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GreenHive

GreenComp in Vocational
Education and Training:

State of Art and Best Practices in Greece





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Introduction

The role of education in shaping active citizens who can put the goals of Sustainable Development into practice is very important. Sustainable development prioritises the quality of human life by ensuring the improvement of three fundamental issues the economy, society and the environment. For this to be achieved, it is necessary to shift the way of thinking and acting of citizens who should not only acquire knowledge on environmental protection and sustainable development, but also actively show their involvement in solving these issues. This will be achieved through cooperation at local, national and international level, by being respectful, caring, developing skills such as critical thinking, problem solving but also having ethical values, building awareness, environmental responsibility, good behaviour and attitudes, values and norms.

Education should bring young people into contact with local community stakeholders and with the problems they face daily, furthermore should inform all citizens, young and old, through coordinated efforts to educate the local community. Thus, the Sustainable School, although one could say that constitutes a utopian school, integrates sustainability in every stage and aspect of its operation, is democratic, follows educational practices and innovations in its actions and curricula, resulting in the formation and production of new perceptions in young citizens in order to support a moral and sustainable society, aiming at the needs of human welfare and safeguarding the environment.

1. The Green Hive Project

Green Hive is a Cooperation partnership in the Vocational Education and Training (VET) field co-funded by the Erasmus+ Programme of the European Union. Implemented by a consortium of five entities, such as the *Technological University of the Shannon: Midlands Midwest* (Ireland), the companies *Lascò* (Italy) and *Femxa* (Spain), and the non-profit and non-governmental organisations *KEAN* (Greece) and *Team 4 Excellence* (Romania), the project aims to increase the



capacity of VET providers to prepare learners for the green transition by developing a **European platform-based ecosystem for sustainability education** called the "Green Hive".

The Green Hive will consist of localised hubs for sustainability education, namely the "Green Combs," established within VET providers. While the Hive will be an open and cross-sectoral long-term cooperation network dedicated to innovation, continuous improvement and co-creation in sustainability education, the Combs will make VET providers the managing centre of networks of local stakeholders (i.e., companies, representatives of universities, civil society organisations and professional associations) for learning, networking and cooperating on sustainability challenges.

Hence, the project promotes the establishment of permanent VET co-creation structures where students will be enabled to think in systems, understand the interconnectedness of the economy, society and environment, and ultimately develop their systemic and critical thinking competencies by collaborating with other students and external stakeholders.

Four **main results** will be co-developed with over 500 VET experts in the scope of the project:

- a "**Methodological Framework**" for developing a VET sustainability education ecosystem and localised hubs to facilitate the transfer of local experience, knowledge and innovation in the field of the implementation of the **European Sustainability Competence Framework "GreenComp"**¹, and encourage collective actions of VET providers, learners and external stakeholders to co-create solutions for sustainability;

¹ Bianchi G., Pisiotis U. & Cabrera M. (2022). GreenComp The European sustainability competence framework, Punie, Y. and Bacigalupo, M. editor(s), EUR 30955 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-46485-3, doi:10.2760/13286, JRC128040.



- a "**Toolkit for the setup and management of Green Combs**", including a how-to guide and canvases to support VET providers in setting up, managing and growing internal hubs for sustainability education;
- "**Educational resources for Green Combs**", including guidelines to implement open spaces for discussion around learner-generated topics among members of localised hubs, micro-learning videos, workshop scenarios and project-based learning experiences in the four competence areas of the GreenComp;
- the "**Green Hive**" **platform**, connecting the hubs through the Internet and providing capacity-building opportunities and digital tools for VET institutions, knowledge-transfer spaces, and co-creation activities for its members. By the end of 2025, the Green Hive is expected to host and connect at least 15 localised hubs and 200 VET learners in 5 countries.

Project website: www.greenhiveproject.eu

2. Sustainability Education in Vocational

Education and Training: The Greek Context

Environmental education (EE) was first established in Greece in the late 70s, but the biggest advancements came in the 90s with a law (1892/1990(φεκ 101 τ.Α31-07-1990) that introduced EE as part of the programmes of secondary schools, aiming to raise awareness of environmental issues among students. Unfortunately, EE did not constitute a separate subject but an educational process in which the duration, time and limits were not strictly defined or bound by the school curriculum or timetable, all the while in secondary education it was carried out after school by volunteer students participating in the school's environmental team, involving one or two teachers and a group of 20 to 25 students. Also, with the possibility of teaching electives related to the environment, such as natural resource management and



others, subjects which were however chosen by a small number of schools. In parallel with the curriculum and timetable, there are also EE programmes taking place outside school ([Kyriazi, 2018](#))².

Under the same law, urban and rural Environmental Education Centres (EEC) were established, now called Education Centres for Environment and Sustainability (ECES), today 54 ECESs exist throughout Greece, being responsible for the design and implementation of Sustainable Development programmes for Primary, Secondary and Tertiary Education, the organisation of training sessions for teachers and those interested and the provision of special programmes on environmental education issues ([Kaloi, 2020](#)),³ ([Georgantas, 2023](#)).⁴ In addition, Environmental Education Officers were appointed in 132 Greek Primary and Secondary Education Districts. These were experienced teachers in EE and each EE Officer coordinated, monitored and supported the teachers who implemented extracurricular projects in the schools of her/his district ([Flogaitis et al., 2018](#)).⁵

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- ² Ecology Teaching as a framework for the development of the Goals of Environmental Education/Education for Sustainable Development, Kyriazi P. (2018) available: [Κυριαζή Παναγιώτα \(2018 Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών \(ΕΚΠΑ\)\) Η διδασκαλία της Οικολογίας ως πλαίσιο ανάπτυξης των στόχων της Περιβαλλοντικής Εκπαίδευσης / Εκπαίδευσης για την Αειφόρο Ανάπτυξη \(ekt.gr\)](#)
 - ³ Education for sustainable development and active citizen: teachers' views of secondary education, Kaloi P. (2020), available: [Εκπαίδευση για την αειφόρο ανάπτυξη και ενεργός πολίτης: απόψεις εκπαιδευτικών δευτεροβάθμιας εκπαίδευσης \(aegean.gr\)](#)
 - ⁴ Views of teacher trainers on the new Programme Studies on the Environment and Education for Sustainable Development. Georgantas (2023), available: [Microsoft Word - ÎñÎĹÎ©ÎĥÎĹÎšÎšÎĹÎŠ 230123V4.docx \(uop.gr\)](#)
 - ⁵ Environment and School Initiatives. Lessons from the ENSI Network- Past, Present, and Future (2018) Flogaitis et. al. [lessons_from_the_ensi_network-book_web_0905.pdf \(gov.hu\)](#)



More actions have taken place in the last decades including, Training seminars held throughout the year by the Universities and the EECs, contributing to the integration of ESD in Greek schools. The creation of Environmental Education or Ecology related disciplines in many Greek universities either as undergraduate or postgraduate courses. Educational Resources related to environmental themes, consisting of appropriate books, packages, CDs, DVDs, etc., funded by the European Union. They are mainly produced by universities, teachers, non-governmental organisations and governmental bodies. These resources can be obtained by stakeholders from the Ministry of Education, school and university libraries, as well as from EECs. The inclusion of EE and ESD in the school curricula, many primary and secondary education courses have been enriched with the topics of Sustainable Development and the Environment ([Kaloï, 2020](#)).⁶ These new books contained many references to environmental concepts and issues in all subjects including languages and mathematics, nonetheless in a fragmented, non continuous and incoherent way aiming primarily at the acquisition of knowledge rather than the development of critical thinking, participation and the connection to visible and local environmental and sustainability issues ([Flogaitis et.al., 2018](#)).⁷

The creation of thematic networks at regional, national and international level. A very large number of school units participate in these thematic networks, functioning in a supportive way to the participating school units, ensuring a continuous flow of information and training for teachers, providing appropriate educational resources and ensuring a stable cooperation with experts. The development of partnerships between the Ministry of Education and governmental and non-governmental bodies. This relationship contributes to the more

1. ⁶ Education for sustainable development and active citizen: teachers' views of secondary education, Kaloï P. (2020), available: [Εκπαίδευση για την αειφόρο ανάπτυξη και ενεργός πολίτης: απόψεις εκπαιδευτικών δευτεροβάθμιας εκπαίδευσης \(aegean.gr\)](#)

1. ⁷ Environment and School Initiatives. Lessons from the ENSI Network- Past, Present, and Future (2018) Flogaitis et. al. [lessons_from_the_ensi_network-book_web_0905.pdf \(gov.hu\)](#)



efficient operation and organisation of the EE programmes. The development of partnerships between Greece and international educational and training institutions. The participation of Greece in European and global programmes, such as Comenius, the activities of the EECs, mobility programmes and others, orientate teachers and students to local activities, but with a global scope. Finally, the establishment of the Panhellenic Association of Teachers for Environmental Education (PEEKPE). PEEKPE has numerous branches throughout the country and its role includes active participation in EE through magazines, seminars, global partnerships, conferences, etc., while seeking financial and moral support for EE, promoting its educational and social necessity ([Kaloj, 2020](#)).⁸

On the other hand, there is the non-typical education with programmes and organised educational activities implemented by non-governmental organisations, natural history, science and technology museums, scientific associations, clubs, groups, etc., providing an opportunity for participants to approach learning in a practical and entertaining rather than purely theoretical context. Participants usually have the opportunity to examine environmental issues from an independent perspective reflecting economic, social and political conditions shaping positive environmental attitudes and behaviour ([Kyriazi, 2018](#)).⁹

In 2009, the "Sustainable School Award" was established. In Greece, the Sustainable School is voluntary, regarding the actions that students and teachers will follow to achieve Sustainability. Responsible bodies were initially designated, the Non-Governmental

1. ⁸ Education for sustainable development and active citizen: teachers' views of secondary education, Kaloj P. (2020), available: [Εκπαίδευση για την αειφόρο ανάπτυξη και ενεργός πολίτης: απόψεις εκπαιδευτικών δευτεροβάθμιας εκπαίδευσης \(aegean.gr\)](#)

1. ⁹ Ecology Teaching as a framework for the development of the Goals of Environmental Education/Education for Sustainable Development, Kyriazi P. (2018) available: [Κυριαζή Παναγιώτα \(2018 Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών \(ΕΚΠΑ\)\) Η διδασκαλία της Οικολογίας ως πλαίσιο ανάπτυξης των στόχων της Περιβαλλοντικής Εκπαίδευσης / Εκπαίδευσης για την Αειφόρο Ανάπτυξη \(ekt.gr\)](#)



Organizations (NGOs) "AEIFORUM", with the program "Sustainable School Label" and the "Hellenic Society for the Environment and Culture" (ELLET), with the program "Sustainable Greek School: We all care, We all participate!". The formalization of the Sustainable School (SS) in Greece took place during the school years 2010 – 2011 with 140 schools registering across the country. All registered schools cooperated with non-governmental voluntary organizations and participated in activities in the local community. Also, most schools developed relationships with schools in other countries in European Union programmes like Comenius, e-Twinning, etc. Today, leaders and administrators, recording and operating SS in Greece, are the non-governmental organizations "Hellenic Society for the Protection of Nature", appointed as the representative of the global non-governmental "Foundation for Environmental Education" with more than 220 schools enrolled in the "Sustainable School" network (including at least 20 Vocational high schools) and almost 300 schools in the "Bravo Schools" network ([Kamberis, 2020](#)).¹⁰

For the school year 2023-2024, the Ministry of Education and Religious affairs promotes a new learning program (LP) "Environment and Education for Sustainable Development" (EESD), by integrating it in the mandatory curriculum in primary, including pre-school and only lower secondary schools. The EESD program promises to benefit students in several ways like, teach them responsibility and love for their living environment, while enhancing empathy and a range of metacognitive skills such as creative thinking and problem solving. The uniqueness of this LP is that it does not have specific hours in the curriculum but is mainly achieved through diffusion in the taught subjects (multidisciplinary model).

