MAKING As a Tool to Competence-based School Programming

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Abstract
In this paper, we describe an ongoing education programme promoted by LABoral Art Centre that uses digital fabrication and ¨making¨ in order to produce methodological change in teaching practice in public schools. Also we present a case study as example of FabLab environment used as constructionist toolkit.

Author Keywords
Making; Children; Constructionism.

ACM Classification Keywords
D.5.2 User Interfaces

Introduction
LABoral Art Centre develops this program in collaboration with the Ministry of Education of Asturias Spain. The aim is to build new learning spaces through research projects, supporting a change in the organizational and curriculum model, more specifically fostering knowledge of technical language in order to achieve a cross-cutting use of ICTs while also encouraging experimentation and critical thinking.

After a training teachers accompany their students in their process of design and producing a project at fabLAB Asturias.

Concept
Project design and production gives the students the opportunity to deal with challenges very similar to the ones they will have to confront in real life. This methodology is also appropriate to work curricula abilities and to create new learning environments.

Dates
From 2nd July 2013 to 1st June 2014

Schools
I.E.S. Vegadeo; I.E.S. Cristo del Socorro, Luanco, I.E.S. Santa Bárbara, La Felguera; C.P. Santa Bárbara, Oyanco, C.P. La Pereda, La Pereda; C.P. Lorenzo Novo Mier, Oviedo; C.P. El Lloreu, Gijón; I.E.S. Santa Cristina de Lena; I.E.S. Virgen de la Luz, Avilés.

Aimed to 175 students and 20 teachers from primary to secondary school part of "Contrato Programa", A

This school year experience is an expanded programme of last year experience with teachers working with students in danger of dropping out the education system. Based on that experience, we focused on teacher´s training, designing projects that involve the groups as a whole, even collaborating with the rest of the school and getting everyone more aware of documenting the research process.

The use of fabLAB has been more adapted to production needs, combining designing and production with an expanded experience about fabLAB's philosophy and uses: making decisions, solving problems, testing and prototyping. The approach allowed teachers to work basic competences and we could try out our fabLAB as a real education laboratory.

Context

Art Centre and Education
The past two decades, the Education Ministry of Asturias has been developing plans and projects adapted to the changing needs of the education community. As a multidisciplinary institution, LABoral produces, distributes and promotes access to new cultural forms arising from the creative use of ICT's, it seemed natural to start a collaboration, reaching out to a more innovative perspective of education, using creativity and art new languages as pedagogic tools and offer an educative and social use of new technologies.

Turning inside out the traditional idea of an art centre , it is presented as an "expanded classroom" that works in collaboration with local education institutions, starting another interesting research: What is the role of a centre dedicated to art, science and technology in the education field? What can be done to encourage a critical use of new technologies through arts and creativity?

FabLAB Asturias at LABoral
The recent democratization of technologies such as digital fabrication and rapid prototyping, empowers users with the ability to think, hack and create their own designs adapted to their own needs. [1] Formal education lacks a critical approach to technologies, focusing on educating good users. A less traditional point of view is needed to ensure future citizens that can not only read but write technology, meaning create and program. [2] Working at the FabLAB gives the opportunity to learn the basics about computer design and object production, becoming a real education laboratory where everyone can learn by making and sharing, establishing a new relationship with technologies. [3]

CASE STUDY: LASER CUTTER AND SILKWORMS

Participants
We present one of the nine groups we are working with as an example of the activities we realized: 18 students and 3 teachers of the Public Primary School "La Pereda".

Due to our region geography and socio-economical characteristics, a new kind of rural school was activates in the late eighties. Small unitary schools that combine students of different ages in the same classroom and even have different buildings, with teacher moving from one another to work. La Pereda is one of them. This scenario is perfect for project methodology in a

Figure 1. Macu, the teacher observing problem solving process.

