# ENERGY INTELLIGENCE SCHOOL PROJECT IN COLLABORATION WITH THE COMMUNITY

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## Abstract

After detecting a real problem of energy deficiency in the community where the school is located, it has been decided to carry out an educational project that involves various educational levels and various agents of the environment, all in search of a common solution. The project presented in this paper is an example of good practice in relation to design thinking, real problem solving and meaningful learning.

The aim of the project is to introduce the basic knowledge of home electricity to our students. In order to end energy poverty, as much as possible, it is important to instil this useful information and to create awareness. This is done by using innovative methodologies, cooperative work, peer learning in different educational levels such as professional training and compulsory education.

The project is a collaboration of the variety of our students' knowledge and it is a great way for them to help each other. It tries to show the way the professional training students share their knowledge to their peers from different levels, by real learning, motivation and the application of everyday skills.

We are trying to break away from the stigma that the professional training students have lower qualification and a lack of skills. These students have to feel prepared and confident as they start to work in the real world.

This initiative does not intend to solve the problem completely, but now we are providing the tools to fight against energy poverty. We are doing this by networking, contacting public administration and local governments, companies and different schools.

The paper presents the objectives of the project, the actions that have been carried out in the different educational levels, the evaluation of the students, the results of the intervention, as well as the collaborations with the external agents that have participated, such as companies, families or associations.

Keywords: Cooperative work, peer learning, real learning, energy poverty, design thinking.

## 1 INTRODUCTION

Both the families of the students, as well as the social agents in the area and our own students, have detected and analysed a local problem related to energy poverty. For this reason, the Arxiduc Lluís Salvador Secondary School in Palma de Mallorca proposes to develop a project at school level to tackle this problem and in collaboration with the local stakeholders.

Faced with the critical stance of our students in the face of rising energy costs, the low willingness of public administrations to renewable production and the impoverishment of the population, begins a process of self-reflection in the school to seek ways to improve that situation. As a conclusion, we decided to share and contribute the knowledge acquired by our students, specialists in energy, in order to help and re-educate the educational community, teaching them to manage their energy consumption and energy expenditure. In short, in this project the students teach the population about energy consumption. The aim is to create a positive collective conscience in the face of problems such as energy poverty.

This project, entitled "Energy Intelligence", seeks the collaboration of students, accompanied by members of the educational community, families, business associations, companies, social agents and public administrations.

For example, the families collaborate by opening their homes and the homes of their friends so that the students can audit the facilities according to the standards received in the formation of the school, in order to be able to detect possible anomalies, failures and the possibility of reducing the amount of electricity bills.

This methodological approach responds to the methodology of Design Thinking and Open Schooling because it seeks to respond to real problems of the environment of students and propose solutions to these problems, with the collaboration of companies, associations, universities, etc. OSOS project, Open Schools for Open Societies, (project included in the European Union's Horizon 2020 Research and Innovation programme 741572) has promoted this methodology, in which the Arxiduc Lluís Salvador Secondary School in Palma de Mallorca participates actively. In addition, it is not an isolated action, but part of the methodological approach of the school, since on several occasions they have identified opportunities for collaboration with external agents to offer significant learning experiences to students.

In addition, within the OSOS methodological approach, this project against energy poverty aims to be an example of good practice for other schools and communities that may have the same problem. Therefore, through the "accelerators" system of the OSOS platform (https://portal. Opendiscovery space.eu/sr/osos)[1], other communities and schools have the possibility of replicating the project in their environment, accessing the resources used in the project, knowing the evolution of the project in its implementation phase and the results of the impact.

## 2 METHODOLOGY

The "Energy Intelligence" project integrates innovative methodologies such as peer learning and co-education, as well as the cross-cutting of knowledge among students at various levels. For this reason, the project involves students in the 3rd year of Secondary School and students in training cycles, specifically in the middle and higher grades of the professional family of electricity and electronics. The main beneficiaries of this project are really the students of the 3rd year of Secondary School, which is intended to motivate to continue their training and give meaning to their previous learning, and of course the local community.

The methodology of the "Energy Intelligence" project is one of the best known of the cooperative techniques among students: peer tutoring, better known as "Peer Tutoring"[2]. Let's understand this concept as a set of strategies and dynamics that favour the learning of a group of students or even people who are interested in the same subject, to learn together. We can define as a set of methods and strategies for learning that favours the sharing of knowledge and even experiences between people, both at the same level and at different levels. The aspect of this methodology that we will use is cross-age tutoring[3]. In this type of tutoring, the older students act as tutors and teach the younger ones. Tutors have a higher academic level compared to their students or apprentices in tutoring between peers of different ages. This approach is very beneficial for students who in this way get effective individual attention from their fellow tutors.