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- ¹⁰ The contribution of the Sustainable School to the Circular Economy and Sustainability. Education for the Sustainable Development in Greece, Kamberis E. (2020) available: [Η συμβολή του Αειφόρου Σχολείου στην Κυκλική Οικονομία και την Αειφορία. Η Εκπαίδευση για την Αειφόρο Ανάπτυξη στην Ελλάδα. | Apothesis - Ελληνικό Ανοικτό Πανεπιστήμιο \(eap.gr\)](#)



The EESD was initially implemented in experimental primary and secondary schools during the school years 2021-2022 and 2022-2023. With teachers in these schools pointing out the need for more substantive training for all teachers and trainers. Trained teachers make the course content more interesting and meaningful through proper curriculum-focused teaching and assessment methods and use modern techniques. Teachers also admitted understanding basic systemic concepts of EE but having difficulty in teaching these in practice. They suggested the design and implementation of training programmes that focus on linking theory and practice, study of local issues and the use of teaching methods in the context of adult education, considering the principles of EE and the educational needs of learners ([Georgantas, 2023](#)).¹¹

Many researchers over the years have analysed the extend of EE/ESD implementation in the Greek education system by reviewing the reforms taking place throughout the years and with surveys of students and teachers in secondary or higher education. All researchers have come to the same conclusion. The initiatives taken are not sufficient as actions, interventions and innovations are recorded in a small sample of school units and are left more to the will and individual initiatives of the administrations and teachers of these units. These actions are insufficient both at the level of educating and training educators in implementing ESD in their teaching, but also motivating new generations by promoting sustainable solutions, developing their critical thinking and their social awareness and ultimately learning to form connections with others to deal with environmental problems.

This new program gives hope that ESD will take on again its rightfull place in the greek school's curriculum, in a modern and holistic way involving all students and subjects in the learning process.

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1. ¹¹ Views of teacher trainers on the new Programme Studies on the Environment and Education for Sustainable Development. Georgantas (2023), available: [Microsoft Word - Ἰνστιτούτο Παιδείας 230123V4.docx \(uop.gr\)](#)



3. GreenComp: State of the Art in Greece

3.1 Research Methodology

3.1.1 Research Strategy

The research strategy employed in this study a mixed-methods qualitative approach, combining desk research with interviews with Vocational Education and Training (VET) experts to investigate the integration of sustainability competencies in the Greek VET system.

3.1.2 Data Collection Method and Tools

For the purpose of this research, document analysis and semi-structured interviews were used. Particularly, the **document analysis** involved the revision of national educational guidelines, policy documents, curricula, syllabi, and research studies, to address the following research questions:

- a. What are the current practices and policies for developing GreenComp sustainability competencies in VET in the country?
- b. How do national educational guidelines address integrating sustainability competencies in VET curricula and courses?
- c. What government policies and initiatives are in place to promote the development of sustainability competencies in VET?
- d. To what extent are sustainability competencies integrated into the country's VET curricula and syllabi?

In addition, **semi-structured interviews** were conducted with VET experts to gather their perspectives on sustainability education in the national VET system. A semi-structured questionnaire was used an interview guide for the researcher. Certain predetermined questions were prepared to guide the interviews and ensure that the research objectives were addressed. However, additional questions arose during the interviews as unexpected insights



and information emerged. Some sample questions that were included in the semi-structured questionnaire were the following:

- a. How do you perceive the current practices for developing sustainability competencies in VET in your country?
- b. What are the strengths and positive aspects of the existing approaches and practices for sustainability competencies development in VET?
- c. What are the weaknesses and limitations of the current practices for sustainability competencies development in VET?
- d. What challenges and barriers do VET experts encounter in the implementation of sustainability competencies in VET programs?
- e. What opportunities and potential benefits do VET experts identify in developing sustainability competencies in VET?
- f. How do VET experts assess the effectiveness and impact of the current practices for sustainability competencies development in VET?
- g. What resources, support, and infrastructure are necessary to enhance the development of sustainability competencies in VET?
- h. How do VET experts perceive the level of awareness and commitment among VET stakeholders towards sustainability competencies?
- i. What innovative approaches or strategies do VET experts suggest for further advancing the development of sustainability competencies in VET?
- j. What collaboration and partnership opportunities exist or should be fostered to enhance the development of sustainability competencies in VET?
- k. How do VET experts envision the future of sustainability competencies in VET, considering the evolving needs and trends in sustainable development?

3.1.3 Sample Selection

The research utilized purposive sampling, a type of non-probability sampling technique, to establish the sample for the study. In accordance with this approach, individuals were selected



based on their knowledge, relationships, and expertise related to the research topic (Freedman et al., 2007). For this particular study, sample members were chosen due to their direct involvement and experience in the phenomenon being investigated, as well as their significant work background in vocational education and training and active participation in sustainability education.

3.1.4 Data Analysis

The data collected from the desk research and interviews were subjected to qualitative data analysis techniques. Thematic analysis was employed to identify recurring themes, patterns, and insights related to the integration of sustainability competencies in VET. The findings were organized, interpreted, and presented in this research publication, contributing to the understanding of current practices, challenges, and opportunities in sustainability education within the VET system.

3.1.5 Ethical Considerations:

Informed consent was obtained from all participants, clearly outlining their voluntary participation in the research and their freedom to withdraw from the study at any point and for any reason. The objectives of the study were thoroughly explained to participants, and they were assured that their responses would be treated confidentially and solely used for academic purposes specific to this research. Moreover, the study ensured that participants were not subjected to any physical or psychological harm. On the contrary, researchers strived to create and maintain a comfortable environment throughout the research process.

3.1.6 Limitations

This research had the following limitations:

- a. The size of the sample for the interviews was relatively small – 15 participants. A bigger sample would probably enhance the reliability of the research;





- b. The findings represent the perspectives and practices within the specific country, and generalization to other contexts should be done cautiously;
- c. The research relies on self-reported information from VET experts, which may be influenced by individual biases or limited awareness of practices outside their immediate scope;
- d. Sustainability education in the country may be influenced by factors which were not mentioned in this research.

3.2 Sustainability competencies in the Greek formal education system: recent evolutions of the Country's educational policies

In Greece vocational education and training (VET) is offered in three levels. One, in upper secondary education, there are 408 VET high schools (EPAL) providing integrated vocational knowledge and skills for access to the labour market, enhancing the capacity to monitor labour market developments, as well as the capacity to absorb and assimilate new technological and professional knowledge, skills and competences in the context of Lifelong Learning and finally providing the possibility of career progression through higher education. The fields and the corresponding specialisations in VET high schools include amongst others “Environment and Natural Resources” however taught in a selection of schools.

The second is the post-secondary level through 31 public Institutes of Vocational Training (IEK) offered by the National Employment Service (DYPA/OAED), many private accredited institutes and higher professional schools. These aim for the development of the necessary skills and qualifications by providing scientific, technical, professional and practical knowledge, for the integration of the trainees into the production process.

The third is through lifelong learning centres, enterprise learning centres and training centres for unemployed and vulnerable groups. These centres provide to adults, short term (less than a year) seminars on a variety of subjects and can be offered by universities, usually participants should have a relevant degree or profession and are required to pay a fee or



centres (public or private) specialised and accredited by the National Organisation for the Certification of Qualifications & Vocational Guidance (EOPPEP) offering training programs by the National Employment Service (DYPA/OAED), for the acquisition and upgrading of skills of unemployed people ([Cedefop](#)).¹²

As mentioned previously Environmental Education (EE) has come a long way in Greece with the first attempts being made in the late 70s, the first institutionalised steps taking place in the 90s and with most recent reforms introduced by the Ministry of Education and Religious Affairs with the learning program on “Environment and Education of Sustainability Development” (EESD) in pre-school, primary and lower secondary education schools, to be implemented in the school year 2023-2024. VET curricula and courses follow similar guidelines as the rest of higher secondary education schools. As pointed out in the previous chapter, ESD is not properly implemented in the curricula of secondary education. Non the less in 9 VET schools of the country a pilot program named "A New Beginning in the EPALs - Action Plans" was implemented in the school year 2017-2018.¹³

Since 2018 the program extended to all VET schools in Greece and more than 1000 action plans have been produced with more than 40,000 students being involved. Due to the specific nature of vocational schools, particular attention was paid to foster innovation, develop creativity and promote entrepreneurship. The Action Plans (projects) of the programme are mainly addressed to the students of the first grade of the VET schools and are implemented during the Creative Activities Zone, are funded and promote innovative creative projects

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1. ¹² Vocational education and training in Europe. Detailed description of VET systems in Europe, Greece (2021) [Vocational education and training in Europe | Greece | CEDEFOP \(europa.eu\)](#)
 1. ¹³ Support and Management of the Action Plans of the project "A New Start in EPAL" through the Operational Programme "HUMAN RESOURCES DEVELOPMENT, EDUCATION AND LIFELONG LEARNING" co-financed by Greece and the European Union, [Μια Νέα Αρχή στα ΕΠΑΛ – ΣΧΕΔΙΑ ΔΡΑΣΗΣ – ΝΟΗΣΙΣ \(noesis.edu.gr\)](#)



related to science, technology, culture, rural economy, health, smart cities, energy saving, environmental protection, accessibility for people with disabilities, etc.