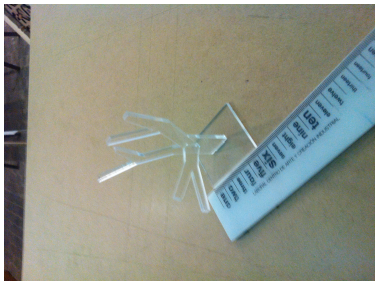

Figure 2. modules for hosting the silk cocoon.

way that almost any activity has a direct impact in the whole school.

Methodology

Teacher's training as a participatory design research

As for all the groups participating in the programme the teachers attended a training in July and September 2013. It was planned as a group investigation process to produce and evaluate prototypes of educational activities which use digital fabrication as a resource to build a proper learning environment in a fabLAB. DBR-Design Based Research was the methodology chosen. It establishes a real investigation process in order to prototypes education activities using digital fabrication as a tool; also analyzing learning difficulties and evaluating results with students at the same time.

As a result the teachers decided not to define a particular product to design, letting the children free to explore and decide what to do with the resources of the fabLAB. In order to do that they invented a fictional character: Doctor Peredin, a mysterious inventor/scientist who started to communicate with the children using several media and languages (messages in a bottle, air balloons, personal e-mails, letters, laser cutter, drones etc.) to invite the children to explore the fabLAB and its potentiality.

From exploring to decision making: Participatory Design

In that happy atmosphere the group started to discuss what to make in FabLAB. After several meeting, they decided to build a new house for the silkworms they are growing at school. The decision was made on the base of a real fact: the death of several worms because a bad design of the previous box.

By observing the silkworm's life cycle and its changing needs during the growth the group defined two possible designs. Then they started sketching, drawing, fabricating prototypes, choosing materials and strategies for fabrication.

The teachers and the researchers were observing and stimulating problem solving, sometimes using the fictional character. Also they were choosing on the way, the topics of the official curriculum to treat in class depending on the needs of the research the children were running. For example they decide to work on angles when the group was discussing the design of the modules hosting the silk cocoon, where the angle is a very important feature. Figure 2

Testing the prototypes

Currently the group is working on the testing of the prototypes. During the next 3 months they will use the boxes to grow silkworms and detecting the problematic features of their design.

Accomplished objectives

"Whether we learn, and what we learn, depends upon our relationships with others".

All through the process of designing and producing each project, the students developed their critical thinking skills and abilities to research and use resources. Also, they established a new relationship as "active users" with technologies. Being responsible for their own learning process had an impact in their self-esteem and offered them an alternative way to deal with problems and making decisions as a group. Also the offset in the typical teacher/student interaction allowed everyone to learn about relational and

emotional skills, something a little more complicated than acquiring technological knowledge.

Objectives
1. Critical perspective to become active technology users (empowerment), allowing a change in their relationship with it and the chance to work with it as a real educational tool.

2. Getting out of the everyday learning spaces changed social roles, allowing teachers to establish an equal relationship and focus on teaching, fulfilling (meeting) both (teachers and students) expectations.

3. A very important part of the programme is the teacher´s training, in order to create innovative learning models that encourage changes in curricula and education system.

4. Students usually show a lack of commitment to mid and long term projects. It is important to say, teachers who took lead of their of learning process, achieved a deeper and better knowledge that allowed them to elaborate resources and tools they can use after this experience and take back to school.

5. Documentation of processes and final results exhibition are essential to draw conclusions and projection to the student's experience. Teachers were asked to evaluate and share the experiences and the results. C.P. La Pereda started a blog with the students.

Conclusions

In the design of the learning environments we tried to follow the logic of *explore before design* [4] in order to improve creativity and enable children to be familiar with the possibility and the potential of a technology or material, specially the fabLAB environment. We think this approach allows focusing on the learning process and enables children to manage how to acquire the knowledge they need. Also we noticed that *exploring before design* helps the participatory making decision and enable the children to construct or improve cognitive models as bases for further learning.

Acknowledgments

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