

## **Entrepreneurial and Scientific Educational Methodologies of activating High School students.**

The aim of this document is to shed light on modern, active learning educational methodologies through entrepreneurship and science, which may induce, motivate, and secure a high level of High School students' hands-on participation in PULCHRA project.

High School students are certainly the most challenging age group to engage in PULCHRA project. This programme offers students learning experiences for the sake of learning and the satisfaction of attaining positive results on quality of life of people living in urban areas.

Creative teachers can engage students by trying team-building activities, adding visual components, and making learning a game, connecting material to current events, and leading by example.

School programmes and activities involving entrepreneurship and science have proven to be extremely attractive and efficient frameworks for inducing students and securing fine results.

Students can work together within schools, through specific organisational frameworks and by cooperating with scientists, professionals, coaches, mentors, research institutions, mass media and local authorities. The aim is to demonstrate that the equilibrium between economic growth, quality of life, climate protection and universal values will lead to viable city environments.

Such organisational schemes may include:

1. Virtual Enterprise – Junior Achievement Company Programme
2. Engolve Entrepreneurship Greece
3. Diamond Challenge for High School Entrepreneurs
4. Junior Squeazy Entrepreneurship Programme
5. Social Innovation Relay Programme
6. City Challenge: Crowd Hackathon # Smart City 2
7. Smart Statistics for Smart Cities
8. eTwinning
9. Coaching
10. Science Student Clubs at Schools.

Each of these frameworks will be thoroughly described in the following sections to understand what they are and how they work, by giving certain examples that verify their relativeness and effectiveness as means to support and serve the purposes of the PULCHRA project. From existing data, it can be inferred that all these frameworks involve a combination of entrepreneurial, technological and scientific knowledge, secure a high degree of students' activation and, therefore, they can be used to safely promote the purposes and ideas of PULCHRA with success.

# Virtual Enterprise – Junior Achievement Company Programme

## Description

One of the finest ways to activate students in the framework of PULCHRA is through the [Company Programme offered by Junior Achievement](#). Company Programme offers students aged 15-18 the opportunity to learn how to move a business idea from concept to reality. The programme provides teachers with a series of learning-by-doing business, economics and entrepreneurship activities, a great way to help students succeed in a global economy.



In 2017-2018 school year, over 350,000 students enrolled in the programme across the [40 JA organisations in Europe](#) that offer it.

The Junior Achievement framework seems to be the most appropriate scheme to respond to the demands of the PULCHRA project since it involves all the following valuable elements: innovation, cooperation with many outside partners, scientific research, a broad participation of students and a real opportunity to improve quality of life in cities.

## Methodology

In many schools, either Gymnasium or Lyceum, public and private, small groups of students are forming their “virtual” enterprise, under the guidance of a teacher, and with the help of a mentor, usually supplemented by Junior Achievement. Students create the organisational form of the company, participate in forming the capital of the company and select their leaders for crucial positions.

The most demanding task is, however, the process of evaluating different business ideas and selecting the one which better reflects the philosophy and the vision of members. This idea must secure to a certain degree innovation, technical effectiveness and financial viability and have a positive overall impact on people’s life.



Virtual enterprises are developing closed ties with local authorities, scientists, research centres, mass media, parents' associations and private enterprises specialised in high technology and communication. It is with their help that students proceed to the production of an innovative product or service. Students undertake the responsibility to promote and sell their products inside school, organise their financial statements and prepare to participate in the internal and external evaluation of their progress.

Virtual enterprises participate to various events inside school, and they have their first external evaluation in a central exhibition with the participation of all schools. After that, teams submit their business plan, and they claim their participation in the final with the best 10 teams.



### Example

FlowOn was the winning team for 2021 in Junior Achievement Competition for High Schools in Greece. The same team won the [2<sup>nd</sup> place in the pan-European final](#) between many European participants from different countries.

FlowOn of the Experimental High School of the University of Macedonia has the vision of a sustainable future for all and a mission to develop innovative technologies and take initiatives to reduce our water footprint.

