



# SNAC

**School Networks Alert Citizens protection**

## **Recommendations for Future Use**

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# School Networks Alert Citizens Protection Consortium



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# 1. Introduction

## 1.1. Scope of the Recommendations for Future Use Guide

This document intends to give a concise and thorough overview of the project's overall framework and results and to guide and support anyone interested in it, from teachers and teacher educators to all individuals and stakeholders involved in educational processes to effectively follow the project approach in developing and offering innovative educational activities and teaching practices. In this document we present the main guidelines, lessons learned and recommendations of designing and implementing an innovative STEM project in the best possible way in order to guarantee results and avoid common pitfalls.

Therefore, this document addresses all the necessary information behind SNAC's philosophy, goals and strategy from its early phase until its implementation in school classrooms. It summarizes all the work done by teachers and schools in the participating countries, while identifying and presenting show cases of best-practice and achievements beyond expectations, examining in parallel the effects of these activities on the participating schools, teachers and students through the outcomes of the Evaluation phase.

In Chapter 2, we consolidate the achieved results and Intellectual Outputs. This Chapter answers the following question: *"Have we managed to develop an effective mechanism to "open" the schools to their local societies and external stakeholders, changing the school culture and positively impacting the participating teachers and students?"*. Specifically in chapter 2.4, we reflect on the overall strategy and approach, comparing the achieved results with the outcomes of the Evaluation Phase (Intellectual Output 4), answering to the question: *"was the selection of Seismology an appropriate subject our approach on?"*.

In Chapter 3 we present an overview of the implementation statistics for the whole project along with a list of all the 94 SNAC schools. Then we dive in each country in detail to report their specific conditions, the main barriers and difficulties we have faced and our actions to overcome them.

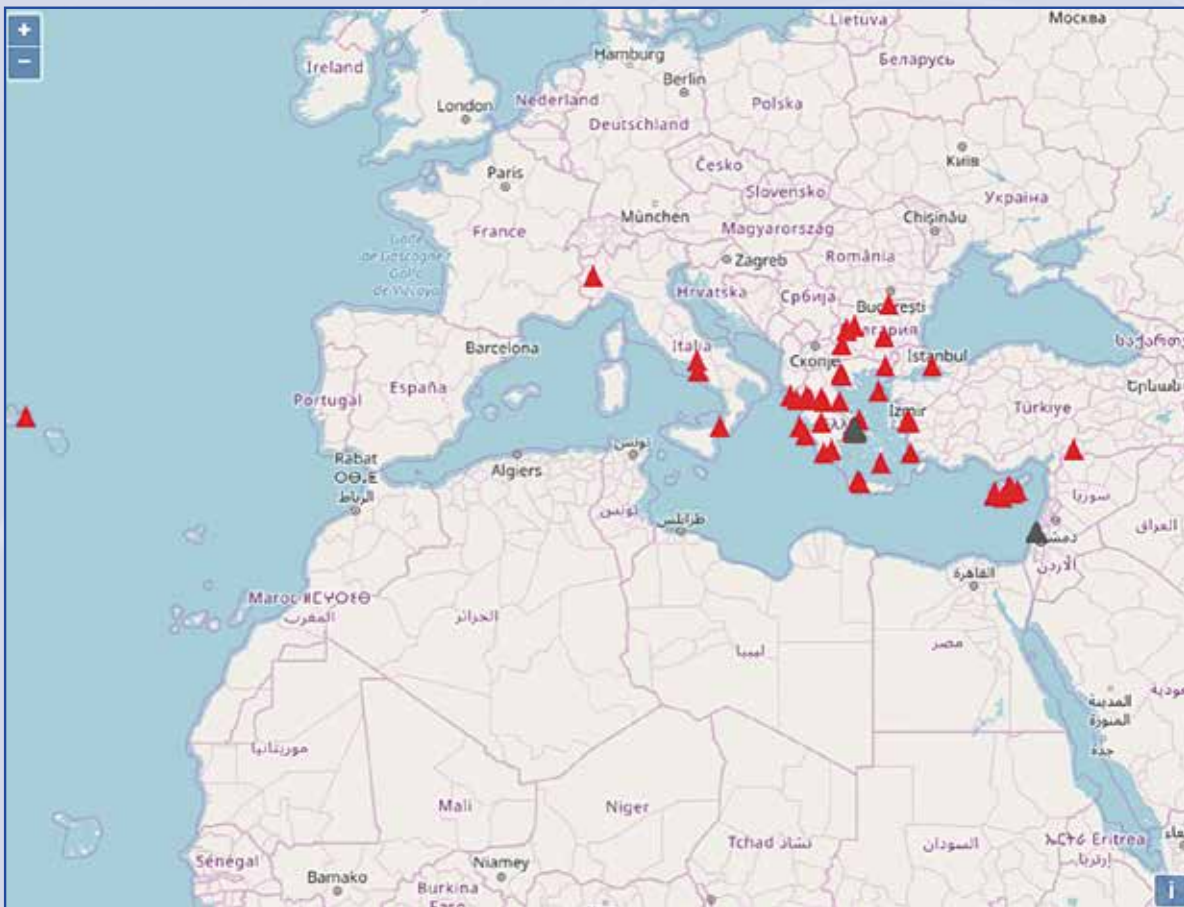
In Chapter 4 we present a selection of the exemplary events, workshops, summer schools that were implemented by all partners, either face to face with the participation of students, teachers, parents and local community stakeholders or virtually through webinars and online communication channels, answering the question: *"is there evidence from the impact of our action on students, teachers, and local communities?"* We also provide examples of the promotional material that was used and the valuable links that SNAC has created with the most important educational networking platforms in Europe, such as the The European Researchers Night (Section 4.1.1), Reflecting for Change (Section 4.4.7), EU Codeweek (Section 4.5.2), eTwinning (Section 4.6), Scientix (Section 4.7), OpenAire (Section 4.8), and the Open Schools for Open Societies (OSOS).

