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INTELLECTUAL OUTPUT 3

CIRO Follow-up Report



INTRODUCING THE IMPORTANCE OF THE COMING EUROPEAN "GREEN" ENERGY MODEL IN SCHOOL EDUCATION

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1. INTRODUCTION

Ciro project aims to promote knowledge, skills, and capabilities on climate change, sustainability, renewable energies, energy storage systems (with emphasis on hydrogen technologies) and the final applications of these technologies. Promotes the training of teachers and awareness of students between 14 and 17 years in these concepts. Its aim is to generate restlessness and proactivity (in students) for the improvement of air quality and the reduction of climate change either to pursue higher education in these subjects (university / professional training) or to apply it to their daily life, through practices that benefit sustainability. Ciro project is co-funded by the Erasmus + programme of the European Commission. The project is coordinated by ARIEMA Energía y Mediambiente S.L with the support of the following project partners: CRES, a company specializing in learning and knowledge technologies (CCS) and 3 educational centres (IES Diego de Guzmán, Jesús Nazareno School and Städtisches Heriburg-Gymnasium).

The Ciro's expected results are the following:

- ✓ Ciro innovative training programme on the renewable energy and hydrogen technologies
- ✓ Training for trainers and students between 14 and 17 (seminars and videos)
- ✓ Training activity for students (pilot testing of the Ciro training programme)
- ✓ Creation of an international collaborative network to improve the training in the renewable energy and hydrogen technologies.

The objective of this report is to give some comments and observations of the Final competition (Training activity C2) and to suggest steps to follow by teachers on their classes to improve the learning of this subject and the use of training materials (O1 and O2).

This report begins by summarizing the training materials and training activities to facilitate understanding of the proposals for improvement presented in this report on the use of training materials O1 and O2, and the observations of training activity C2.



2. TRAINING MATERIALS

In this section it is summarized the training materials developed within Ciro Project.

O1.- Definition and development of training contents about the coming European “Green” energy model

The Ciro Project takes its name from one of the protagonists of Jules Verne's novel The Mysterious Island. Jules Verne foresaw in this novel that hydrogen will be the fuel of the future – at this moment, near future.

Ciro training program on renewable hydrogen and climate change has been developed considering the results of the analysis and investigation phase focused on the new skills required for the emergent European energy model and the analysis of industry trends, rh2 niche markets and country barriers from primary and secondary sources.

This training program has been developed taking into account the contributions from trainers involved in the project, from the target group (based on enterprises, professors and students) and from the external experts committee that also contribute with their objective input about the quality and professionalism of the developed work.

Ciro training program is enclosed in a Moodle Platform which has been used as support for teaching in the classrooms. This tool allows to easily handle the learning environment offered, making available to users all the resources needed to obtain an optimal training experience intuitively and easily.

Contents of Ciro training course are distributed by modules. Once we access our course, we are ready to consult the material posted. These resources are elements that contain information that can be read, viewed, downloaded from the network, or used in some way to extract information from it.

The whole Training Program counts on 5 modules. The Ciro training modules are summarised in the table below:

Unit n°	Title of the module
1	Climate change & air quality – Sustainability
2	Renewable Energies
3	Energy Storage Systems
4	Integration of Hydrogen with Renewable Energy Systems
5	Applications of hydrogen technology (stationary, transport and portable)



Each module is structured following the structure here below summarised:

- 1 Guidelines for trainers: Document format: PDF
- 2 Presentations: Total duration of this section: 1,5-2 h. Presentation format: (PowerPoint and PDF). Maximum time per presentation 45 min. Due to the total duration of each unit is 2 h, the presentation could be divided in three parts (45 min each part).
- 3 Supporting Materials and Sources: practical exercises, videos, podcasts, references, etc.
- 4 Exercise and Practices: some modules include a guidelines and videos to develop these activities.
- 5 Evaluation: The evaluation is foreseen for each module, and it should include 7-8 multiple-choice questions of each. The grading method of this test is highest grade, which means that you can attempt any tries that you need, with no limit of attempts

The most common resources in Moodle are:

- Office files: PDF documents, text documents, presentations, etc.
- Web pages and web links
- Multimedia material: videos, animations, audio files, etc.