The team designed and created, using robotic technology and 3D printing technique, an accessory, which is placed on each type of external faucet in a few seconds, turning it into a "smart" - automatic faucet that automatically opens and closes with motion sensors, locks when not in use, and does not require user contact. This drastically reduces water waste and consumption costs, while substantially helps reducing the spread of germs.

## Engolve Entrepreneurship Greece

### Description

During 2020-2021, the [first Pan-Hellenic Youth Entrepreneurship Contest](#) focused on Sustainable Development was conducted with the participation of public and private schools.

The students' ideas included projects that offered sustainable products and services for everyday life and nutrition, proposals for sustainable cities, environmental monitoring and revitalisation, offering environmental work, social networking and support, waste management and product production.

The participating teams of the competition were evaluated in terms of the business idea and its business model-business plan, the orientation towards sustainable development, the quality of the final product/ service, the video presentation of their final product/service, the innovation, and the ability to use new technologies.



### Methodology

The competition, which targeted High School students, was validated by the Ministry of Education, Research and Religious Affairs. Its aim was to stimulate students in secondary education to engage in entrepreneurship, combined with environmental protection and sustainability at the heart of their strategy.

Groups of up-to-four students were formed with the mandatory coordination by a teacher. Groups completed and submitted an online application form while support has been given to participants through video conferences/ webinars.

The timetable has been, as follows: February 28, 2021: Deadline for electronic submission of business ideas, March 1-March 19, 2021: Evaluation and announcement of the business proposals that qualified in the final phase, April 11, 2021: Final competition and awards.

### Examples

1. First Place: Team R.A.I.S.E. (Reusable, Advanced, Innovative, Safe, Economical) from the 1<sup>st</sup> Lyceum of Philothei, Athens. The team built a bench from compressed recycled materials, which was painted with photocatalytic paints including recycling bins with filling sensors whose energy needs are met by solar panels.
2. Team AIRMEIS: The group took the form of a Social Cooperative Enterprise and records air pollution through sensors (using Arduino technology). The Municipality and the Civil Protection upload the information to an application, which is downloadable.

## Diamond Challenge for High School Entrepreneurs

### Description

The [Diamond Challenge](#) is a global High School Entrepreneurship Competition organised by the University of Delaware Horn Entrepreneurship since 2012. It involves the creation, submission and presentation of original content in the form of business and social venture concepts. Each Diamond Challenge submission and presentation represents an original work that has been created by a team of 2-4 High School students.

Every year more than 30 teams from private and public schools in Greece submit and present their entrepreneurial ideas in front of a committee. The best idea represents Greece to semi-final and final rounds at Delaware, USA. The whole process is conducted at Pierce-The American College of Greece.



### Methodology

Teams must be comprised of 2-4 High School students typically between 14-18 years at the time of the submission deadline and must be enrolled in an official High School/ secondary education institution or programme for the duration of the Diamond Challenge.

Teams require one adult advisor (21 years old or older) who can provide the opportunity to participate and be broadly available to offer support to the team.

Each team works based on its business idea and with the help of experts from all areas. By the end of December, the presentations are sent to the organiser and are evaluated by external judges. Of these, the top ten compete against each other during the mid-February-March pitch event and the winning team represents the country in the semi-finals and finals held in USA.

### Examples

- 1<sup>st</sup> Place 2020 world final, Business Innovation: Astrofilter is a self-clearing filter designed to remove debris from spacecraft ventilation systems, increasing the efficacy of CO<sub>2</sub> removal units.
- 3<sup>rd</sup> Place 2020 world final, Social Innovation: EZ Water is determined to defy the challenge of affordability and accessibility to provide clear drinking water to masses worldwide. The team from Pakistan in collaboration with scientists and engineers has constructed a filter that cleans water.

