Improving Learning in Electronic Engineering through Platform Open Source

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Abstract In this study, the main objective is to present an initiative on the Grade students of the School of Industrial Engineering and Informatics, University of León. We have applied the methodology of teaching that allows enhance the interest of students for their own learning. The working method has been organizing workshops that employ strategies of project-based learning and group projects. These projects are limited in time and with a high degree of involvement by the student. There has also been an information system which supports communication and work with all of the workshop participants. For the development of this experiment, we used a microcontroller system as open source Arduino (1). This platform allows improving the teaching of electronic and automatic concepts in a simple and easy way to apply.

Keywords: Arduino, learning workshop, learning Group, workshop

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1. Introduction

The Bologna process and technological changes in our environment have led to changes in our education system. The actual approach is student-centered, where the students are active participants in learning process.

The first-year engineering students are facing changes in requirements and procedures of learning. One element should be encouraged in these levels and in particular engineering is to improve the motivation to learn (1). Encouraging self-learning, and introduce elements or resources to develop new initiatives. We introduce resources that may enhance new initiatives to facilitate the interconnection between all the knowledge that students acquire in their university period.

Teachers have to use different strategies[1] to facilitate learning and involving students themselves in their own learning. You must allow them to be players in this process. Also as engineers have to enhance abilities that allow stimulate creativity and enhance abilities among which we can emphasize:

- Encourage and practice teamwork.
- Stimulate the practical development demanded by enterprises.
- Improve the methodology to be used in oral and written communication of new engineers.

- Enhance the reuse of materials and devices.
- Define a working structure by conducting projects.
- Set challenges to facilitate cooperation among students from different engineering degrees.

Therefore, we want to enhance the abilities to learn to acquire knowledge and are able to use them to develop new electronic systems. They should also be able to transmit the acquired knowledge in written form to other colleagues.

Therefore, we have developed during 2012-2013, a workshop, limited in time, to enable students to:

- Believe in themselves, in their abilities to develop a project.
- Develop a project where direct involvement.
- Promote teamwork and the spirit of collaboration.
- Enhance and evaluate behaviors involving an effort.
- Stimulate interest in learning about new electronic devices.
- Identify some goals or achievements, which use the acquired knowledge and know seek new tools of knowledge that allows them to develop a job or new project.
- They can bring improvements in electronic systems implemented.
- And finally they are able to transmit the acquired knowledge to other colleagues

On the other hand we should be able to make the necessary tools to improve their learning. Many of these tools allow you to bring students to the development of modern electronic systems, enhancing their imagination

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1 Learning strategies as a set of processes that facilitate the acquisition and transfer of knowledge. The strategies are intended to facilitate the acquisition, storage and use of information.

and are an important support to improve student motivation. This experience has been financed by the PAID[2] 2013 at the University of León.

2. Experimental/ Methodology

Every day in social media we can see the new possibilities that the introduction of microcontrolled systems using electronic devices. The idea is open a new work ways and the realization of creative projects. It would offer improvement of motivation and more effective learning.

Arduino is the tool that we select for the implementation of this project. It is a platform for open-source development, based on the AVR microcontroller, which allows the connection of multiple electronic devices. It is a tool that facilitates the realization of electronic prototypes.
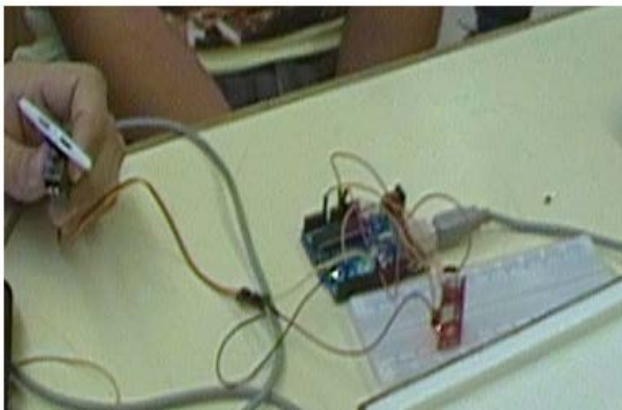

Image 1. Proyect example

In a workshop on technical course the methodology is an active working for the students. It requires a team work from them and get involved in a project. This structure includes a project-based learning strategy (PBL). We emphasize two learning methods:

- The explained method to present the devices and the tool to use.
- The method of work together as a group for the realization of projects.

2.1. Organization

This type of activity requires an organization and a division of labor between the various members of the working group; preparation of the work material and the creation of collaborative information environment.

The organization of the workshops has been developed in three distinct phases:
1 The generation of the announcement
2 The preparation and development workshop
3 Analyze the results.