Finally, in Chapter 5, we identify the characteristics and outcomes of the project that make it sustainable for the years to come and we give our recommendations for uptake and present strategies for scale-up of the SNAC Network as it, as well as potential replications by other disciplines than Seismology.

## 1.2. The initiation and extension of the School Network of Installed Seismographs

Through a unique partnership among the SNAC partners, the development and support of the School Seismograph Network started in 2015 with the installation of educational seismographs in five Greek schools, The Network expanded to 22 schools in Greece but also in Turkey, Cyprus, Italy and Bulgaria, through the Schools Study Earthquakes Erasmus+ project. SNAC has succeeded in expanding the School Network of installed Seismographs to a total of 58 school seismographs, while two more countries have been involved.

The Network now extends from the Azores, Portugal (North Atlantic) to the depths of Eastern Turkey and Israel, Wcovering the entire highly seismic region of the Eastern Mediterranean. Seismographs have also been installed on islands to study volcanic earthquakes in the Azores, Sicily, Santorini and Nisyros.



The Network encourages students to become familiar with seismology and the scientific data resulting from the operation of the network of seismographs. Students themselves act as multipliers and transfer all this valuable information to their families and so the Network acquires another meaning, that of its contribution to society. Students learn how to be better protected in the event of an earthquake and this in turn communicates beyond the school environment. In many cases, the schools open and invite either other schools in the city or members of the community to visit the seismograph, outside of school hours and organize very interesting events. It is extremely important to point out that this is an action that methodically and systematically simulates scientific methodology in school reality.

SNAC students understand that the scientific instrument they have under their supervision must always be in operation, to provide correct data as the correct estimation of the magnitude and location of each earthquake also depends on their own seismograph. The activity, as in the real study of earthquakes by scientists, requires cooperation between schools that exchange data and results. Many students plan additional activities with their teachers e.g. converting earthquake data into notes and composing melodies giving a more artistic and creative approach to the study of the earthquake phenomenon.