## **Junior Squeezy Entrepreneurship Programme**

### **Description**

The Innovative Pitching Entrepreneurship Competition “[Junior Squeezy](#)” is organised by [Orange Grove](#), the international start up incubator in Athens, initiated by the Dutch Embassy in Athens with the participation of young students aged 15 to 17.

Junior Squeezy offers students, who participate either individually or as a team, the opportunity to understand the profile and actions of an entrepreneur and discover the skills needed to follow a successful business course in the future. The programme, which runs from March to May every year, aims to educate, advise and prepare participants to meet the demands of the modern, global economy by fostering a culture of innovation and entrepreneurship.

The students’ teams, after having attended interactive lessons for the development and promotion of their business idea by the experienced mentors and coaches of Orange Grove, present their ideas on stage during the Pitching Competition, which marks the completion of the programme.

### **Methodology**

During the 3-month programme, students are attending training sessions delivered by the Orange Grove’s network of experienced mentors and coaches to develop and promote their entrepreneurial ideas. Students are also working together with scientists, researchers and members of the local business community to develop and formulate their business idea.

### **Example**

In the first place for 2020 Junior Squeezy Competition was the team of Bio Bottles, which had the pioneering idea for a disposable bottle made of biodegradable polyester (polylactic acid), which will replace the existing disposable single-use plastic bottles.

## Social Innovation Relay Programme

### Description

[Social Innovation Relay](#) is a global initiative that brings together experienced business mentors and students to advance real world social problem solving in their local communities and beyond.

The Social Innovation Relay (SIR) is the primary activity in the collaboration with NN Group. The competition challenges secondary school students to develop an innovative business concept that addresses a social need. SIR provides young people with the hands-on skills and entrepreneurial expertise needed to start a successful career through a combination of virtual and face-to-face mentoring by experienced executives.



The participating teams are paired with e-mentors who are all business volunteers and who connect with the best 20 teams in each participating country, to help them develop concept papers that can translate into feasible business ideas. Social innovations are solutions that address social need which can be found in the following sectors: education, health, social innovation, livelihood development, and sustainability.

### Methodology

As the project is introduced into schools, a series of Social Innovation case studies are run by Volunteers, in schools or online, to give students a first understanding of the concept of social innovation. After they take part in the case studies, students move to the online platform where the competition begins.

The first part of the relay consists of an interactive, web-enabled learning platform, where students register and take the “Social Innovation Relay Quiz”. This quiz is meant to give them a better understanding on what the social innovation field is and how they can create a change. Once students pass the quiz, they are eligible to form teams and submit their socially innovative business concept.

During the next part of the relay, the entries are reviewed by the Junior Achievements’ national office. The top 20 teams advance to the next round of the competition and are eligible for volunteer mentors. Mentors counsel the student teams to help them refine and perfect their concepts, either in person and/ or via the latest interactive meeting technology and online resources. Mentors provide counsel on improving the commercial viability of the ideas and how to boost the impact of concepts. The relay culminates in a global final round of evaluations of the national winners and the announcement of the global winner. Students go online to defend their idea.

### Examples

On June 22, 2021, the global final competition of the Social Innovation Relay took place online. The first two places were given to Scribo Markers from Slovakia and Esperanza from Singapore, respectively.

1. Scribo Markers’ vision was to make every school and company progressively more sustainable through a novel and ecological way of writing on whiteboards. Thanks to their innovative wax composition, these markers never dry out and do not need a plastic cover, thus producing less waste.
2. Resistable, created by Team Esperanza, is a one-stop guide for sustainable wardrobe management. It allows consumers to make greener purchases and facilitates the decision-making process through behavioural change and positive reinforcement, effectively reducing garment waste and building a community of environmentally conscious individuals.

## City Challenge: Crowd Hackathon # Smart City 2

### Description

Following the successful *City Challenge Crowd Hackathon # smart city 1*, the [Central Union of Greek Municipalities](#) (KEDE) has organised the *2<sup>nd</sup> Innovation Marathon City Challenge Crowd Hackathon # smart city 2* from June 28 to July 1, 2018, at Stavros Niarchos Foundation Cultural Centre (SNFCC).