The Action Plans aim to develop personality, sociability, skills and cooperation between students and teachers. It is a method of group teaching in which everyone participates decisively. It evolves according to the situation and the interests of the participants. Learning comes from the experience gained by the members through their active participation in the processes. The main objectives are the development of hard skills, i.e. the transfer of knowledge from the workshops to the group work of the action projects and the development of soft skills problem solving through cooperation which strengthens communication, critical thinking and self-confidence. In addition, through the action plans, the connection with the local community is made through extroversion actions of the students (presentations in exhibitions, festivals, performances) and contact with professionals in the field who train them on their activities (special seminars for the transfer of know-how).

With the European Year of Skills running from 9 May 2023 to 8 May 2024 and aiming to boost talent, improve qualifications and acquire new skills, these actions will help create quality jobs, close skills gaps and mismatches in the EU and empower the workforce to take full advantage of the opportunities of the digital and green transition.

The Science Dissemination Centre & Technology Museum "NOESIS", a cultural and educational institution of General Governance, has been appointed responsible for the implementation of Action Plans and Good Practices by all Vocational High Schools of the country (Φ25α/1956/Δ4) and supports the Action Plans in the framework of the Operational Programme "Human Resources Development-Education and Lifelong Learning" of the NSRF 2014-2020. Specifically, NOESIS as the managing body at the beginning of each school year issues the notice for the Action Plans and undertakes the collection, categorization, control and evaluation of the submitted Plans. All Plans are collected and evaluated by NOESIS based





on the degree of correlation of the school's proposal with the overall objectives of the Action Plans action and the relevance of the individual activities proposed by the School's Plan. In addition, NOESIS is responsible for communicating with the school units, providing guidelines for the implementation of the Action Plans and at the same time monitoring and advising on the financial management of the Action Plans in accordance with the principles of the NSRF ([“A New Beginning in the EPALs”](#)).

In January 2020, the COVID-19 pandemic reached Europe, leading to a health crisis with major socio-economic consequences. The EU's response was, among other things, an emergency recovery fund the NextGenerationEU, setting out that each Member State will submit a National Recovery and Resilience Plan identifying the reforms and investments that the Member State is committed to implementing. In Greece, the National Recovery and Resilience Plan "Greece 2.0" was adopted on 13 July 2021 and included 106 investments and 68 reforms, distributed across 4 pillars: Green Transition, Digital Transition, Employment-Skills-Social Cohesion, Private Investment and Transformation of the Economy ([greece20.gov.gr](#)).¹⁴

Within this context the National Employment Service (DYPA)¹⁵ in cooperation with the Training and Lifelong Learning Centres of the Greek Public Universities, as well as with licensed Training and Lifelong Learning Centres that meet specific quality assurance criteria, provides training programmes on a wide range of choices in modern, high-demand training subjects focusing on digital and "green" skills, to private sector employees, employees in all sectors of the economy and to those seeking employment. The aim of the action is for trainees to adapt to the requirements of modern trends in the workplace, to upgrade their prospects

1. ¹⁴ Greece2.0 National Recovery and Resilience plan. [At a glance - Greece 2.0 \(greece20.gov.gr\)](#)

1. ¹⁵ D.Y.P.A - Training Programs for the Recovery Fund, "Upskilling and retraining programs for workers in all sectors of the economy with emphasis on digital and green skills", [Επιταγή Επαγγελματικής Κατάρτισης \(voucher.gov.gr\)](#)



and thus contribute to the modernisation of the Greek economy (voucher.gov.gr, greece20.gov.gr).

Training topics in "Green" skills include:

- Application of New Technologies in Natural Disaster Management
- Circular Economy
- Smart Building Programming Technician
- Environmental Protection and Product Recycling
- Renewable Energy Sources (RES)
- Waste Management
- Specialist in circular economy applications in the primary and secondary sector

The most popular topics are Specialist in Circular Economy Applications in the Primary and Secondary Sector, Specialist in Renewable Energy Applications for Buildings Energy Needs and Business Skills for Exploiting Green Opportunities (pitsilkas.edu.gr,¹⁶ imerisia.gr)¹⁷. In addition, in June 2023 a new pilot training programme called "e-mobility in practice" by the National Employment Service (DYPA) in cooperation with the Training and Lifelong Learning Centre of the University of Western Macedonia, took place in the framework of the actions of DYPA to support the labour market and strengthen social cohesion in Western Macedonia. The programme aims to prepare the region's workforce for the green and digital transition of the economy and is addressed to unemployed people and workers of Western Macedonia with previous experience in conventional car workshops. Through the programme, trainees will

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1. ¹⁶ Topics in digital and green skills, In the framework of "Upskilling and retraining programs in high demand sectors with emphasis on digital and green skills" of DYPA, [Θεματικά αντικείμενα κατάρτισης στις ψηφιακές και πράσινες δεξιότητες - ΚΕΚ Le@rn-it Λάρισας, Σεμινάρια, Φοιτητικά μαθήματα, Ξένες Γλώσσες \(pitsilkas.edu.gr\)](#)
 1. ¹⁷ DYPA: Which training programs "break funds" - The top 10 choices by workers and unemployed, [ΔΥΠΑ: Ποια προγράμματα κατάρτισης «σπάνε ταμεία» - Το top 10 των επιλογών από εργαζόμενους και άνεργους | Ημερησία \(imerisia.gr\)](#)



receive the necessary theoretical and practical knowledge and skills to be able to repair and maintain an electric or hybrid vehicle (imerisia.gr).

3.3 Experiences from the field: interviews with VET experts

For the interviews more than 70 VET schools, university and private licensed Training and Lifelong Learning Centres, Environmental Education Centres, the Environmental Association of Municipalities of Athens – Piraeus (PESYDAP) and Vocational Training Centres around Greece were originally contacted through email. Next all parties were contacted by phone to arrange an appointment for the interview. With these actions taking place late June to beginning of August most of these institutions, especially VET schools, were closed for the summer holidays and therefore was not possible to get in direct contact with teachers and trainers. However, for many of the institutions, we were informed that our email with the project presentation and link to the online questionnaire would be forwarded to them. Furthermore, the trainers that we managed to get in contact with chose to fill in the electronic questionnaire at their own preferred time rather than arranging an online or face to face interview with us. Only one interview was conducted online with the Sustainability Education Project Coordinator, with a short conversation taking place and him filling out the online questionnaire at his own time.

3.3.1 Composition of the Group

The group was composed of 1 trainer from PESYDAP, 4 educators from Training and Lifelong Learning Centres, 4 VET school teachers, 5 Upper secondary educators/trainers, and 1 Environmental Education Centre educator.

3.3.2 Summary of the findings

This section summarises the main responses collected during the interviews to the main 11 questions highlighted in section 3.1.2.



Q1	How do you perceive the current practices for developing sustainability competencies in VET in your country?
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The interviewees agreed that there are attempts and programs in both typical and non-typical education trying to implement sustainability competences. Here you can see some of the responses.

- *I don't think there are specific practices for sustainability in VET. In the framework of the "A New Start in VET schools" programme, "Action Plans" can be created and implemented in each school on social, economic, environmental, and labour issues, of a local or general nature and depending on the interest shown by the participants.*
- *With the new NextGenerationEU Green Skills Programme.*
- *In recent years, efforts have been made to equip trainees and trainers with the knowledge, skills and mindset needed for a greener and more sustainable economy and society. This is slowly becoming a priority and efforts are being made to provide all learners with opportunities to learn about the climate crisis and sustainability in both formal and non-formal education.*
- *Since 22 new training programmes for unemployed people are being promoted on green skills. These programmes address the needs of the new labour market in both renewable energy and electromobility.*
- *Fragmented.*
- *In the context of the climate and environmental emergency, sustainability education should become an area on which all training centres will focus as a priority.*
- *I believe that there are efforts to integrate sustainability skills into VET programmes in order to prepare students to face the challenges of sustainable development in their professional lives.*
- *At the moment with the action plans in the VET programmes many schools and students are choosing to work on sustainability development.*
- *With the Greece 2.0 recovery plan thousands of workers and unemployed people have benefited from DYPAs programmes on green skills.*



- *Many vocational high schools are undertaking action plans on sustainability skills. But it depends on the topic chosen by the students.*
- *A start has been made, with great response, programmes should continue.*
- *Efforts should be intensified and formal programmes should be integrated into VET.*

Q2	What are the strengths and positive aspects of the existing approaches and practices for sustainability competencies development in VET?
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Most of the respondents believe that the positive aspect is that VET is getting involved with the development of sustainability competencies.

- *I would say the strengths are mainly for schools that choose environmental topics. Students come into contact to a certain extent with the problems currently affecting the environment and are called upon, with the technical knowledge they have and depending on their specialism, to provide their own solution.*
- *The positive aspect is that it starts a training towards green professions.*
- *The positive point is that national and European funds have been released for investment in green and sustainable equipment, resources and infrastructure. As well as the continued effort to actively engage students and staff, local authorities and the research and innovation community in learning about sustainability.*
- *On the positive side, education and training has begun to address sustainability. But more initiatives and programmes are needed.*
- *The positive side is that it helps students to assimilate theory in an experiential way and gives a real dimension to knowledge.*
- *The strengths are linked to the skills of the trainers.*
- *In general, the level of approaches and practices used to develop sustainability skills has developed quite a lot.*
- *The strengths of the practices for skills development in my opinion are: Working with the community and businesses, focusing on practical application, interconnectivity approach, promoting awareness, encouraging critical thinking.*



- *The positive aspect is that it gives students the opportunity to get in touch with green skills.*
- *That they cover a range of training subjects on green skills.*
- *That students respond positively and present original ideas.*
- *They meet the needs of the new green labour market.*
- *Authorities are moving towards sustainability.*

Q3	What are the weaknesses and limitations of the current practices for sustainability competencies development in VET?
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The weaknesses and limitations pointed out by the respondents were, the lack of an established framework, the lack of proper training of educators and the lack of motivation.

- *The weaknesses and limitations are the lack of specific content and instructions for teachers and the fact that these actions are optional. They are not knowledge and experiences that are acquired by the students as a whole.*
- *Perhaps there should be more incentives and opportunities for training in green professions.*
- *Often the different training programmes do not achieve the objectives and many participants take part motivated by the level provided without getting the necessary knowledge.*
- *The lack of relevant knowledge of existing practices*
- *The weaknesses of adult training are that it only aims at the purely technical part without giving the theoretical background of sustainability.*
- *The weaknesses are that they are based on the personal willingness of the teachers to organise these activities. With whatever knowledge they have and resources available, but also the small number of students involved.*
- *There is no established framework. Also, the incentives for using the skills remain unclear.*
- *The biggest weakness, at least in Greece, is that the material that can be used by teachers is not updated in time, so that learners do not have access to new developments.*
- *The lack of teachers with sustainability expertise*
- *Beneficiaries should be informed so that more of them choose green skills programmes.*



- *Qualified teachers to organise the programmes.*
- *Programs should be made available for more beneficiaries.*
- *The training level of trainers.*

Q4	What challenges and barriers do VET experts encounter in the implementation of sustainability competencies in VET programs?
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The barriers encountered by the VET experts are mainly lack of experienced trainers, motivation of trainers and trainees and lack of awareness of the green labour market.