The School Network of installed Seismographs has recorded all the major earthquakes that have occurred since the operation of the network (2015). Characteristically, in 2016 the earthquake in Ithaca of 6.4R, in

2017 in Lesvos the earthquake of 6.4R and in Kos the earthquake of 6.7R. In 2017, the Network recorded a nuclear explosion in Korea. In 2018 the 6.8R earthquake in Zakynthos, in 2019 the 8.2R in Mexico and the most recent earthquake in Turkey that occurred in January 2020 in Eastern Turkey of 6.8R.

The Geodynamic Institute and specifically Professor Gerasimos Houliaras and Mr. Costas Boukouras coordinate the operation of the Network in collaboration with Ellinogermaniki Agogi, which has the pedagogical responsibility for the implementation of educational activities in schools in Greece and abroad. A very big achievement of the Network is the opening of the involved schools to the local community. Each seismograph installation was an occasion for a small or large event in the area of each school or municipality, with guests from the local government, local stakeholders, parents and students of the school. In fact, there were events to which government representatives and officials from the Ministry of Education were invited and responded positively.

Another emblematic action of the Network was the educational competition “Make your own seismograph”, which is addressed to students of all levels for the three consecutive years. Under the auspices of the Greek Institute for Educational Policy (IEP) of the Ministry of Education, groups of students were invited in collaboration with their teachers to build an improvised seismograph and record the whole process in a presentation accompanied by audiovisual material. In these three years more than 70 teams, 200 teachers and 400 students have participated. At the end of the competition, the ten best projects were awarded and invited to an event in Athens. In fact, the auspices for the award ceremony, which took place in Gazi in 2018, within the Athens Science Festival, was undertaken by the Presidency of the Republic with Mr. Prokopis Pavlopoulos handing over the awards to the winning teams, in the presence of other representatives of the state leadership, students, parents and teachers from the 10 schools that stood out with their constructions.

The Ministries of Education in the participating countries are redesigning the curricula of Natural Sciences, considering the effects in school education of the COVID-19 pandemic. The School Seismograph Network has proved to be initiative that requires their attention. Installing a low-cost seismograph in school buildings, allows students and teachers to record and analyse earthquakes of different sizes over long distances with admirable accuracy without stopping. The SNAC Network is a unique laboratory - always in operation like the earth under our feet - effectively transferring scientific methodology to the classroom, while the interest of schools in participating in the SNAC Network is constantly growing.

The intention and vision of Dr. Chouliaras is a global network of schools that will study and inform their local communities on such an important issue as information and preparation for upcoming earthquakes and that will highlight the cooperation of research organizations with schools as well as with local government, businesses and other stakeholders with beneficial results for all.

**SNAC students participate in a network of 94 schools, with 58 seismographs installed from Israel to the Azores, which cover its extremely seismic Eastern Mediterranean basin.** They collaborate with their classmates from Greece, Cyprus, Italy, Turkey and Bulgaria, looking for ideas and creating unique projects. As young scientists, they understand the phenomenon of earthquakes. Some of them learn to write code, to create automatic warning mechanism for the local communities. Others, prefer to listen to the Sound of the Earth, turning seismographs into musical notes!

The SNAC consortium’s great effort to introduce seismology in schools is continued for the 5th consecutive year. The dance of the tectonic plates never ends, even in through the COVID-19 pandemic, offering us a living lab that never sleeps. The closed schools did not stop seismographs of the unique School Seismograph Network to record seismic vibrations and constantly update the open database of the network hosted at the Geodynamic Institute of the National Observatory Athens. Studying the data we collected in the last two years, we found that SNAC schools are more active in action planning concerning the local community but also the systematic cooperation with its bodies local government and other research and business of them.