These phases are represented by flow charts that describe the operations, the documentation generated and its participants. We emphasize phase 2: The preparation and development workshop. The development that we have followed for the workshop is reflected in the following diagram:
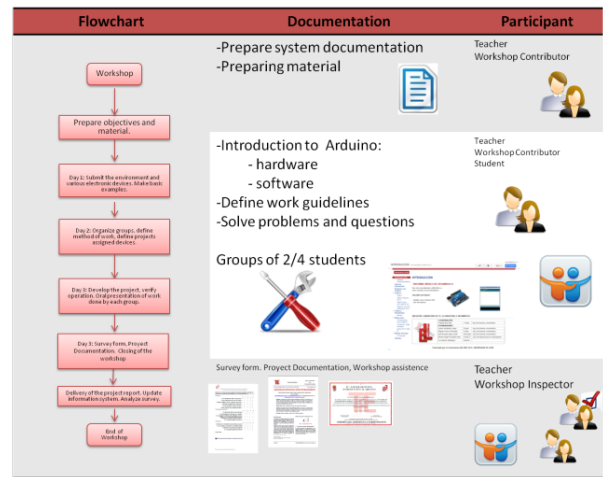
Image 2. Flowchart. Phase: workshop development

The organization of the workshops carried out by a work plan.

The responsibilities are established and resources are allocated. The student works directly on the workshop management and maintenance of the work material.

Table 1. Roles and functions of different Participates

Icon	Role	Function
	Teacher: a group member. **Contributor:** initially been a member of the group	-Responsible for the workshop. -Material Preparation. Resolve doubts
	Reviewers: other members of the group of teachers who do not teach in the workshop	-Reviewers documentation -Verify documentation -Making the final evaluation of the workshop -Getting Results
	Students: Recipients of the workshop	-Participating in the workshop directly -Perform the report of the work done.

2.2. Development Workshop

Joint sessions have been developed to describe the functionality of the system to use.

Defined working groups have been assigned a project to do. Finally, they had to present the work and respond to the issues raised by the other groups.

There are several points that we can emphasize in development of such workshop:

- **Reinforce collaborative work** with the companions and other users of the Network
- **Create real systems**, not virtual or simulated. This allows the students to face the real problems of engineering, we are in practical developments.
- Allows **interaction with new technologies** and current devices.
- They define a **working methodology** that values critical thinking and the relationship with people.
- Working **communication skills internal and external,** to give/receive feedback, to take responsibility.
- **Presentation skills**, create standard reporting describing actions performed..
- **Improved motivation**. The student is the main actor in their learning. We awaken their interest in building electronic systems, where you can apply your knowledge and build new systems.

2.3. Information Systems

Finally, as a monitoring system and summary of this experience, is set an information system. So we have a widespread collaborative tool in the network, which has facilitated the interconnection of all projects. This tool allows diffusion of the knowledge obtained and enhances cooperation among members of the workshop. The tool used belongs to one of the free services offered by Google is called Sites (3).

The information has been divided into different sections to allow easy navigation. The sitemap:

Image 3. The Sitemap workshop

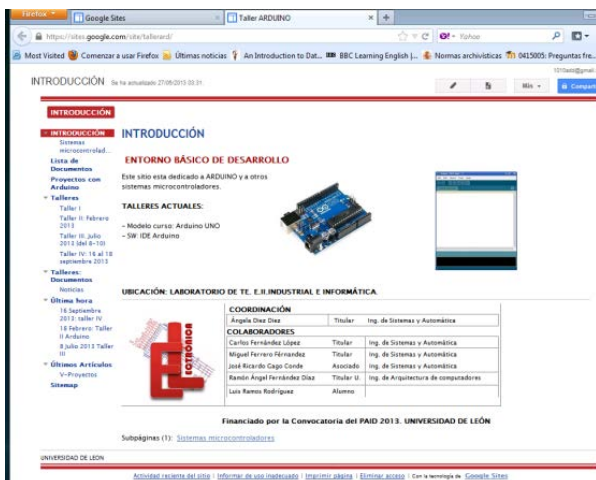And the home page provides access to all content:

Image 4. Web: https://sites.google.com/site/tallerard/home. Homepage

The organizational structure of the site can be displayed in the graph below:
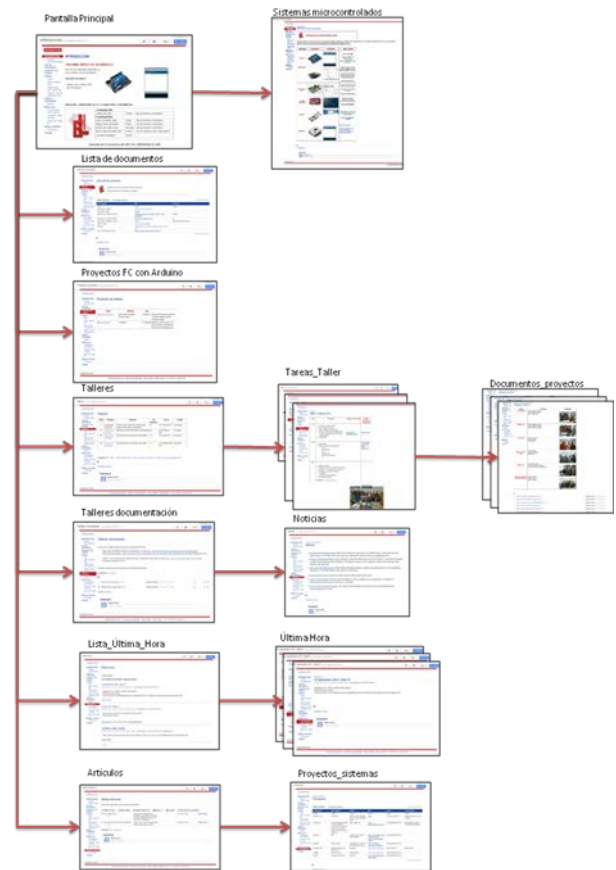

Image 5. Level structure of the website

The level structure obtained in the Sites is three levels deep. Generating a simple structure easy to follow and maintain.

3. Results and Discussion

The phases that can emphasize development of these workshops are:

- Presentation of the objectives to all participants.
- In the First Session: theoretical exposition of the control unit to use and its connection to other devices or inputs and outputs.
- Define methods for efficient search of articles or links on the device used. Give access to the information system.
- Provide the necessary equipment to perform various tasks; differentiate between different kinds of sensors that can use, wiring and programming.
- Promote active participation in the discussion forums.
- Describe the guidelines for the study of the case to develop and creation of a technical report.

The degree of participation and learning is evaluating as a result of the workshop.

Participation:	Learning Results:
• Number of workshops organized 3 • Average number of student per class has been; 16. • Average students who have completed the workshop with a good academic progress: 15 • Average of students per group 3 • Promedio de grupos por taller: 5,7	• If we have achieved the learning objectives. • Oral presentation about the project developed by other groups. • Making a final technical report.

To assess the degree of student motivation, we conducted a survey with 14 questions scoring 0-5 points of the report were:

1) The contents have covered your expectations
2) You have worked actively in the workshop
3) The workshop is useful to your training
4) Teamwork was success
5) You have achieved the objectives of the workshop
6) Are you satisfied with the workshop?
7) The duration of the workshop was appropriate
8) The methodology has been adapted to the content
9) The environmental conditions and materials used were appropriate to the learning process
10) The overall organization of the workshop
11) The teacher has provided you the necessary basic material
12) The contents have been exposed with sufficient clarity
13) The teacher has motivated participation
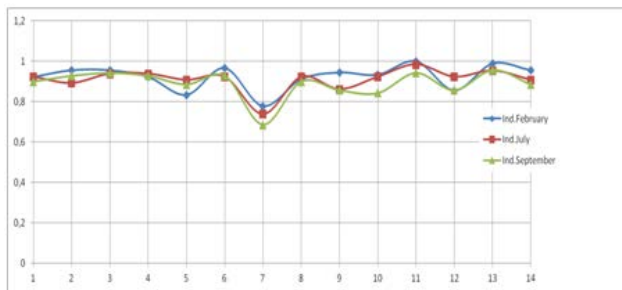14) The overall organization of the seminar

Image 6. Result of the quetionnaire

Importantly, 15% of students who have attended workshops have been students of other engineering degrees. This has enabled multidisciplinary working groups; initially we had not anticipated.

The question 7) was the lowest rated. But it allows us to assess two important factors.

- High Degree of motivation, need more time to work with the system.
- How to manage time and organize the student group for results.

We must emphasize that students have recognized the organizational work of the workshop.

This workshop allows us to detect skills we need to work more effectively. Among them include:

- Instilling students the need to document the work develops.
- Improve report writing.
- Increase group work within the formal teaching.

4. Conclusions

These workshops have allowed to present tools to facilitate knowledge of electronics. It is a tool to be included in the subjects of electronics. With a practical methodological approach, the students have been very focused on the projects that they had to perform. It has increased collaboration between different working groups; power is group work as a method of collaborative learning. The students' interest in this type of environment has been increase. Facilitate and motivate Student Learning and Creativity. Promote student collaboration using collaborative tools, and the creation of multidisciplinary groups.

The idea of "do it yourself", think, create and design, we have added "document and spreads." This can be a good slogan for these workshops.

Acknowledgement

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