- *Lack of funding, lack of experience and knowledge of teachers on sustainability issues and lack of infrastructure.*
- *The challenge is for the unemployed who attend these programmes to find employment and gain more experience in the field.*
- *It is always the challenge to design supportive learning environments for sustainability that cover all activities and functions of an educational institution and enable practical, interdisciplinary and locally adapted teaching and learning. This requires cooperation and sound planning.*
- *Lack of motivation and knowledge of the effects of climate change.*
- *The challenge is that there is a high demand for few places.*
- *Teachers do not have much knowledge on the subject and without a guide with practical exercises and examples they are hindered and discouraged.*
- *Difficulty in explaining their usefulness. There is a feeling that it is aimed at specific groups of stakeholders and does not concern-benefit the general public.*
- *Lack of resources and informed teachers.*
- *Lack of infrastructure and interest/knowledge of school administration and teachers.*
- *Trained teachers.*
- *Motivation.*
- *Make beneficiaries aware of the labour market to which these programmes are targeted.*
- *Lack of an established framework.*



Q5	What opportunities and potential benefits do VET experts identify in developing sustainability competencies in VET?
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- *The benefits are most likely to be immediate for both students and teachers who are members of a society, a country and the planet to improve living conditions.*
- *The benefits are that it creates a new industry with new jobs and many unemployed people will be eligible to take them up.*
- *Envisioning sustainable futures enables students to imagine alternative scenarios for the future, to deal with ambiguity and uncertainty in a flexible way, to experiment and to go beyond the boundaries of science,*
- *The presentation of issues inspired by vocational education lessons and the application to practical experiences.*
- *The benefits are many, as we are talking about a new labour market with many professional opportunities.*
- *Students develop teamwork and cooperation, acquire critical thinking and become aware of issues that affect not only themselves but everything around them on a global scale.*
- *A new market can be created around them and the demand for sustainable development solutions can be increased.*
- *In this era, it is essential to have sustainability skills in every work sector as the European Commission's policies have now become much stricter in all areas.*
- *Multiple. From social - environmental awareness to the students' professional careers.*
- *Students gain a different, more ecological understanding of the exploitation of natural resources.*
- *Awareness raising and perhaps to a change of mindset.*
- *They are now necessary.*

Q6	How do VET experts assess the effectiveness and impact of the current practices for sustainability competencies development in VET?
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The VET experts felt that the impact is still very small. That in Greece things are still at the beginning and these efforts should continue.

- *There is demand but there should be better information from the state about labour advantages.*
- *I assess positively, as we are getting close to concepts and practices necessary for the future, but steps should be taken towards a targeted and substantial design of these programmes.*
- *Compared to previous years there is a clear mobilisation and greater impact of practices but not to a satisfactory degree.*
- *It is still early days. It should continue and increase the programmes and training areas.*
- *They are effective but for a small percentage of students who already feel the need to do something about sustainability and the environment.*
- *Limited.*
- *Compared to previous years when these practices were non-existent in the education system clearly better, but there should be no complacency because other countries are much more advanced in this area.*
- *I would say that the impact is still small judging by the small percentage of schools that reduce their environmental footprint.*
- *More should be done to promote these programmes.*
- *It is a start more initiatives are needed in more schools.*
- *Continuous education and training is needed. An 80-hour programme is not enough.*
- *Inadequate.*

Q7	What resources, support, and infrastructure are necessary to enhance the development of sustainability competencies in VET?
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The main necessary resources, support and infrastructure mentioned by the respondents were properly trained educators and trainers, EU and national funding, and a separate course on sustainable development in the school's curriculum.



- *It should be included as a subject in the curriculum and taught by qualified teachers in all schools and to all students.*
- *To create a specialty for sustainability?*
- *More time and better expertise in designing programmes and their practices would help to strengthen the development of sustainability skills in VET.*
- *European funds and education, training and awareness raising for teachers, changing the books and updating the examples in the books, having a standalone course 'SUSTAINABLE DEVELOPMENT' as a general education course.*
- *The state subsidies to the unemployed.*
- *Appropriate content and practical instructions should be given to teachers, teachers should be trained properly and comprehensively, and adequate resources should be provided to achieve such actions within the timetable.*
- *Human, technological, financial.*
- *Resources from the European Union and the ministry's funding programmes are necessary in any case.*
- *Certainly, funding but also proper and comprehensive training of teachers.*
- *The funding from the EU, and qualified trainers.*
- *Technological equipment and continuous funding.*
- *Funding from the EU and from the state.*
- *Financial, technological and information.*

Q8	How do VET experts perceive the level of awareness and commitment among VET stakeholders towards sustainability competencies?
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The VET experts are positive, but they point out that more awareness needs to be raised.

- *Many children are aware, but they need the right information and guidance.*
- *There is no interest.*
- *Those involved in green skills are aware of the professional future.*



- *Satisfactory. There should be an effort for more participation and sensitization for sustainability skills in VET.*
- *Low to moderate.*
- *It is a new industry with many opportunities and young people are aware of it and want to get involved in the field.*
- *Many children are aware and show great enthusiasm during the activities, they share their knowledge with the group and try to give their best.*
- *Vague. Since it is on a voluntary basis and not binding, awareness-raising actions should be multiplied to increase their usefulness.*
- *Most of the stakeholders are quite aware about developing skills for sustainability.*
- *At an early stage.*
- *It is positive and many children are interested in dealing with issues with environmental impact.*
- *Positive, but there is a need for awareness of both career opportunities and the benefits of a sustainable mindset.*
- *Not sufficient, more information is needed.*

Q9	What innovative approaches or strategies do VET experts suggest for further advancing the development of sustainability competencies in VET?
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- *I think experiential teaching, workshops and practical exercises have a greater effect on the understanding of a subject but also on the development of critical thinking and cooperation between students.*
- *More training programmes.*
- *provide more support for teachers in enriching their knowledge and skills to enable them to teach about the climate crisis and sustainability and to deal with, among other things, their students' ecological anxiety.*
- *The consolidation of a digital course on "Sustainable Development" translation not only in European languages, but also in Farsi, Arabic, Urdu due to the refugee issue.*



- *More programmes aimed at training on sustainability issues.*
- *Experiential workshops and practical exercises with in-depth theory and coherent.*
- *Case studies, field research, participatory planning for their prioritisation*
- *The material and content used in vocational training should be regularly updated as developments in technology combined with events in each country (natural disasters) change the way in which these issues should be approached.*
- *Greater integration of sustainability programmes in education, by well-trained teachers.*
- *Renewal of educational materials and integration of technology.*
- *Getting students in touch with new technologies.*
- *Not only theory but also training opportunities in a professional environment.*
- *More correct and responsible information for all, from scientists and technocrats in the field.*

Q10	What collaboration and partnership opportunities exist or should be fostered to enhance the development of sustainability competencies in VET?
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The main collaborations suggested were with universities and professionals specialising in sustainable solutions, but also the local community.

- *At present from my own experience there are no opportunities for cooperation. Perhaps a network should be created with organisations and professionals working on sustainable development.*
- *I don't know.*
- *Those who complete the programmes should directly fill vacancies and maybe there should be retraining with similar programmes.*
- *Greater cooperation between institutions and the local community.*
- *Linking with environmental organisations, interconnection with university branches of Agriculture, Geology, Geoinformatics, Spatial Planning and Environment, International and European Studies, Law, to map issues with concrete examples.*



- *Teachers of different disciplines should initially work together and be accompanied by qualified trainers and given integrated programmes.*
- *Interface with the public, social and private economy and implement to evaluate the activity.*
- *Private and public bodies should develop cooperation with education and training institutions in order to incorporate the latest developments in sustainability in teaching and learning, and indeed across the whole range of their activities.*
- *There should be cooperation with higher education institutions and with professionals for the transfer of knowledge and technology.*
- *There should be cooperation along the whole chain from education, vocational training and professional application.*
- *A bridge should be created between schools, universities and professionals.*
- *Cooperation with professionals and those who develop these technologies.*
- *Cooperation between educational institutions and public and private bodies.*

Q11	How do VET experts envision the future of sustainability competencies in VET, considering the evolving needs and trends in sustainable development?
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- *It would be very positive for the students of EPAL to gain knowledge and experience in sustainability issues to fill positions in a new labour market.*
- *I do not know.*
- *I think they are very important for the new labour market.*
- *Skills that will provide solutions at any time and full integration of sustainability values in them.*
- *Positive with many career prospects.*
- *I think it will be bright, with many career opportunities.*
- *I see a positive future because there are both teachers and students with willingness and sensitivity.*
- *Through the equal promotion of economic development, social progress and environmental protection.*



- *To build consensus on the profound and transformative changes needed in education and training for sustainability and green transition.*
- *I envision a future of Vocational Education and Training (VET) where sustainability skills will be an increasingly critical part of the educational process and the preparation of young people for their career path. In the light of evolving needs and trends in sustainable development, sustainability will be an essential pillar for the professional success and adaptability of individuals.*
- *Opportunities and funding must be provided for young people to develop innovative ideas and solutions.*
- *With continuous education and training even for professionals with many years of experience.*
- *New professional opportunities are emerging, the green professions sector is looking for qualified professionals.*
- *As long as the state provides incentives there will be qualified professionals to cover jobs.*
- *The entire society will be aware of their individual responsibility.*

4. Developing sustainability competences: Best practices in Greece

This chapter presents ten Greek best practices in developing the GreenComp sustainability competencies. The following criteria guided the selection of the best practices:

- **Effectiveness:** The extent to which the practice has demonstrated positive outcomes in developing sustainability competencies among VET learners, such as improved knowledge, skills, and attitudes towards sustainability.
- **Inclusiveness:** The practice's ability to cater to diverse learners, including individuals from different socio-economic backgrounds, genders, ethnicities, and abilities, ensuring equitable access and participation in sustainability competencies development.
- **Innovation:** The degree of creativity, novelty, and originality exhibited by the practice in its design, implementation, and delivery of sustainability competencies development in VET, incorporating new approaches, methods, or technologies.



- **Transferability:** The potential for the practice to be adapted, replicated, and scaled up in different VET contexts and settings, considering factors such as feasibility, adaptability, and compatibility with varying institutional and cultural contexts.
- **Impact:** The impact of the practice on learners' ability to apply sustainability competencies in real-world contexts, as well as its potential to contribute to broader societal and environmental goals.
- **Scalability and Replicability:** The potential for the practice to be scaled up and replicated in other VET systems, considering factors such as scalability, cost-effectiveness, and practicality.