The most relevant objectives of the "Energy Intelligence" project are:

- To work for society, interposing the common good over the individual.
- To encourage a critical spirit, both collective and individual, in the face of the challenges of today's society.
- To promote the entrepreneurial spirit in the students.
- To awake the students' capacity for self-improvement and their self-esteem.
- To identify the real needs of people in the use of electrical installations in houses and buildings.
- To design real projects, adjusted to the reality of society and to adverse circumstances.

In order to develop the project, a series of phases have been defined, which are detailed below.

### 2.1 Awareness phase

Firstly, there is an awareness phase for students and teachers. The first contact is through the faculty. At this time, it is important to seek consensus and arouse interest in the teaching teams that want to participate, in this case the teachers of the electricity department and the group of tutors and the teaching teams of the 3rd year of the Secondary School. The first contact with the students consists of a

[1] Open Schools for Open Societies,Reproduced from https://portal.opendiscoveryspace.eu/es/osos/

[2] Gonzalez Bellido. A.(coord.,)(2015). Programa TEI, Tutoría entre iguales, Innovación educativa, USC,25, 17-32.

[3] Topping, K. J., Peter, C., Stephen, P., & Whale, M. (2004). Cross-age tutoring of science in the primary school:Influence on scientific language and thinking. Educational Psychology, 24: 57-75.

motivational session, which the coordinator carry out. In this session, the students know what they are going to do during the development of the project. In this phase, it is also time to look for the necessary contacts with the collaborating companies and to mobilize the social agents of the zone, to know if the social needs of the zone adjust to the objectives of the project. The objective is to obtain a maximum approximation to reality

## 2.2 Implementation phase

In this phase, six sessions are carried out with the 3rd year of the Secondary School. In each session, the students learn a series of contents that they will be able to put into practice at the time of carrying out the final work and that will consist of carrying out inspections in different homes of families and friends. These sessions will serve to determine strategies to help families to improve the comfort of their homes through small interventions that in many cases they will be able to carry out themselves. This will contribute to family savings, optimizing the resources available to each family. At the end of the project, the participating students will have the necessary knowledge about the electrical installation, air conditioning and types of insulation in their homes. They will also learn different ways and strategies to save energy in their homes. They will be able to interpret the electricity bill and whether the electrical panel and the installations of the house are in good condition. All this enters into the level of knowledge that every citizen should have regarding the management of their own energy based on their economic resources, hence the title of the "Energy Intelligence" project, making the simile with emotional intelligence.

Different members of the educational community conduct these six sessions including: tutors, members of the electricity department, and their own teachers, both in technology and in physics and chemistry. Each session is designed differently. In each session, the work between the students is collaborative and the beginning of each session is adapted to the previous learning of the students on the subjects to work on.

- *First Session*: Emphasis is placed on the characteristics of this project, what it means and what it contributes to society and how it contributes to the students' own learning.
- *Second session*: within the physics and chemistry subject, students are reminded of previous knowledge about the principles and main magnitudes of electricity, types of energy... as an introduction to the subject.
- *Third session*: teachers from the electricity department explain responsible electricity consumption and savings on energy bills.
- *Fourth session*: in the Technology subject, the insulation of houses is explained: types of windows, types of glass, walls, air currents... They also learn how to avoid and correct possible insulation damage in a simple way. It also explains the different systems of air conditioning and hot water generation that they have in their homes, such as heating systems or air conditioning.
- *Fifth session*: teachers from the electricity department explain the main concepts of home safety. They analyse the electrical installations of their homes, how to use the electrical installation safely, the minimum maintenance that the installations have and, of course, learn to detect faults and see how serious they are.
- *Sixth session*: a brief explanation is given about the electricity market, the different forms of contracting and electricity tariffs, such as the night tariff. learn how to interpret an electricity bill and learn how to carry out a visual inspection in a house. The inspection will be carried out by means of a checklist, or list of items to be analysed. Each student undertakes to carry out between 3 and 5 inspections of people in their environment and, if possible, located in areas close to our school. When the students have carried out the visual inspections in their homes, they will communicate the results obtained to the teachers and the actions to be determined in each house will be evaluated according to the type of facilities available in each home. The actions will serve to contribute to the reduction and/or improvement of energy consumption in the homes.

At the same time, students of the Higher Degree in Electrotechnical and Automated Systems carry out four other sessions.

