- ✓ Milicevic, M., (2015). Contemporary Education and Digital Technologies, in International Journal of Social Science and Humanity, 5, 7.
- ✓ Blikstein, P. (2013). Digital Fabrication and 'Making' in Education: The Democratization of Invention. In J. Walter-Herrmann & C. Büching (Eds.), FabLabs: Of Machines, Makers and Inventors.

LEARNING ACTIVITIES

You may choose the activities you like, although we recommend that you start with the first and follow the given order. Please document each of your chosen activities and publish the documentations in the appropriate location, so peers can access them and contribute feedback. [LINK to course spaces, forums, recommendations on social network uses, #hashtag]

DiDIY and the learning flow:

- ✓ Think about how DiDIY can be exploited to ease/emphasize the transition from a teacher/curriculum-centred school to a student/experimentation-centred education.

The role of teachers:

- ✓ Do you think that DiDIY is transforming the role of teachers? How? What new competences are expected from them?

The role of creativity:

- ✓ With DiDIY, creativity has a crucial role and is relieved from the burden of the actual "making" of any outputs (if you can imagine it, you can create it). Pupils have the opportunity to work on their ideas, shaping them mostly in a non-physical environment. Could the actual separation of these two parts of the process (design and realisation) impact on the pupils' creativity? How?

Your experience:

- ✓ Describe your experience as a teacher or student with DiDIY. Bonus: Upload a design you made to a platform of your choice.

QUESTIONNAIRE

1. What is the difference between data, information, and knowledge?
    a. There is no difference, these terms are synonyms.
    b. Data is always true, while information and knowledge are not.
    c. Data deals with facts of the world, information captures data at a single point, and knowledge is the interpretation of that information.

2. Our educational systems are changing because:
    a. Children and adolescents spend more time with media than they do in school.
    b. Students learn much more in informal environments.
    c. Learning from peers play an increasingly important role.
    d. All of the above.

3. The practices of building and making, augmented with computational tools could:
    a. Generate more sophisticated projects.
    b. Replace traditional practices.
    c. Enhance manual dexterity.

4. A dedicated space for digital fabrication in schools is:
    a. Not necessary: schools can use existing robotic or science labs.
    b. A sign of how much schools value a particular activity.
    c. A place where like-minded students could gather, hang out together and create a productive subculture.
    d. B and C.

5. Interdisciplinary projects can be:
    a. Not suited for digital fabrication.
    b. Easy for non-STEM (Science, Technology, Engineering and Math) teachers to carry out without technical support.
    c. A chance to appreciate the boundaries and limits of all disciplines.

Answers: 1-c, 2-d, 3-a, 4-c

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Disclaimer: The views expressed in this document do not necessarily retlect the views ot the EC