4.1 Cooking oil to biodiesel- mass production

The 3rd EPAL-VET school in the municipality of Chalandri, Athens in the context of the European WASTE4think (Horizon 2020) programme, in October 2019, received a reactor device for the mass production of biodiesel from cooking oil. The issues the teachers and the students wishing to address were alternative forms of energy, natural resource management and sustainability, sustainable management, waste management, circular economy, through the production of alternative 2nd generation biodiesel fuel from the processing of cooking oil.

Cooking Oil To Biodiesel- Mass Production	
2019-2023	Author(s): 3rd EPAL-VET school in the municipality of Chalandri, Athens
Element	
Goals of the best practice	<i>What is the purpose or objective of the practice? Brief description.</i> Energy problem, alternative forms of energy, natural resource management and sustainability, sustainable management, waste management, circular economy. Its main theme is the production of alternative 2nd generation biodiesel fuel from the processing of cooking oil.
Target Group/Beneficiaries	<i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i> The beneficiaries are the students directly involved in the project. The school which uses the produced biodiesel for the schools heating. The local





	community that ‘discards’ the unwanted cooking oil. Other municipalities in Athens have taken up interest for this project.
Needed resources	<i>Which resources are needed to replicate and/or adapt the practice?</i> A reactor, pumps and filters, methanol, NaOH, masks, protective goggles, gloves, cooking oil stock.
Methodology	<i>A step-by-step description of the practice</i> The students for 3 years before starting the production of biodiesel were stocking up cooking oil from the local community. With the EU project WASTE4think-Horizon 2020, the scientific support of the school of chemical engineers of the national technical university of Athens, the municipality of Chalandri and the company ENBIO specialised in biological treatment and the treatment of water and solid - liquid waste, and funding by the "Support and Management of the Action Plans" of the project "A New Beginning in the EPAL-VET schools" of the National resources and co-financed by the NSRF 2014-2020, the students together with their teachers and school principal, were able to set up their laboratory at the school’s premises. In the first year of production, school year 2019-2020, more than 100L of biodiesel were produced. This was used to heat up the school for one week. This project continues 5 years later with success and a great interest from the school students and the local community.
Success Factors	<i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i> The necessary internal conditions are the support of the educational community of the school. The interest shown by the students to get involved and carry out this project. The external conditions were the support by the local municipality, the scientific support given by the national technical university of Athens and the private sector. In addition, the interest shown by the local community that supported this task by providing the primary raw material-the cooking oil.
Competence s of the GreenComp addressed	<i>What specific competencies of the GreenComp have been addressed by this practice?</i> The GreenComp competences addressed are, promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.



<p>Related Resources /Link</p>	<p><i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.).</i></p> <p><i>Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i></p> <p>https://3epal-chalandr.att.sch.gr</p> <p>https://3epal-chalandr.att.sch.gr/m%ce%bf%ce%bd%ce%ac%ce%b4%ce%b1-%ce%bc%ce%b5%cf%84%ce%b1%cf%84%cf%81%ce%bf%cf%80%ce%ae%cf%82-%ce%b2%ce%b9%ce%bf%ce%bd%cf%84%ce%af%ce%b6%ce%b5%ce%bb/</p> <p>https://3epal-chalandr.att.sch.gr/%cf%80%cf%81%cf%8c%ce%b3%cf%81%ce%b1%ce%bc%ce%bc%ce%b1-%cf%80%ce%b5%cf%81%ce%b9%ce%b2%ce%b1%ce%bb%ce%bb%ce%bf%ce%bd%cf%84%ce%b9%ce%ba%ce%ae%cf%82-%ce%b5%ce%ba%cf%80%ce%b1%ce%af%ce%b4%ce%b5%cf%85%cf%83/</p>
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4.2 Smart bins with solar panel

The EPAL-VET school in Kalambaka, Thessaly, have created smart recycling bins permanently located at the main corridor of the school and which students and teachers use every day, emphasizing the necessity of recycling and reinforcing the culture of green development.

<h2 style="background-color: #76b82a; color: white; padding: 5px;">Smart Bins With Solar Panel</h2>	
<p>2018-2020</p>	<p>Author(s): EPAL-VET school in Kalambaka, Thessaly</p>
<h3 style="background-color: #d9d9d9; padding: 5px;">Element</h3>	
<p>Goals of the best practice</p>	<p><i>What is the purpose or objective of the practice? Brief description.</i></p> <p>The purpose is to collect statistical data on recycling materials, such as the amount of materials recycled by the school, based on the specific weight of each material (paper, glass, plastic, metal) and the number of times each bin has been filled. This information is displayed on a large</p>



	<p>screen that is permanently installed above the bins and linked to a computer connected to the internet. This way it emphasizes the necessity of recycling and the reinforcement of the culture of green development.</p>
Target Group/Beneficiaries	<p><i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i> The beneficiaries are the students and the teachers of the school.</p>
Needed resources	<p><i>Which resources are needed to replicate and/or adapt the practice?</i> 4 recycling bins (paper, glass, plastic, metal) External metal shell to which the lid of the bin, the Arduino microcontroller, cables, power supplies are attached, while the bin is fully detachable. Digital servo motor mounted on a shaft, which is commanded by the Arduino microcontroller to lift the lid when the ultrasonic sensor located on the front detects an object in close proximity. Ultrasonic sensors on the lid of the bin, which depending on the height of the waste level provide information on how full the bin is. Digital lcd screens that display the percentage of fullness of each bin. Interface to the internet via special wifi modules to send data from the sensors. Smart TV 50" where sensor information is displayed through a special web platform. The installation and adjustment of an autonomous photovoltaic system, which supplies power to the system of smart recycling bins.</p>
Methodology	<p><i>A step-by-step description of the practice</i> The 4 bins will accept recycling materials. Arduino robotics technology will be used, motion mechanisms connected to distance sensors for automatic opening and sensors placed at appropriate locations at the bottom, middle and top of the bins. The sensor and motor are controlled by an arduino, which will be permanently powered and connected to a wifi module to continuously send data on the status of the bins (Internet Of Things). The information about the level will be displayed on special small digital lcd screens integrated in the front of each bin. All data will also be entered into a website, where a suitable dashboard will display graphical information on the status of the bins (full, below average, above average, etc.) and statistics on recycling materials.</p>





<p>Success Factors</p>	<p><i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i></p> <p>This practice was successful because the teachers and the students that participated to this project wanted to take recycling a step further by automating the process and making use of the statistical data collected in order to increase and make more productive their recycling process. Funding by the "Support and Management of the Action Plans" of the project "A New Beginning in the EPAL-VET schools" of the National resources and co-financed by the NSRF 2014-2020.</p> <p>This can be adopted in a large scale eg. by municipalities for monitoring the degree of recycling.</p>
<p>Competences of the GreenComp addressed</p>	<p><i>What specific competencies of the GreenComp have been addressed by this practice?</i></p> <p>The GreenComp competences addressed are promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.</p>
<p>Related Resources /Link</p>	<p><i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.).</i></p> <p><i>Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i></p> <p>https://mnae.noesis.edu.gr/%CE%B5%CF%80%CE%B1%CE%BB-%CE%BA%CE%B1%CE%BB%CE%B1%CE%BC%CF%80%CE%AC%CE%BA%CE%B1%CF%82-%CE%AD%CE%BE%CF%85%CF%80%CE%BD%CE%BF%CE%B9-%CE%BA%CE%AC%CE%B4%CE%BF%CE%B9-%CF%88%CE%B7%CF%86%CE%B9%CE%B1%CE%BA/</p> <p>https://www.tameteora.gr/topika/dimos-meteoron/349125/to-epal-kalampakas-oloklirose-to-schedio-drasis-prasini-energeia-kai-technologiea/</p> <p>https://1epal-kalamp.tri.sch.gr/mnae/2019/04/01/138/</p> <p>https://1epal-kalamp.tri.sch.gr/noesis/</p>

4.3 Electric vehicle- solar electric vehicle and solar energy power station

During the school year 2018-2019 the teachers and the students of 1st EPAL-VET school in Komotini, Thrace, designed and built an electric car. Following the production of this electric car in the school year 2020-2021 the students upgraded the vehicle with the installation of flexible photovoltaic panels and constructed a solar energy charging station.



Electric Vehicle- Solar Electric Vehicle And Solar Energy Power Station

2018-2021

Author(s): 1st EPAL-VET school in Komotini, Thrace

Element

<p>Goals of the best practice</p>	<p><i>What is the purpose or objective of the practice? Brief description.</i></p> <p>The objective was for the students using the practical application of the acquired knowledge to design an electrification system for a single-seater vehicle following the current trend in motoring.</p> <p>In addition, the use of solar panels can take advantage of solar energy to produce electric power. New technologies and inventions push the human mind to think and act in new ways.</p>
<p>Target Group/Beneficiaries</p>	<p><i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i></p> <p>The direct beneficiaries are the teachers and the students at the school. The indirect beneficiaries are the people of the local community that were acquainted with new technologies and as the principal and teachers at the school suggested this type of cars could prove beneficiary to older and disabled citizens in urban areas.</p>
<p>Needed resources</p>	<p><i>Which resources are needed to replicate and/or adapt the practice?</i></p> <p>Two electric motors, a battery pack, an electronic speed controller for the motors and electric accelerator.</p> <p>A sensor system based on a microcontroller was designed, which sends information about the speed of movement, distance from obstacles and the status of the batteries.</p> <p>The vehicle's electrical system was completed with a battery charging circuit. The sensor system can intervene in the movement of the vehicle such as braking the vehicle in case of an obstacle.</p> <p>Installation of flexible photovoltaic panels.</p> <p>A charging station, in the form of a city bus stop, with installed solar panels on the roof capable of charging an electric vehicle.</p> <p>The construction on a circuit board of a charging circuit that converts the electrical energy produced by the photovoltaic panels into constant electrical energy that charges the batteries of the charging station.</p> <p>An application was developed for Android operating system, which can be installed on a mobile phone and uses the wireless network to collect</p>