O2.- Build your sustainable city. Web/mobile didactic application as training methodology of sustainable energy concepts, particularly renewable energy systems, hydrogen as energy storage method and fuel cells

CCS has developed a digital didactic game based on creating a genuine sustainable city. This game is available for mobile, tablet and computer on iOS, Android and Windows stores. The app contains the following features:

- Money/work/taxes
- Infrastructure - energy supply, (hydro, solar & wind). It also includes hydrogen technologies
- Residential Buildings - upgradeable
- A fixed pre-defined map to build upon.
- -Transport (cars, taxi, bus) and refueling station.

Moreover, ARIEMA, and CRES have developed two didactic kits, a car and a house, respectively, that have been used by students to experiment, manage and practice with these technologies at first-hand.



O3.- CIRO Competition.

CIRO project promotes that student in school education, who are in full decision on their professional future, get motivated to implement sustainable practices in their daily life. Furthermore, the skills acquired throughout the course will guide these students in pursuing a professional career related to environmental sciences, climate change and renewable energies.

For this matter, CIRO is a contest of innovative ideas where different groups of students from the participating schools (3 centers in 2 European countries) have developed and disseminated their own projects with the aim of reducing climate change and enhancing air quality in their cities.

CIRO's most remarkable feature is its combined methodology. The knowledge acquired by students during the first phase of the program as well as the improvement of their soft skills will be used afterwards, when they had to face the project's final presentation in front of the evaluating team.

The training material developed for CIRO Final Competition (O3) was the following one:

1. Motivation and innovation.

This activity begun with an inspirational talk by Rafael Luque, CEO of ARIEMA, explaining his personal experience regarding the process of creating a company from a business idea. Then the scholars had to analyse and debate in groups about who, what, how, why, when and where a person/company succeeded in the role game activity "*Time to role - Who I am?*".

2. Entrepreneurship.

The objective of this activity is to help students realize the essential skills that an entrepreneur must have and identify those aspects in which they excel and those that they can improve. The goal of the activity "*Make It Happen – a quick run campaign*" is to design a product/solution that can help to solve a specific problem or reduce the harmfulness of the problem.

3. Leadership.

This last activity required a quick thinking, and collaboration of the participants. The goal is to help the students both realize which are the most essential skills that a "leader" should possess, as well as enhance their "leadership" activities through the role-playing game "*The best survives*".

4. Empathy map. Product

ARIEMA provided to the participants information regarding: a brief product overview, an empathy map template to fill up and answer three questions. Each group shared their answer and made a short comment about their product and its opportunities on the market.



4. Empathy map. Project

Student discussed their feelings and perceptions regarding their projects considering the empathy map, then they filled it with their conclusions and answered the questions considering their project as a product to be commercialized and finally implemented. At the end of the activity, each group presented their answers and made a short comment about their project and the feasibility of its implementation conclusions in the common room, to the other teams, teachers and evaluators.

5. Conclusion

Scholars practiced a brainstorming technique about the following aspects of their projects:

- Interesting aspects that they had learned during C2 activity, and they did not consider during the development of their project.
- Constructive criticism of their project: weaknesses and lacks the team had come up with after C2 activity.
- New ideas to face the weaknesses and lacks identified within their projects and new aspects that could be implemented.
- New questions and doubts raised to the team with the improvement's proposal for their projects.

Then, each team dedicated 10 minutes to talk about their conclusions of the entire project. Finally, a representative of each team summarized the matrix and their conclusions in the common room, to the other teams, teachers and evaluators.

4. Final Defence

Evaluators made five different questions to each group. Giving them the opportunity to defend their project.