At the City Challenge Crowd hackathon # smart city 2, different groups participated regardless of experience, cognitive background or studies. They all worked together so that teams could present pilot services and applications to solve Local Government problems, have business and/ or social interest, improve the quality of life and support local and national development through new technologies. The Marathon hosted special events such as a student innovation contest and city labs in 16 Greek cities.



### Methodology

Secondary/ High School students participated in the student innovation contest of KEDE. Regarding the contest's thematic areas, teams submitted suggestions and ideas related to one or more of the following topics: improving the quality of life in cities, friendly Municipality, improving the environment and public health and providing solutions to everyday life problems students and citizen face.

Each idea should include a pdf/ ppt file (presentation) of up to 10 pages, photos etc. It should also cover the following contents: summary of the idea, benefits for the citizens, benefits for the city, application example. The proposals were submitted online and were assessed by the evaluation committee, based on their innovation, creativity and applicability features. Fifteen winners (teams) from all over Greece presented their ideas and five winners (teams) were awarded prizes.

### Examples

1. The first prize was awarded to the team Needsa for their application Happy Trees. It is about remote irrigation of green areas with the ability to collect weather, soil moisture data and so on.
2. The second prize was awarded to the team MX2T for their application "Social wallet for vulnerable groups".
3. The third prize was awarded to the team City Hub for their application API Dashboard that links existing applications of Municipalities.



## Smart Statistics for Smart Cities

### Description

Between 5-6 October of 2018, an International Conference was held in the city of Kalamata, Messinia, Greece. The title of the conference was 'SmartStatistics4SmartCities' and it was co-organised by [Eurostat](#), the [Hellenic Statistical Authority](#) (ELSTAT), the [National Documentation Centre](#) (EKT), the [2<sup>nd</sup> Lyceum of Kalamata](#) and the [City of Kalamata](#). Speakers from various countries participated in the conference representing city administrations, academic institutions, the private sector and statistical offices.



The aim of the conference was to raise awareness about the importance of building sustainable partnerships between official statistics, municipalities, academic institutions, schools, citizens and businesses. The potential of data analytics for informed policy decisions on cities can be maximised, for the wellbeing of the people living, working and/ or visiting them and for the operation of the businesses with activity in and with them.

Smart Statistics can be seen as the future extended role of Official Statistics in a world impregnated with smart technologies. Smart technologies involve real-time, automated, interactive technologies that optimise the physical operation of appliances and consumer devices. Statistics themselves would then be transformed into a smart technology embedded in smart systems that would transform "data" to "information".

### Methodology

Regarding schools' participation of in the conference, 35 groups of students from different Greek High Schools qualified from about 80 proposals. These groups attended the competition and presented their ideas on Saturday, June 30, 2018, at the Lighthouse of the SNFCC. The prizes were worth a total of 6,500 euros. Each team consisted of 8-10 students per High School and worked with the assistance of a teacher. Students carried out their research with the help of specialised scientists, made measurements, prepared a presentation and sent their work to the evaluation committee.

### Examples

Eight High Schools were awarded for their innovative research.

1. 1<sup>st</sup> Experimental High School "Manolis Andronikos", A' Lyceum, Group "*Thesspesies*": Bracelet for bid boarding ticket.
2. 1<sup>st</sup> Experimental Lyceum from Thessaloniki, Group "*Thessaloniki*": Sign language in text.
3. 2<sup>nd</sup> Gymnasium of Moschato, A' Gymnasium, Group "*Ecosquad*": Smart Can/ Bucket Sensor.
4. 5<sup>th</sup> General Lyceum of Heraklion, Crete, B' Lyceum, Group "*System Overload*": Robotic Garbage Collection.
5. General Lyceum of Agias, B' Lyceum, "*Gold Citizen*" Group: Cigarettes Butts.
6. 4<sup>th</sup> General Lyceum of Mytilene, A' Lyceum, Group "*Cypher Group*": Tomato Collection with one move.
7. Gymnasium of Kos, A' Gymnasium, Team "*The three friends*": Recycling-Education.
8. Zipariou Gymnasium, C' Gymnasium, Group "*Sensor for the level of noise pollution in cities*": Sensor for the level of noise pollution in cities.