	<p>information such as the status of the batteries of the charging station and the car, the energy produced by the photovoltaic panels of the charging station and the car, while calculating the time required to fully charge the car.</p>
<p>Methodology</p>	<p><i>A step-by-step description of the practice</i></p> <p>With the help of the teachers of the Electro-electronics department, a drive system was implemented with two electric motors, a battery pack, an electronic speed controller for the motors and an electric throttle. At the same time, a sensor system based on a microcontroller was designed, which sends information about the speed of movement, distance from obstacles and the status of the batteries. The vehicle's electrical system was completed with a battery charging circuit. The sensor system can intervene in the movement of the vehicle such as braking the vehicle in case of an obstacle.</p> <p>Furthermore, the students designed a charging station, in the form of a city bus stop, where they installed solar panels on the roof capable of charging an electric vehicle. The stop was painted with eco-friendly paint to protect it from the weather, as the station was placed outdoors. This was followed by the construction on a circuit board of a charging circuit that converts the electricity generated by the photovoltaic panels into constant electricity that charges the batteries of the charging station. Using these batteries, the vehicle can be charged at the station at any time of the day regardless of the sunshine. In addition, the vehicle constructed in 2018-2019 was upgraded with the installation of flexible photovoltaic panels. Finally, an Android application was developed that can be installed on a mobile phone and uses the wireless network to collect information such as the status of the station and car batteries, the energy generated by the charging stations and the car's PV panels, while calculating the time required to fully charge the car.</p>
<p>Success Factors</p>	<p><i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i></p> <p>The willingness of the teachers and the students in addition to the funding by the "Support and Management of the Action Plans" of the project "A New Beginning in the EPAL-VET schools" of the National resources and co-financed by the NSRF 2014-2020 made this project successful and gave the opportunity to upgrade and transform it.</p>





Competences of the GreenComp addressed	<p><i>What specific competencies of the GreenComp have been addressed by this practice?</i></p> <p>The GreenComp competences addressed are promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.</p>
Related Resources /Link	<p><i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.).</i></p> <p><i>Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i></p> <p>https://www.youtube.com/watch?v=nVsF6fS7MQo</p> <p>https://www.youtube.com/watch?v=kI1r-gktgtA</p> <p>https://xronos.gr/epikairoitita/paroysiazetai-ilektrokinito-aytokinito-toy-1oy-epal</p> <p>https://mnae.noesis.edu.gr/portfolio/1%ce%bf-%ce%b5%cf%80%ce%b1%ce%bb-%ce%ba%ce%bf%ce%bc%ce%bf%cf%84%ce%b7%ce%bd%ce%b7%cf%83-%cf%8c%ce%bb%ce%bf%ce%b9-%ce%bc%ce%b1%ce%b6%ce%af-%ce%ba%ce%b1%cf%84%ce%b1%cf%83%ce%ba%ce%b5%cf%85%ce%ac/</p> <p>https://mnae.noesis.edu.gr/portfolio/1%ce%bf-%ce%b5%cf%80%ce%b1%ce%bb-%ce%ba%ce%bf%ce%bc%ce%bf%cf%84%ce%b7%ce%bd%ce%b7%cf%83-%ce%bf%ce%b9-%ce%b1%ce%bd%ce%b1%ce%bd%ce%b5%cf%8e%cf%83%ce%b9%ce%bc%ce%b5%cf%82-%cf%80%ce%b7%ce%b3/</p> <p>https://www.ypaithros.gr/1o-epal-komotinis-metatrepoun-iliaki-aktinobolia-ilektriko-reyma/</p>

4.4 Smart irrigation using automation and IT systems.

In 2019 the 1st EPAL- VET school in Kiato, Korinthos, developed a project to highlight the need to address the exponentially growing problem of land degradation and desertification by integrating the data of the digital revolution into agricultural practice. The students cultivated lettuce in the premises, aiming to inform the students about the possibility of using new technologies, but also to transfer the example and results of this process to the farmers of the surrounding area.

Smart Irrigation Using Automation And IT Systems



2019		Author(s): 1st EPAL-VET school in Kiato, Korinthos	
Element			
Goals of the best practice	<p><i>What is the purpose or objective of the practice? Brief description.</i></p> <p>The purpose was for the students to get informed about the possibility of using new technologies by integrating the data of the digital revolution into agricultural practice, but also the development of a protocol available to the local producers for raising awareness in smart and digital agriculture.</p>		
Target Group/Beneficiaries	<p><i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i></p> <p>The direct beneficiaries were the students and the teachers. The indirect beneficiaries were the local farmers that came acquainted with smart and digital agricultural practices and charitable foundations (hamogelo) that received 2000 lettuces grown in the school's fields.</p>		
Needed resources	<p><i>Which resources are needed to replicate and/or adapt the practice?</i></p> <p>An available field. Humidity sensors and an agro-meteorological station, as part of the implementation of an intelligent irrigation system. Appropriate software, with the aim of formulating a comprehensive proposal for irrigation characteristics (dose, duration, range). The quantitative and qualitative data of the irrigation is recorded periodically in technical bulletins.</p>		
Methodology	<p><i>A step-by-step description of the practice</i></p> <p>For the realization of the action, a part of the school field of 500 m² was used, where Romaine lettuce was planted at planting distances of 0.5 m on the rows and 1 m between them. The planting was carried out in two growing seasons, January - March and March - May. The crop was divided into two parts. In one, covering an area of 400 m², moisture sensors and an agrometeorological station were installed as part of the implementation of an intelligent irrigation system. The data is processed using appropriate software, with the aim of formulating an integrated proposal for irrigation characteristics (dose, duration, range). In the other 'witness' section, covering an area of 100 m², the traditional method is used, without the use of the system data, in order to compare the two irrigation methods at predefined, regular intervals.</p>		



	The quantitative and qualitative data on irrigation are recorded periodically in technical reports.
Success Factors	<p><i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i></p> <p>The necessary conditions for success are the combined efforts of the students and teachers. In addition, the intelligent agriculture system gaiasense by Neuropublic and the funding by the "Support and Management of the Action Plans" of the project "A New Beginning in the EPAL-VET schools" of the National resources and co-financed by the NSRF 2014-2020.</p>
Competences of the GreenComp addressed	<p><i>What specific competencies of the GreenComp have been addressed by this practice?</i></p> <p>The GreenComp competences addressed are promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.</p>
Related Resources /Link	<p><i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.).</i></p> <p><i>Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i></p> <p>https://1epalkiatou.blogspot.com/2019/06/blog-post_29.html?fbclid=IwAR3dMFHKuoBGxqOTkqOJ2DXYEm33cgHStC6b1fM9t8vW2KBPARbkI1WDP1k</p> <p>https://www.ypaithros.gr/1o-epal-kiatou-eksypna-maroulia-metadidoun-ofeli-eyfyous-georgias/</p> <p>https://mnae.noesis.edu.gr/portfolio/1o-%ce%b5%cf%80%ce%b1%ce%bb-%ce%ba%ce%b9%ce%b1%cf%84%ce%bf%cf%85-%ce%b7-%ce%ba%ce%b1%ce%b9%ce%bd%ce%bf%cf%84%ce%bf%ce%bc%ce%af%ce%b1-%ce%ba%ce%b1%ce%b9-%cf%84%ce%bf-%ce%b5%cf%80%ce%b9%cf%87/</p>

4.5 Virtual Net Metering

In the framework of the pilot program "A New Beginning in the EPALs", on 2018, the implementation of the construction of a Solar System took place by the 1st EPAL of Mytilene, in the context of Virtual Net metering. The students acquired know-how but also produced electricity made available to the local community.



Virtual Net Metering

2018

Author(s): 1st EPAL-VET school of Mytilene

Element

<p>Goals of the best practice</p>	<p><i>What is the purpose or objective of the practice? Brief description.</i> The aim of the action was to provide students with technical expertise on issues related to mild forms of energy and new technologies. Furthermore, through the action there was a connection between the school and society, as the energy produced from the construction was made available to the Mytilene Infant Care Centre - PIKPA of Mytilene.</p>
<p>Target Group/Beneficiaries</p>	<p><i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i> The beneficiaries are the teachers and the students at the school and from the local community a kindergarten that receives about 5000Wp the total of the produced energy.</p>
<p>Needed resources</p>	<p><i>Which resources are needed to replicate and/or adapt the practice?</i> Economical and spatial study for the placement of 300Wp solar panels with a total power of 5kWp. Seminars on the basics of installation and maintenance. With the installation of solar panels, solar energy is captured and electricity is produced, which is fed into the power grid.</p>
<p>Methodology</p>	<p><i>A step-by-step description of the practice</i> In the course of the action, an economic and spatial study was carried out by the students for the installation of 300Wp photovoltaic panels with a total power of 5kWp. Also, seminars on the basic principles of installation and maintenance were conducted by the supplying company, which were attended by students and teachers. With the installation of the photovoltaic panels, solar energy is captured and electricity is produced, which is fed into the power grid. The aim of the action was to give the students technical expertise in the field of soft energy and new technologies. Furthermore, through the action there was a connection between the school and the community, as the energy produced from the</p>



	<p>construction was made available to a facility designated by the Social Care of the Municipality of Lesvos.</p>
Success Factors	<p><i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i></p> <p>With the funding by the "Support and Management of the Action Plans" of the project "A New Beginning in the EPAL-VET schools" of the National resources and co-financed by the NSRF 2014-2020 and training by the supplying company, the students and teachers at the school acquired new competences and at the same time supported the local community.</p>
Competences of the GreenComp addressed	<p><i>What specific competencies of the GreenComp have been addressed by this practice?</i></p> <p>The GreenComp competences addressed are supporting fairness, promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.</p>
Related Resources /Link	<p><i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.).</i></p> <p><i>Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i></p> <p>https://mnae.noesis.edu.gr/portfolio/1%ce%bf-e%cf%80%ce%b1-%ce%bb-%ce%bc%cf%85%cf%84%ce%b9%ce%bb%ce%ae%ce%bd%ce%b7%cf%82/</p> <p>https://www.lesvospost.com/2018/07/1_11.html</p> <p>https://www.lesvospost.com/2018/05/virtual-net-metering-1.html</p> <p>https://www.ertnews.gr/perifereiakoi-stathmoi/voreio_aigaio/synergasia-metaxy-1oy-epal-mytilinis-kai-dimoy-lesvoy/</p>

4.6 An intelligent hub for the management of renewable energy sources and energy saving (APEX)

The APEX project has design and construct physical hubs at the Sivitanideio School in Athens and at the 1st EPAL of Mytilene including technological equipment for the development of a smart local electricity grid.