- *First Session*: students analyse the problem of energy poverty. It is important to redirect this initial reflection towards what they can contribute as professionals. They also reflect on the reference standards that they know, which can be of help to carry out the purpose just raised: the Low

Voltage Electrotechnical Regulation, the Technical Building Code[4], the reference standards, the categorization of domotic installations according to CEDOM[5], among others. Also in this session, the general objectives of the project are proposed and the conditions that the group work to be presented must have, as well as the composition of the work groups and the objectives of the work, will be established.

- *Second session*: the students work autonomously designing what will be the check-list of electrical installations in houses for two different levels. In the first level, the visual inspection that every person should do as the final user of the electrical installations. And, secondly, the inspection is proposed to them as professionals who are going to be the students themselves.
- *Third session*: the students present in class the work done in groups, both in the classroom sessions, as autonomous work at home.
- *Fourth session*: the students transfer their work to the students in the 3rd year of Secondary School with the supervision of the vocational electricity training teachers and by the project coordinator also.

## 2.3 Dissemination phase

Once all the previous work has been completed and coinciding with the third trimester, on a Friday afternoon, at the centre a day is held to disseminate the scope of the project, as well as the main conclusions reached after implementation. This day brings together a series of stands in the school yard where, hand in hand with our students, are explained the experiences of the project. Also participating in this event are the different entities collaborating in the project, such as associations, social agents and companies, among others. This day is open to the public, inviting the entire educational community: families, neighbourhood organizations and public administrations

# 3 RESULTS

The "Energy Intelligence" project has involved close to  people: 12  teachers, 130 students from different educational stages, 45 family, 60 neighbours and 150 people from companies and 25 administration.

In order to know the real impact of the project, we have carried out random personal interviews with social agents (family members, friends) and we have passed a satisfaction questionnaire on to students and teachers.

The overall assessment by people outside the school who have participated in the project has been very positive, valuing in a very positive way the work of social awareness carried out in the environment and especially literacy in energy consumption.

The students who have participated have also valued the project very positively. On the one hand, the 3rd year of Secondary School students felt empowered to learn certain skills and have been able to put them into practice as if they were acting as professional experts (90 %). Seeing the true usefulness of learning increases the motivation of the students, that they are more interested in learning and that it is more lasting. Upper Grade students have also valued the experience positively by reinforcing the applicability of their learning and by feeling that they are protagonists in the training process of the students in the 3rd year of Secondary School (88 %). Intergenerational learning has turned out to be a very positive experience.

The teachers, for their part, have recognised the effort to integrate the same project from different subjects and even educational stages (100 %), and have highlighted the impact observed in the learning and motivation of students (100 %).

# 4 CONCLUSIONS

The most remarkable points of this project have been the possibility to raise people's consciousness about energy poverty, and the enthusiastic support given to the project by all the participants.

[4] Reglamento Electrotécnico para Baja Tensión e Instrucciones Técnicas Complementarias (ITC) BT 01 a BT 51, Spanish Law of low voltage electrical installations (RD 842/2002, 2 august).

[5] Asociación Española de Domótica e Inmótica - CEDOM, Reproduced from; http://www.cedom.es/es

Society has become more conscious of the problem. All the participants have been fully involved. They have shown a great interest in the topic and have expressed their concern about people without resources. They also highlighted the fact that, from a public school, initiatives like this have been taken to contribute to solve this problem. and most outstanding has been that the students on the 3rd year of Secondary School, who participated actively, asked future projects to be based on the production of energy with renewable energies.

In the questionnaires of satisfaction we have included the points to improve and possible issues on social impact for a possible future edition of the project.

We do not know if we will be involved in another project in the future, but if we do so, we will use this project format again, due to the number of advantages we have found.

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## REFERENCES


[1] Open Schools for Open Societies, Reproduced from: https://portal.opendiscoveryspace.eu/es/osos/

[2] Topping, K. J., Peter, C., Stephen, P., & Whale, M. (2004). Cross-age tutoring of science in the primary school:Influence on scientific language and thinking. Educational Psychology, 24: 57-75.

[3] Gonzalez Bellido. A.(coord.,)(2015). Programa TEI, Tutoría entre iguales, Innovación educativa, USC,25, 17-32.

[4] Reglamento Electrotécnico para Baja Tensión e Instrucciones Técnicas Complementarias (ITC) BT 01 a BT 51, Spanish Law of low voltage electrical installations (RD 842/2002, 2 august)

[5] Asociación Española de Domótica e Inmótica - CEDOM, Reproduced from; http://www.cedom.es/