3. TRAINING ACTIVITY

In this section it is summarized the training activities carried out within Ciro Project.

Pilot test (C1): Learning/Training Activity (Length: 5 days, place: Greece) – Activity attendance: Training for trainers.

Activity C1 took place face-to-face in Greece in October 2019: ARIEMA and CRES acted as trainers, and teachers (including assistants from the External Expert Panel) validated, reviewed and facilitated the adaptation of the material for use in teaching students.

Pilot test (C2): Learning/Training Activity (Length: 3 days, place: Virtual) – Ciro Final Competition.

CIRO competition (C2) was divided into two phases:

PHASE I (held in each school): participating students' groups developed an innovative project based on reducing climate change and improving air quality in their cities. This PHASE ended with an internal competition in each school where the two best teams from each Center were classified for PHASE II. As a result of this phase, six projects were submitted to ARIEMA, CRES and CCS by email.

PHASE II: a virtual competition was held over three days, divided into 3 consecutive stages.

- On the first day of the competition (May 11th) students received training on interpersonal skills (entrepreneurship, leadership, innovation, and motivation).
- On the second day (May 12th), participants orally presented their application projects.
- On the last day (May 14th) the scholars had the opportunity to work on a commercialization plan for their project using an empathy map template. The trainees then discussed the findings and insights gained from the CIRO project. Each group collaborated by explaining, why their projects are strategic, innovative, and why it should be implemented in their cities. Finally, the student defended their projects (Questions-Answers).



4. Comments about Ciro Final Competition (C2)

The CIRO competition (O3) that was implemented in the frame of the C2 activity offered the students the opportunity to both present the projects they had developed in a very cooperative and analytical way and to support and argument on the methodology and concept their projects were based upon.

Based on the presentations of the projects elaborated by the group of students from the 3 schools, i.e. IES Diego de Guzman y Quesada, Colegio Jesus Nazareno and Heriburg – Gymnasium, it was obvious that the students of all the participating groups / schools manifested a sincere and deep knowledge of all the addressed topics (either energy efficiency, renewables, hydrogen, or energy storage). They were able of analytically and efficiently presenting all the steps and expected results of the projects, proving both that they have deepened during the learning period to the subjects elaborated in the frame of the C1 activity of CIRO and that they are capable of developing complete and solid innovative projects using the RES and energy efficiency and/or Hydrogen technologies with the purpose of theoretically contributing to the reduction of climate change and enhancing the air quality in their cities.

The projects that have been elaborated by the 6 groups of students have in their majority been very well structured, covering the theoretical background, the project development steps description, and the conclusions. In all presented projects, the structure was the most dominating characteristic. In many cases the projects are covering many alternative technologies (i.e. RES and energy efficiency interventions) and one of the strengths of the majority of the projects is the fact that each one of the suggested technologies to be used in schools is presented as far as its technological background is concerned. Another worth mentioning characteristic of the projects is the financial approach of the suggested interventions aiming at proving the feasibility of the project. Furthermore, in most cases the students have based their projects on the necessity of solving practical problems that their school and/or their city is experiencing, which is an added value for the projects themselves.

On the other hand, in some cases the projects were including rather more “generalized” approaches of RES use or energy efficiency interventions, without the necessary argumentation on the feasibility of the proposed changes. Another missing characteristic of the elaborated projects is the fact that the proposed measures might not be in practice viable, due to the lack of financing resources. Thus, an idea would be that the students complemented their projects with a short research on possible sponsors or any other kind of funding, in order to achieve more possibilities for making their very interesting and environmentally friendly ideas more possible to be implemented.