An Intelligent Hub For The Management Of Renewable Energy Sources And Energy Saving (APEX)

2022

Author(s): Sivitanideio School in Athens and 1st EPAL-VET school of Mytilene

Element

<p>Goals of the best practice</p>	<p><i>What is the purpose or objective of the practice? Brief description.</i></p> <p>The aim of the APEX project is to transfer scientific knowledge and experience on modern electricity systems to secondary education, focusing on renewable energy sources, energy saving and smart grids. The APEX hubs will be equivalent to academic laboratory standards, making the application unique and original in the context of Greek schools. Ensuring the operation of the nodes after the end of the APEX is of particular importance and a key pillar in the design of the project. The aim is to create the appropriate structures and train the necessary people to be able to operate and expand the nodes, while seeking additional resources. In order to achieve sustainability, teachers in the schools where the nodes will be installed will be trained to acquire the necessary knowledge and skills.</p>
<p>Target Group/Beneficiaries</p>	<p><i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i></p> <p>At first the beneficiaries of the practice are both the teachers and the students at the two schools who will be equally trained. The teachers so they can further transmit this knowledge to other students and the students to use these technological developments to combat the energy crisis through their professional development.</p> <p>All secondary education schools, professional training centres and lifelong learning centres in Greece will benefit through the creation of a physical hub at the Sivitanidio School in Athens.</p> <p>Students in remote areas of the country will have the opportunity to participate in innovative practices, through the creation of a physical hub in Mytilene.</p> <p>Open digital tools and educational material will be available to all students in the territory via the Internet. Possibility of remote access to the hub via the Internet (remote lab).</p>



	<p>A research culture will be cultivated through the application of modern educational methods such as guided inquiry and experiential learning, highlighting how science and engineering are linked to society and how they contribute to addressing current problems.</p> <p>Environmental awareness will be developed and raised for climate change by giving a broader perspective on a global problem.</p> <p>Familiarisation with the use of modern experimental apparatus, laboratory instruments and tools.</p> <p>Understanding and application of techniques to save and increase the energy efficiency of a building, in particular a school building.</p>
Needed resources	<p><i>Which resources are needed to replicate and/or adapt the practice?</i></p> <p>Digital tools that will give students/users access via the internet to the measured system parameters of each hub (voltage, current, power, etc.), as well as the possibility of remote control.</p> <p>Portable devices ("suitcases") on the issue of energy saving, which can be made available on loan to other schools.</p> <p>At the Sibitanideion hub, there will be additional equipment to familiarise the students with energy saving issues and related construction techniques.</p> <p>Accompanying digital educational material (slides, worksheets, etc.).</p>
Methodology	<p><i>A step-by-step description of the practice</i></p> <p>Digital tools were developed that will give students/users access via the internet to the measured system parameters of each hub (voltage, current, power, etc.), as well as the possibility of remote control. The equipment also includes portable devices ("suitcases") on the issue of energy saving, which can be made available on loan to other schools.</p> <p>At the Sibitanideion hub, there will be additional equipment to familiarise the students with energy saving issues and related construction techniques.</p> <p>Accompanying digital educational material (slides, worksheets, etc.) has been developed. The subjects covered by the educational material are electricity generation with a focus on renewable energy sources, energy storage, smart grids, energy saving, environmental footprint and climate change.</p>
Success Factors	<p><i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i></p>



	<p>As part of the APEX project, two physical hubs were built at the Sivitanidio school in Athens and at the 1st EPAL of Mytilene. These nodes are modern and include technological equipment for the development of a smart local electricity grid, like small RES generation units, photovoltaic panels, small wind turbine, storage units (batteries), metering devices, meteorological measuring instruments and the necessary electronic converters.</p> <p>Digital tools were also developed to give students/users access via the internet to the measured system parameters of each node (voltage, current, power, etc.), as well as the possibility of remote control.</p> <p>The research project APEX is funded by the Hellenic Foundation for Research and Innovation ELIDEK and is implemented in collaboration with the SmartRUE team of the National Technical University of Athens, and the energy start-up Community Energy River - CER.</p>
<p>Competences of the GreenComp addressed</p>	<p><i>What specific competencies of the GreenComp have been addressed by this practice?</i></p> <p>The GreenComp competences addressed are, promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.</p>
<p>Related Resources /Link</p>	<p><i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.).</i></p> <p><i>Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i></p> <p>https://apex.edu.gr/?fbclid=IwAR2RJQfLyg7JWgpsshH6fmn3DEhfYOEsqveUpgoBmTX1MV7XTbMbvPetXk</p> <p>http://1epal-mytil.les.sch.gr/cms/?page_id=1337</p> <p>https://www.ecotec.gr/emp-sivitanideios-synomilisan-gia-tin-energeia/</p> <p>https://www.youtube.com/watch?v=fqdh6wqXG7A</p>

4.7 Autonomous Robotic Metallic Recycler

In 2018 the 2nd EPAL of Herakleion, Crete created the CanBuddy a robotic metal recycler that moves autonomously in a space and allows the recycling of metal cans such as soda cans, food containers, etc. At the same time, it offers information, entertainment by showing news, videos, etc., as well as interactive online services. The recycler is dressed in themes for advertising purposes. It can be used in places such as museums, airports, public services, businesses, etc. This project was funded by the "Support and Management of the Action Plans" of the project "A New Beginning in the EPAL-VET schools" of the National resources and co-financed by the NSRF 2014-2020.



Autonomous Robotic Metallic Recycler

2018

Author(s): 2nd EPAL-VET school of Herakleion ,Crete

Element

Goals of the best practice	<i>What is the purpose or objective of the practice? Brief description.</i> The goal of this project was the use of open technologies in robotics.
Target Group/Beneficiaries	<i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i> The beneficiaries were the students at the school.
Needed resources	<i>Which resources are needed to replicate and/or adapt the practice?</i> Wemos D1 mini (ESP-8266EX) 3D printing for the base 2 x stepper motors 1 x carton box 30x30x40 1 x servo for opening and closing the lid 1 x metal detection sensor (Metal strip - cables) 1 x prototype board Arduino coding
Methodology	<i>A step-by-step description of the practice</i> The students collected the above mentioned materials and constructed the CanBuddy. Programming was done by Snap4Arduino using Arduino un r3, sensor shield v5.0, Ultrasonic sensor HC-SR04, motor shield L298n, infrared remote control module KY-022, 3x infrared tracking sensor KY-033, Bluetooth module HC-06 and 3x optical sensitive resistance LM393.
Success Factors	<i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i> The success factor was the originality of the CanBuddy. The students that developed this project successfully participated in Europe's leading technological event, Rome Maker Faire 2018. In addition, the school was invited to participate in the Berlin Maker Faire, to present itself to France's largest recycling organisation and to be privately funded for further development if the students so choose.



Competences of the GreenComp addressed	<p><i>What specific competencies of the GreenComp have been addressed by this practice?</i></p> <p>The GreenComp competences addressed are, promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.</p>
Related Resources /Link	<p><i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.).</i></p> <p><i>Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i></p> <p>https://mnae.noesis.edu.gr/portfolio/2%ce%bf%cf%85-%ce%b5%cf%80%ce%b1-%ce%bb-%ce%b7%cf%81%ce%b1%ce%ba%ce%bb%ce%b5%ce%af%ce%bf%cf%85-%ce%b1%cf%85%cf%84%cf%8c%ce%bd%ce%bf%ce%bc%ce%bf%cf%82-%cf%81%ce%bf%ce%bc%cf%80%ce%bf%cf%84%ce%b9/</p> <p>https://edu.ellak.gr/wp-content/uploads/sites/11/2018/09/%CF%80%CE%B1%CE%BD%CE%B1%CE%B3%CE%B9%CF%89%CF%84%CE%B1%CE%BA%CE%B7%CF%82%CE%91%CE%BD%CE%BF%CE%B9%CE%BA%CF%84%CE%B5%CF%82-%CE%A4%CE%B5%CF%87%CE%BD%CE%BF%CE%BB%CE%BF%CE%B3%CE%B9%CE%B5%CF%82-%CE%BA%CE%B9-%CE%95%CE%BA%CF%80%CE%B1%CE%B9%CE%B4%CE%B5%CF%85%CF%84%CE%B9%CE%BA%CE%B7-%CE%A1%CE%BF%CE%BC%CF%80%CE%BF%CF%84%CE%B9%CE%BA%CE%B7.pdf</p> <p>http://2epal-irakl.ira.sch.gr/?p=2384</p> <p>https://www.facebook.com/profile/100064228857138/search/?q=2%CE%BF%CF%85%20%CE%95%CE%A0%CE%91.%CE%9B.%20%CE%97%CF%81%CE%B1%CE%BA%CE%BB%CE%B5%CE%AF%CE%BF%CF%85%20%CE%B5%CE%AF%CE%BD%CE%B1%CE%B9%20%CE%BF%20CanBuddy</p>

4.8 Bioclimatic Technology Museum

The students at Thira, Santorini day EPAL designed, studied and constructed a Bioclimatic kiosk which was enriched with renewable energy systems (Solar panel and Wind turbine). This project was funded by the "Support and Management of the Action Plans" of the project "A New Beginning in the EPAL-VET schools" of the National resources and co-financed by the NSRF 2014-2020.



Bioclimatic Technology Museum

2021

Author(s): Day EPAL-VET school Thira, Santorini

Element

<p>Goals of the best practice</p>	<p><i>What is the purpose or objective of the practice? Brief description.</i> The purpose of this practice was to construct a Bioclimatic kiosk with multiple uses including its conversion into a Bioclimatic Museum.</p>
<p>Target Group/Beneficiaries</p>	<p><i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i> The beneficiaries are the students at the school.</p>
<p>Needed resources</p>	<p><i>Which resources are needed to replicate and/or adapt the practice?</i> The construction was based on traditional, environmentally friendly techniques, which are combined with modern forms of energy production such as solar and wind energy.</p>
<p>Methodology</p>	<p><i>A step-by-step description of the practice</i> The students designed, studied and built a Bioclimatic kiosk with multiple uses including its conversion into a Bioclimatic Museum. The construction was based on traditional, environmentally friendly techniques combined with modern forms of energy production such as solar and wind. The first grade students, in collaboration with the Department of Structures and Mechanical Engineering, chose the site right next to the greenhouse that was built in 2020. Installation of the frame, a solar panel system for an autonomous lighting system, and an integrated wind turbine system on the roof were carried out. Then, with the assistance of the Department of Agriculture, an irrigation system was installed in the existing greenhouse, which was connected to the Bioclimatic kiosk from which it is powered by electricity. Finally, the space was converted into a Bioclimatic Museum, which also serves as a showcase for organic products and technologies.</p>
<p>Success Factors</p>	<p><i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i> The success of this practise is that the students with the collection of available information on environmental and sustainability issues gained</p>



	valuable knowledge which can be transferred through the bioclimatic museum to the rest of the students but also to visitors of the school. In addition, with the instalment of the renewable energy sources they have automated their greenhouse adding value to organic farming practices.
Competences of the GreenComp addressed	<i>What specific competencies of the GreenComp have been addressed by this practice?</i> The GreenComp competences addressed are, promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.
Related Resources /Link	<i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.). Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i> https://mnae.noesis.edu.gr/portfolio/%ce%b7%ce%bc%ce%b5%cf%81%ce%b9%cf%83%ce%b9%ce%bf-%ce%b5%cf%80%ce%b1%ce%bb-%ce%b8%ce%b7%cf%81%ce%b1%cf%83-%ce%bc%ce%bf%cf%85%cf%83%ce%b5%ce%af%ce%bf-%ce%b2%ce%b9%ce%bf%ce%ba%ce%bb%ce%b9%ce%bc/ https://epaliofikanea.wixsite.com/epaliofikanea/post/%CE%AD%CE%BD%CE%B1-%CE%B2%CE%B9%CE%BF%CE%BA%CE%BB%CE%B9%CE%BC%CE%B1%CF%84%CE%B9%CE%BA%CF%8C-%CF%80%CE%B5%CF%81%CE%AF%CF%80%CF%84%CE%B5%CF%81%CE%BF-%CF%83%CF%84%CE%B7%CE%BD-%CE%B1%CF%85%CE%BB%CE%AE-%CF%84%CE%BF%CF%85-%CE%B5%CF%80%CE%B1%CE%BB-%CE%B8%CE%AE%CF%81%CE%B1%CF%82

4.9 Energy in our lives

In 2022 the students at the 8th EPAL in Thessaloniki, understood the concept of energy and its forms, calculated their energy footprint and raised their 'energy' and 'environmental' awareness. The students also learned about the importance of increasing the share of renewable energy in the global energy mix, as well as raising awareness on issues related to climate change mitigation, adaptation and early warning. This project was funded by the "Support and Management of the Action Plans" of the project "A New Beginning in the EPAL-VET schools" of the National resources and co-financed by the NSRF 2014-2020.