In all countries, high school students had the opportunity to attend amazing lectures by Dr. Gerasimos Chouliaras and other researchers of the consortium partners, adapted to the needs of their school and their country’s curriculum. The “Open Schools” of the network create strong relationships of cooperation and offer unique educational experiences to their students but also significant benefits training opportunities for participating teachers through: (i) a unique archive of training materials and lesson scenarios, (ii) the SNAC online Technical Platform with the real-time seismic map that allows continuous monitoring of seismic activity, constantly offering and updating its vast and open seismic database, (iii) the innovative automated solutions system and (iv) specialized webinars and Seismology summer schools.

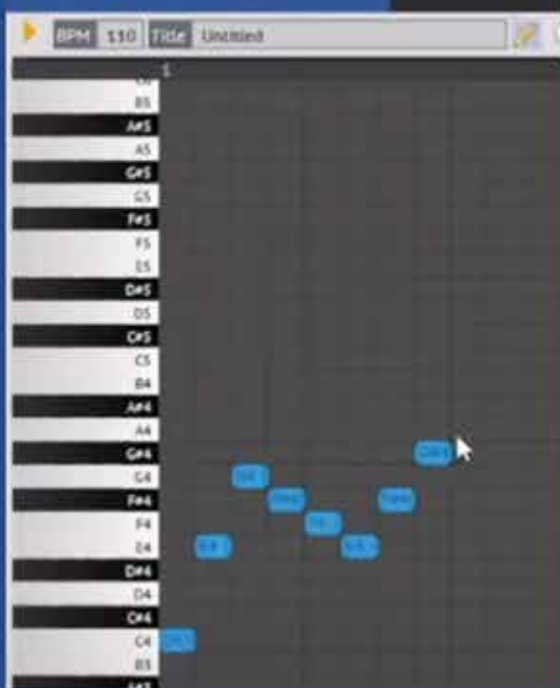
# The SNAC Project: Students study earthquakes!

...and participate in a network of 58 School seismographs installed from Israel to the Azores, covering the extremely seismic basin of the Eastern Mediterranean

...and collaborate with their classmates from Greece, Cyprus, Italy, Turkey and Bulgaria, seeking ideas and creating unique projects

...and listen to the Sound of the Earth, turning seismograms into notes

Online Sequencer Sequences M  
Make music online



...and as young scientists, they understand the phenomenon of Earthquake, learn to deal with it and write code to warn the local communities.

...and they design and construct their own seismographs in the context of student competitions for three consecutive years



[snac-project.eu](http://snac-project.eu)

# The dance of the tectonic plates: A workshop that never sleeps

...is our Earth, that does not stop its perpetual dance, under our feet, not even in the midst of a pandemic. Our great effort for the introduction of seismology in schools continues for the 5<sup>th</sup> consecutive year.

The closed schools did not prevent SNAC's student seismologists of the only School Network of Seismographs, to record the seismic activity and to constantly update the open database of the Network hosted by the Geodynamic Institute of the National Observatory of Athens.

SNAC's High School and Lyceum students, even during the Pandemic, had the opportunity to **attend excellent lectures** by Dr. Gerasimos Chouliaras and researchers of the partners, adapted to the needs of their school curriculum.

From the data we have collected over the last two years, we have seen that the schools of the SNAC network show a **significant improvement in the planning of actions concerning the local community** but also the systematic cooperation of local stakeholders and other research and business bodies in the area.

The "Open Schools" of the **SNAC network** create strong collaboration networks and **offer unique educational experiences to their students** but also important professional development opportunities for the participating teachers, through:

- A unique **archive of educational material** and lesson plans
- **The SNAC technical platform** with real-time seismic map, seismic database and innovative **automated solutions system**
- **Specialized webinars** with field experts
- **The Summer Schools of Seismology**

*"Our network will continue to grow, expand, other teachers and other schools will be involved and will get to know the science of seismology that is so directly connected to our daily lives."*

*Dr. Gerasimos Chouliaras, Research Director of the Geodynamic Institute of the National Observatory of Athens*



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## 2. Consolidation of Achieved Results