The strengths and weaknesses of each project are summarized in the table below:



Project	Strength/ Weakness	Comments
Heriburg - Project School Building	Strength	<ul style="list-style-type: none"> I appreciate that the project set out from their day-to-day environment where they could discover a 'market gap'. A good introduction of the context and the technology to be used in this project. Good reasoning about the choice of energy storage system is given. A cost estimation is included.
	Weakness	<ul style="list-style-type: none"> It will even be better if you present the costs of different categories of works in tabulation form. The Thermal Insulation section could be placed earlier to justify the importance of your project.
Heriburg - Project Scooter	Strength	<ul style="list-style-type: none"> I appreciate that the project set out from their day-to-day environment where they could discover a 'market gap'. I appreciate that the students contacted a company which produces electric scooter and have developed a model scooter.
	Weakness	<ul style="list-style-type: none"> The section 'Why is it necessary to act now?' may be a bit too general. It would be better if you can show that students originally travel to another campus by bus and now with this project, they travel by scooter causing a reduction in carbon footprint.
Huelva - Sustainabl e Edificatio n	Strength	<ul style="list-style-type: none"> It is a project with a good will and vision for the city. The project includes a wide range of energy technology. The students must have put a great effort in learning all of them.
	Weakness	<ul style="list-style-type: none"> It may include too many objectives for which one single project might be hard to achieve. You may focus on the major ones while developing your project. More details on implementation such as implementation timeline, costs, predicted obstacles can be elaborated.
Huelva - Sustainabl e Transport	Strength	<ul style="list-style-type: none"> It is a project with a good will and vision for the city. The team could show a good understanding of the transport problem in the city. Specific actions were proposed.
	Weakness	<ul style="list-style-type: none"> You may elaborate more details about the innovative aspects such as scientific theory, advantages, disadvantages, practical application etc. You may incorporate an implementation plan in the project.
Madrid - Project_0 1	Strength	<ul style="list-style-type: none"> It is a project with a good will and vision for the city. It is good that you compared the use of different energy sources in achieving your goal. It is good that you analysed a related country-wide law.
	Weakness	<ul style="list-style-type: none"> You may incorporate an implementation plan in the project.
Madrid - Project_0 2	Strength	<ul style="list-style-type: none"> It is a project with a good will and vision for the city. You showed a good understanding of your city.
	Weakness	<ul style="list-style-type: none"> Water pollution is mentioned in the project, but it seems this problem is not tackled by your solution. You may estimate how much energy can be produced by your solution such as the windmill so that you can justify the feasibility of your project.