## eTwinning

### Description

[eTwinning](#) is the community for schools in Europe. eTwinning promotes school collaboration in Europe using Information and Communication Technologies (ICT) by providing support, tools and services for schools. eTwinning also offers opportunities for free and continuing online professional development for educators.

Launched in 2005 as the main action of the European Commission's eLearning Programme, eTwinning offers a platform for staff (teachers, head teachers, librarians, etc.) working in a school in one of the European countries involved to communicate, collaborate, develop projects, share and, in short, feel and be part of the most exciting learning community in Europe. eTwinning is co-funded by Erasmus+, the European programme for Education, Training, Youth and Sport.

### Methodology

Its Central Support Service is operated by [European Schoolnet](#), an international partnership of 34 European Ministries of Education developing learning for schools, teachers and students across Europe.



eTwinning is further supported at national level by 38 National Support Organisations. The eTwinning portal is the entry point to the *eTwinning world*. Available in 28 languages, *eTwinning.net* offers news from the eTwinning countries, professional development opportunities, information about recognition as well as examples of successful projects.

Teachers can search for other registered eTwinners and schools, connect with them and follow their activities. They can also access all the online and on-site events created by eTwinners and create their own. Through *eTwinning Live*, teachers can create their own projects in which they can set off activities on different topics and key competences by collaborating with two or more teachers and their students.

### Examples

1. Team "*Climate Volunteers*" from Ukraine won the first place in the e-twinning European 2020-2021 prizes in the age category 16-19. Global climate change, which is one of the biggest environmental problems of our age, threatens all living things on the planet. The project aimed to raise awareness about mitigating and adapting to the impacts of climate change from global problems. In addition, contribution would be made to the development of 21<sup>st</sup> century skills, such as participation in discussions, taking responsibility, communicating, collaborative work, using digital tools consciously and effectively, cultural understanding and foreign language proficiency.
2. Team "*eco\_fab\_lab*" from France and Germany won the Prize for the special category "Citizenship" for 2021. Too often, people tend to blame our indifferent society but in doing that we forget that 'we are society'. This is a short but intense make-change-happen project. The students worked in transnational teams using Arduino technology, single-board microcontrollers and microcontroller kits for building digital devices, which can interact with the environment using sensors and actuators. As for the [Sustainable Development Goals](#) (SDGs), the 'they-don't-apply-to-me' mentality would be overcome by the understanding that not only governments or multi-nationals have to be involved, but each single individual has an important role to play.

## Coaching

### Description

Coaching in primary, secondary, and tertiary education has seen a period of sustained growth over the last 15 years. The term covers a broad range of interventions that have the aim of improving outcomes for learners within educational settings. Coaching is a powerful tool for personal change and learning. At the core of the coaching approach is the facilitation of learning, using active learning and inquiry and providing appropriate challenge and support. It aims at unlocking people's potential to maximise their own performance. Coaching is different from mentoring, teaching or tutoring. It helps a student to self-discover himself.

### Methodology

Coaching in secondary education is a one-to-one conversation that focuses on the enhancement of learning and development through increasing self-awareness and a sense of personal responsibility.

The coach facilitates the self-directed learning of the coachee through questioning, active learning and appropriate challenge in a supportive and encouraging climate.

Global framework for coaching in secondary education focuses on four areas: student success and wellbeing, educational leadership, professional practice and community engagement.

Coaching creates a common approach to working together on activities and solving problems and great questions and listening; it encourages students to work together. This provides opportunities to learn from each other and develop the skills of collaboration and knowledge sharing.