### 2.1. The Open Schooling Roadmap (Intellectual Output 1)

#### 2.1.1. Definition of Openness

The first intellectual output that the project developed was the “Open Schooling Roadmap”. It offers the general layout and a clear description of the necessary steps that schools will need to take in order to embark on the process of opening-up to their local community by focusing on the specific example of seismology education to support the implementation of the project activities as a state-of-the-art approach in the introduction of Responsible Research and Innovation in the school settings. In the context of SNAC, a school is considered “Open” when it adopts the following main characteristics (Sotiriou, S., et al. 2017):

- **Welcomes, encourages and promotes collaboration with non-formal and informal education providers**, initiatives, parents and local communities to ensure engagement of all societal actors with focus on earthquake awareness and protection. In this respect, the school entity is not considered as an isolated self-contained closed system but as an active core component, to some extent autonomous and dynamic, in active interaction with the activities of out-of-school stakeholders.
- **Becomes an agent or central point of community well-being.** SNAC supported schools, teachers and their students to develop educational projects that are proposing solutions to the needs and challenges of their local communities emphasizing the fact that well-being is equivalent to living safely in general, with earthquake precaution measures being a particular vital element of it. The main approach was to challenge and encourage students to explore themselves the notion of well-being by identifying and expressing what matters to them, what bothers them, what they can change or influence, how they can contribute or serve. In this process, not only they feel engaged and empowered but also, they develop and foster their attitude of responsible citizenship for the years to come.
- **Promotes collaboration and partnerships** that foster expertise, networking, sharing and applying knowledge, research/survey findings **that bring real-life problems or challenges related projects to the classroom.** The project partners in SNAC, individually or collaboratively, have been developing and promoting innovative educational applications and approaches for schools for many years. Within SNAC, cross-sharing and co-creation will be enhanced and facilitated thus, further supporting the development of the 21st century competences through creative problem solving, discovery, learning by doing, experiential learning, critical thinking and creativity.
- **Focuses on or promotes effective parental engagement.** This characteristic builds on the general notion of knowledge capital of schools’ communities and its two-way transfer, exchange and diffusion. In other words,

**SNAC Open Schooling Roadmap Glossary**

- 05 Open Schooling**  
Institutions that promote partnerships with families and the local community with a view to engage them in the teaching and learning processes but also to promote education as part of the local community development.
- 04 Open School Culture & Open Schooling Hub**  
Open School Culture imports external ideas that challenge internal views and beliefs and, in turn, exports its students – and their assets – to the community it serves. An Open Schooling Hub is a school-based environment that implements the Open School Culture.
- 03 Responsible Citizenship & RRI**  
Responsible Citizenship views citizenship as a total practice of responsibility between individuals and their political, social, economic and natural environment. Responsible Research and Innovation means that societal actors work together during the whole research and innovation process.
- 02 Project-Based Learning**  
Learning begins with a problem to be solved, and the problem is posed in such a way that children need to gain new knowledge before they can solve the problem. Rather than seeking a single correct answer, children interpret the problem, gather needed information, identify possible solutions, evaluate options and present conclusions.
- 01 Inquiry**  
Scientific inquiry is defined as “the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work”.

knowledge or awareness acquired by students' projects developed in school is transferred to parents and on the other way around - parents' experience and expertise is engaged to influence effective change.

It is natural to expect that the schools, which express interest in participating in SNAC may not have developed these characteristics at the same level. Thus, SNAC proposed a roadmap as described in detail in Intellectual Output 1 – Open Schooling Roadmap and teacher training programmes, which are the focus of Intellectual Output 2 and that will have been offered as practical guidance or support mechanisms and scaffolds to nurture the incubation of a change cycle for schools and teachers to facilitate the process in acquiring or developing the abovementioned characteristics.

### 2.1.2. SNAC's Open Schooling Roadmap

The **Open Schooling Roadmap** is a reference document that has been translated by all SNAC partners in their native language (Greek, Bulgarian, Italian, Turkish). The **Open Schooling Roadmap** proposes a concrete overview of the implementation of open schooling approaches, offering a clear description of the necessary steps that schools need to take, in order to become hubs of responsible innovation that bring together as many stakeholders as possible with an aim to produce ideas and solutions that address local issues and challenges.