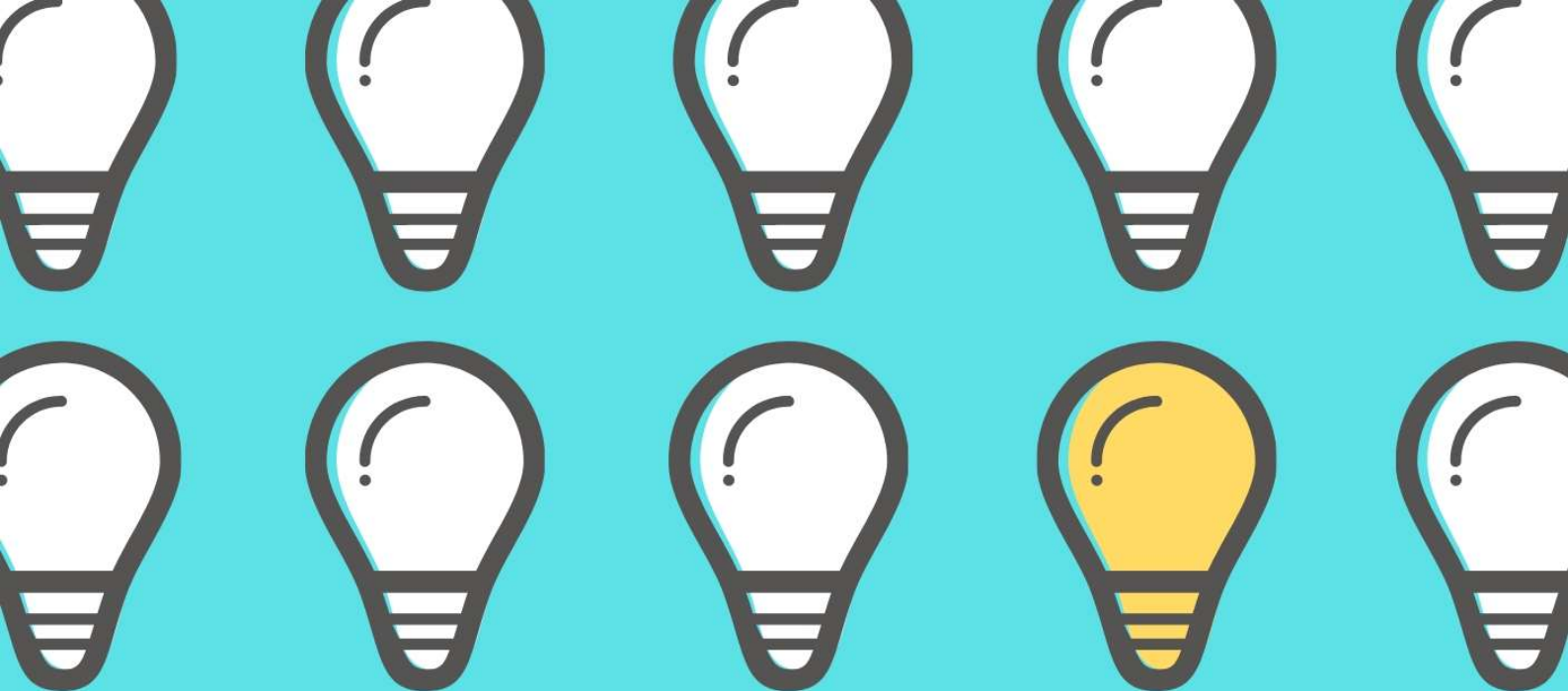
5. Recommendations to improve the training with the materials from O1, O2

The entire consortium agrees that the training materials developed for O1 were well written and well organised. The material set covers a wide range of topics such as climate change, traditional and renewable energy sources, and energy storage in both academic and application point of view.

Nevertheless, it would be interesting to further enhance the modules in the future with more materials, newer texts, more links etc. For instance, as especially the hydrogen market seems to be very active today, it would be easy to add more local hydrogen applications and projects. Moreover, it could be improved including contents on energy pricing. As most of the technology used in renewable energy are innovative and massive funding should be injected into their development especially in the early stage. For instance, developed countries, investing in this technology will not be a big problem financially and they may benefit in a long run. For developing and undeveloped countries, they may not be able to afford a huge investment in this technology and so they may have enough incentive to use them. Therefore, including discussions on energy pricing could let students realise the difficulty in promoting renewable energy and could facilitate more understanding in energy development globally.

Additionally, in order to improve the learning procedure of the training material elaborated in the frame of the project (O1), a number of different digital tools could be used during the teaching procedure. More specifically, a large number of digital tools are currently available (e.g. Socrative, Edmodo, etc.) and could be purchased at low cost by the schools. Their contribution to a more enhanced and in practice learning procedure is quite valuable since they can offer a certain level of autonomy to the students, encouraging the collaboration, and facilitate in a pleasant yet easy way the communication between teachers and learners. In other cases, the use of a digital tool may allow the teachers to create either exercises or educational games, which the students can solve with the use of mobile devices (smartphones, laptops, or tablets). Thus, the teachers can – based on the results of the activities – adapt the next lessons to make them more personalized.

A didactic game and two didactic kits were developed for O2. These materials are good resources for teaching energy sustainability and relevant technologies. To bring the function of the didactic game into full play, it could be developed a learning activity in which students compare the impact between cities using different kinds of energy sources. This can deepen their awareness on the importance of renewable energy. In addition to the existing O2 materials, it could be included an interview of a hydrogen-powered car user. This helps students understand the advantages and disadvantages when hydrogen power comes into use in real life.



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