Energy In Our Lives



2022

Author(s): 8th EPAL-VET school in Thessaloniki

Element

<p>Goals of the best practice</p>	<p><i>What is the purpose or objective of the practice? Brief description.</i> The aim of this practice was for students to understand that the indiscriminate use of non-renewable energy sources has led to an energy crisis and environmental pollution, which primarily affects human health. To understand that the first step in solving the energy problem is to save energy and the second step is to use the appropriate renewable energy sources for each region. To adopt positive attitudes and behaviours towards the prudent use of energy at individual, national and international level.</p>
<p>Target Group/Beneficiaries</p>	<p><i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i> The students at the school.</p>
<p>Needed resources</p>	<p><i>Which resources are needed to replicate and/or adapt the practice?</i> The necessary resources are the engagement of the students to this task, the collection of all the information and the production of the school's posters, calendars, and story books for preschoolers.</p>
<p>Methodology</p>	<p><i>A step-by-step description of the practice</i> Initially the students collected information on the production of energy, different sources and their advantages and disadvantages. Then the researched for all the types of renewable energy and how this can be utilised. The students then created posters that decorated the corridors of their school. They also created year calendars providing useful information, energy saving advice and fun crosswords related to energy. Next the students created flyers on the types of energy (pros and cons), climate change, and energy saving advise. Following they created a model of a city-a village-a hill side with wind turbines. Finally, the students created and illustrated story books for preschoolers about the energy. This action was completed with physical visits to sites of renewable energy production.</p>



<p>Success Factors</p>	<p><i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i></p> <p>This practice was successful because the students became aware of their energy footprint. They understood where energy comes from the consequences of non renewable energy like pollution, climate change, global warming, acid rain, etc.</p> <p>They learned about the types of renewable energy and how these could help mitigate climate change. Finally story books were produced to help explain all these issues to preschoolers.</p>
<p>Competences of the GreenComp addressed</p>	<p><i>What specific competencies of the GreenComp have been addressed by this practice?</i></p> <p>The GreenComp competences addressed are, promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.</p>
<p>Related Resources /Link</p>	<p><i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.).</i></p> <p><i>Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i></p> <p>https://mnae.noesis.edu.gr/8%ce%bf-%ce%b5%cf%80%ce%b1-%ce%bb-%ce%b8%ce%b5%cf%83%cf%83%ce%b1%ce%bb%ce%bf%ce%bd%ce%b9%ce%ba%ce%b7%cf%83-%ce%b7-%ce%b5%ce%bd%ce%b5%cf%81%ce%b3%ce%b5%ce%b9%ce%b1-%cf%83%cf%84%ce%b7-%ce%b6%cf%89/</p> <p>http://8epal-thess.thess.sch.gr/?p=5168</p> <p>https://read.bookcreator.com/library/-NKSYPsKzVNHhb5qGK-e/book/x2LLJQTzRfS3_xDvOkWY-Q/I1ztdQ08TO6sMh7CuLHUw</p>

4.10 Optimising plant growth with new technologies

For the school year 2022-23 the students at 1st EPAL in Thiva, Boeotia, constructed an enclosed seedbed and proceeded to germinate and grow plants under controlled conditions using new technologies. This project was funded by the "Support and Management of the Action Plans" of the project "A New Beginning in the EPAL-VET schools" of the National resources and co-financed by the NSRF 2014-2020.



Optimising Plant Growth With New Technologies

2023

Author(s): 1st EPAL-VET school in Thiva, Boeotia

Element

<p>Goals of the best practice</p>	<p><i>What is the purpose or objective of the practice? Brief description.</i> The purpose of this practice was for the students to record the differences of cultivation under controlled conditions using new technologies like an enclosed seedbed and agro-meteorology versus conventional agriculture.</p>
<p>Target Group/Beneficiaries</p>	<p><i>Who are the beneficiaries (direct or indirect) of the practice? How many are there? (If available, disaggregated data by gender and age)</i> The beneficiaries are the students at the school that learn how to use new technologies for optimising agriculture.</p>
<p>Needed resources</p>	<p><i>Which resources are needed to replicate and/or adapt the practice?</i> Construction of an enclosed seedbed in which temperature, soil moisture and atmospheric humidity are controlled by automation. Sensors, camera, light, resistances and automatic watering to control the above conditions. Installation of a camera to take pictures of the germination and growth of the plants. The esp32 cam which was programmed with Arduino ide was used to take the photos of the system. Also, on the esp32 microcontroller for the basic control of the system (sensors and outputs) the programming was done with tasmota software. The synchronization of the microcontrollers was done with the Raspberry Zero microcomputer and the programming was done with node-red. Growing vegetables on an experimental farm. Recording data on temperature, humidity, wind and rainfall from the weather station and the camera installed at the school's weather station.</p>
<p>Methodology</p>	<p><i>A step-by-step description of the practice</i> The students in cooperation with the teachers built an enclosed seedbed in which the temperature, soil moisture and humidity are controlled by automation. Specifically, sensors, camera, light, resistors and automatic watering were used to control the above conditions. In addition, a camera was installed to take photographs of germination and plant growth. The esp32 cam which was programmed with Arduino ide was used to take the photos of the system. Also, on the esp32 microcontroller for the basic control of the system (sensors and outputs) the programming was done with tasmota</p>



	<p>software. The synchronization of the microcontrollers was done with the Raspberry Zero microcomputer and the programming was done with node-red. The students experimentally sowed bean seeds in an outdoor field seedbed and in the indoor seedbed to observe the differences in terms of germination and growth time. The conclusion was that in the indoor seedbed there was 100% germination of the seeds, and the germination time was shorter.</p> <p>In addition, the students in collaboration with the teachers grew vegetables in an experimental farm. Daily they recorded meteorological data from the weather station and the camera installed at the school's weather station. Then, considering the weather conditions they applied integrated farm management. They observed the effect of weather conditions on the development and outbreak of pests and diseases in vegetable crops.</p>
<p>Success Factors</p>	<p><i>What are the conditions, internal (classroom elements, systems, and tools) and external (institutional, economic, social, etc.), necessary to make this practice successful?</i></p> <p>This practice is successful because students learn with the aid of technology how to optimise cultures depending on the climatic conditions. The gained knowledge can be an investment for their future professional decisions and can also be transferred to conventional agriculturiers.</p>
<p>Competences of the GreenComp addressed</p>	<p><i>What specific competencies of the GreenComp have been addressed by this practice?</i></p> <p>The GreenComp competences addressed are promoting nature, systems thinking, critical thinking, problem framing, futures literacy, adaptability, exploratory thinking, collective action and individual initiative.</p>
<p>Related Resources /Link</p>	<p><i>Establish a list of references related to the practice (training manuals, guidelines, photos, videos, web pages, etc.).</i></p> <p><i>Link to the home page of the experience in question. If possible, contact the organisation and/or person who carried out the practice.</i></p> <p>https://mnae.noesis.edu.gr/%ce%b2%ce%b5%ce%bb%cf%84%ce%b9%cf%83%cf%84%ce%bf%cf%80%ce%bf%ce%af%ce%b7%cf%83%ce%b7-%ce%b1%ce%bd%ce%ac%cf%80%cf%84%cf%85%ce%be%ce%b7%cf%82-%cf%86%cf%85%cf%84%cf%8e%ce%bd-%ce%bc%ce%b5-%ce%bd%ce%ad/</p> <p>https://1epal-thivas.voi.sch.gr/wordpress/%ce%b2%ce%b5%ce%bb%cf%84%ce%b9%cf%83%cf%84%ce%bf%cf%80%ce%bf%ce%af%ce%b7%cf%83%ce%b7-</p>



<https://permissos.gr/2023/06/13/ekdiloseis/permissosgmail-com/%CE%BC%CE%B9%CE%B1-%CE%BD%CE%AD%CE%B1-%CE%B1%CF%81%CF%87%CE%AE-%CF%83%CF%84%CE%BF-%CE%B5%CF%80%CE%B1%CE%BB-%CE%B8%CE%AE%CE%B2%CE%B1%CF%82%CE%B2%CE%B5%CE%BB%CF%84%CE%B9%CF%83%CF%84%CE%BF%CF%80%CE%BF/>



Conclusions

We have seen that in the last decades the Greek educational system has made several attempts to integrate environmental awareness and education in primary and secondary education. Yet these attempts were not holistic or targeted in a way that could guarantee the student's knowledge on sustainability in such a way that could change their attitude, ideas, and way of living for the planet's better future. In addition, we have seen that the educators and trainers themselves feel that their training on the subject is insufficient to be able to support the needs of their students and be able to provide them with the right content and practical examples for learners to change their behaviour and act for sustainable development. This was supported by the responses collected in the 15 interviews. Where it was pointed out that the efforts for implementing sustainability education need to be upscaled.

The Greek VET education, at least at the level of upper secondary education, is trying to become part of the new more sustainable and greener professional world. Students as seen from the 10 best practises presented in this report, do their best to gain the skills and competences required for a more sustainable future. This, however, isn't enough. These and many more students should become equipped with knowledge on sustainability not only as technical and technological advances but as knowledge of everyday living. This year the whole world has become more aware of the need of an immediate response and action for tackling climate change. Educational systems need to hold their end of the responsibility in producing responsible, competent and aware citizens that can make amends where previous generations couldn't.