Additionally, it focuses on the specific example of seismology education to support the implementation of the project activities as a state-of-the-art approach in the introduction of **Responsible Research and Innovation (RRI)** in the school settings. The **Open Schooling Roadmap** offers a clear and step-by-step outline of how a SNAC school can embark on the process of opening up to its local community, through the use of RRI-enriched student- projects, engaging students in real-life projects that are proposing innovative solutions adopted to the local conditions by employing real-problem solving skills, dealing with real seismic data that they students have acquired themselves, handling and studying situations and participating in meaningful and motivating science inquiry activities on earthquake disaster prevention and mitigation.

The roadmap includes six steps which school staff can follow to realize “open schooling” innovation. The following figure presents a roadmap model in order to create open schooling culture.



The six steps are defined as:

- Step 1: Build an **open schooling transformation committee** and working groups
- Step 2: Organize **Professional Development Seminars** for school staff
- Step 3: Build **effective connections with stakeholders** and other innovation hub schools
- Step 4: Create an **RRI based teaching and learning environment** in the school
- Step 5: Make **assessment** for quality check
- Step 6: Reflect and **share best practices** using different media channels

These steps were developed to explain the ways that teachers can develop an open schooling culture in their school. Many of these steps are directly connected to each other. For example, the creation of the school transformation group and sub-groups is directly connected with all activities at the school. In the document IO1 – The Open Schooling Roadmap, each one of the abovementioned steps are analysed in detail, providing school heads mainly and interested teachers with practical and meaningful information, resources and methodologies to initiate a culture change in their schools and achieve openness.

Implementing the Open Schooling agenda has offered to SNAC Schools:

- Unique professional development experiences for school staff
- Connection with local stakeholders, research centres and science centres, policymakers and community members
- Expanded horizons for their students, teachers and school heads by enabling them to work with partner schools on learning and scientific activities, using the network of existing seismometers, developing new seismometers and conduct experiments with students and teachers from other schools of the SNAC network.
- Improved teaching and learning through interdisciplinary and project-based learning while assessing innovative practices and providing valuable feedback on students' performance
- Guidance to be part of international activities which signal that a school is ambitious, with bold expectations for its students and staff. These schools are gradually developing or adopting innovative curricula, or implement new ways of teaching, all of which increase school's standing and influence at local, national and international level. Some of SNAC schools have already started this process.
- Recognition of the important part that students can play as peer enquirers/researchers

## 2.2. Training Programme for Teachers & School Heads (Intellectual Output 2)

### 2.2.1. Development of the SNAC Training Framework

The main aim of the School Networks Alert Citizens protection (SNAC) project is to assist and guide schools around the partner countries to become open hubs of education, training, awareness and information on earthquakes starting from their teachers and students and reaching out their local communities and beyond. **The Open Schooling Roadmap** is followed by a comprehensive training programme for teachers and school heads. This is the scope of the second intellectual output of the project, **IO2: The SNAC Training Framework**. Its objective is to provide participant teachers and school heads with practical knowledge, background information and guidance on how to implement the necessary changes and with the intervention skills to best plan and then diffuse SNAC related activities in their own schools, helping them to evolve to an Open Schooling Environment, establishing Responsible Research and Innovation principles.

**SNAC's training programme consists of three complementary modules** that offer a staged framework addressing the three dimensions of SNAC, namely **open schools, responsible citizenship and integrated educational activities on seismology utilizing the SNAC network of seismometers and collected data**. The three distinct modules and accompanying training materials and resources are designed as practical reference guides for both partners and schoolteachers and thus they can be utilized as handbooks for self-teaching or for hands-on training workshops organized by partners in each country. The offered

resources and tools can be associated with a broad range of curriculum areas within science, technology, engineering and mathematics depending on schools' and/or teachers' focus or interest. Therefore, they do not impose a fixed curriculum but support a flexible model that can be customized based on interest, experience, location, conventional practice and culture.