Providing teachers with one-on-one coaching is a popular alternative. A coach (a professional one or a researcher or a university professor) comes to the classroom, observes the teacher and provides practical feedback. Coaching has big positive impacts on both teacher practices and on student learning. Students whose teachers received coaching learned twice as much as students whose teachers received training.



Teachers and coaches often work together to create a lesson, a unit, an activity or an approach based on examination of the results of a shared analysis. In secondary education, there are instructional coaches, technology coaches, literacy coaches, data coaches, content coaches, among others.

In practice, many of these roles overlap. In addition, there are two larger categorical differences. Coaches can be external -outsiders tapped to coach teachers- or internal -a lead teacher or peer coach.

### **Examples**

According to a desk research conducted for the current deliverable, it appears that many private Greek schools have already introduced coaching techniques and practices in their educational programmes. Such schools include Arsakeia-Tositseia Schools, Athens College, Pierce - The American College of Greece, I.M.Panayotopoulos, Geitonas Schools, and The American Community School in Athens. Some public or specialised schools have also introduced coaching in their programme, such as the Music School of Volos.

In the Music School of Volos, coach for the 2020-2021 school period for the PULCHRA project has been a researcher, who has been providing data, material, equipment and guidance to participating teacher and students. The aim was to identify the problems of city of Volos related to the urban environment and to discover ways and propose solutions so that the city of Volos becomes “smart”.

In Geitonas School, coach for the 2020-2021 school period for the PULCHRA project has been a Ph.D. Candidate, Physics Department from University of Athens. He has visited the school, worked with the teachers and presented to the students the phenomenon of Urban Heat Island, the causes and the ways of mitigation of the phenomenon, as well as the way in which the satellite data is utilised in the measurement of the surface temperatures both in the centre and suburbs of a city.

Coaching can play a crucial role in advancing PULCHRA project, since it can help inspired teachers cultivate a spirit of self-guided discovery and creative thinking among students. The experience from Greek schools participating in PULCHRA offers a convincing evidence for the positive role coaches can play for the success of the project.

## Science Student Clubs at Schools

### Description

It is a common practice in almost all High Schools of general education the creation of science student clubs, where students coming from all grades form a team and undertake the initiative to study and find solutions for environmental themes, among other topics. Teams work under the guidance of experienced teachers from the science department of each school and cooperate with external scientists, researchers and coaches.

These clubs have the advantage of being consisted by students from all the High School grades, independently of age, but having the same love and devotion to service science and its applications. Furthermore, it is with this way that teams may be consisted of especially talented students, all devoted to pursuing and fulfilling the same goal.

These teams can choose to work on different subjects and participate in many Greek and international competitions and projects, like PULCHRA. The common element in their approach is conducting serious original research and using scientific knowledge and methods.

### Methodology

Teachers and Coaches define the agenda and the way of scientific work expected to be undertaken by students. Students are divided into groups, conduct experiments and observations, use modern technology, record measurements, exchange information and seek scientific discovery and coverage of a topic related to the environment, climate, greenery and urban change in general.



### Examples

Examples of Science Student Clubs from Greek private and public schools can be found in the PULCHRA project, where students from different grades form a science team, work together under the supervision of one or more teachers and with the help of an outside coach in relative subjects.

1. 17<sup>th</sup> High School of Athens participates in PULCHRA with a team of 12 students from 1<sup>st</sup> and 2<sup>nd</sup> grades under the guidance of five teachers. Project: "Reforming our schoolyards to cope with extreme heat".
2. Model High School of Anavryta, Athens participates in PULCHRA with a team of 30 students from all three Grades of High School. Project: "Urban Astronomy Guide of Attica".
3. 1<sup>st</sup> Arsakeio High School, Athens participates in PULCHRA and works on climate neutral cities, green buildings, urban heat mitigation, sustainable urbanisation, nature-based solutions and social cohesion.
4. Secondary Art School of Gerakas, Athens participates in PULCHRA and works on "Buildings for the Future Cities".