**The first module focuses on the overall approach and process “towards open schools”.** After laying out the SNAC roadmap, its main steps and necessary preparations, practical guidance and available tools follow. The module consolidates the main aspects of the “Open Schooling Roadmap” that was developed in the first intellectual output of the project. It offers the general knowledge and understanding of which changes and practices define an open school, how these can be introduced, facilitated managed and achieved by school administration.

**The second module is entitled “responsible citizenship” and encompasses the concept of Responsible Research and Innovation and how in practice it can be integrated in schools.** SNAC schools are part of a seismic school network and aim to become open hubs of innovation, education, training and information about civil protection and seismic activity for their local community. Thus, the active integration of RRI concepts and activities in the process has been established by teachers during various stages of the project. SNAC’s practical guide can be used by teachers and school-heads to facilitate the understanding of the RRI concept and to suggest ways of effectively involving aspects of RRI in students’ projects.



**The third training module addresses the subjects of seismology and how to use the SNAC platform of seismometers and data.** This module contains a concise overview of **basic knowledge on seismology**, a generic plan and **list of proposed educational activities & resources** that partners developed for school students aged 10-18 years and a **detailed step-by-step user’s guide** of the tool to access and analyze data from the installed network of seismometers (SWARM):

- Installing the SWARM software tool
- Accessing the network of seismometers
- Viewing the data from a station/seismometer
- Selecting a waveform to analyze
- Estimating the magnitude of an earthquake
- Determining the epicenter of an earthquake

Throughout the modules and where possible we adopt and propose a staged approach so that any suggested activities can run in sequence or be interchanged. This gives higher flexibility to schools or/and teachers to adopt and adapt them to their circumstances, to choose to focus more on one aspect relative

to others depending on their priorities, interests, experiences or standard curriculum constraints. In this context having these suggestions as basic starting point, teachers involved in the project will be also encouraged and supported to develop their own initiatives, educational activities and learning projects to spark and engage the enthusiasm, attitudes and thinking of their students.

### 2.2.2. The Five Stage Stakeholder Engagement Framework

The success and sustainability of the innovation process in the school is closely related to the development of stakeholders' community that will allow school administration to change the way of teaching and learning. It is important to build stakeholders' community in the school and engage it to help and support school staff wherever it needs stakeholders' contribution to school activities. To this end, SNAC proposed to the participating schools to follow the Five Stage Stakeholder Engagement Framework (Krick et al, 2005):



#### The first stage is called “Think Strategically”.

This stage is used to set priorities and strengthen resources to ensure that school staff and stakeholders are working toward the common targets. For that reason, there should be a discussion on which stakeholders will be contacted, which issues will be discussed, and which ways should be used to reach the target strategically. An example is presented to engage stakeholders below:

- **Researchers** – How do we design a research? / What should our focus be? / How can we collect data? Get researchers involved in students' projects; They can help them get started and feel confident in their ideas and provide feedback and general guidance during all the research stages.
- **Seismologists** – How do we record seismic data? / How can we locate the epicenter of an earthquake? SNAC is a citizen seismology project and thus, involving seismologists (or scientists in related fields) is important. They can really motivate students and help teachers to navigate through the process of collecting data, analyzing it and actively engage students in these processes.

- **Civil protection organizations and/or NGO's** – How can we protect ourselves from an earthquake? / how can we inform others? You cannot only approach the concept of earthquakes through the “science lenses” but also through the civil protection perspective. Students can inform their peers, school, community and organizations in their country in various ways (public events, social networks etc.) and can help them tackle this issue effectively.
- **Other schools** – What seismic data did other schools record? / Can we collaborate to identify the epicenter of an earthquake? / Did other schools of the network record the earthquake? Your school is part of a large school seismic network with a lot of collaboration opportunities, so you do not hesitate to take advantage of them. Share data, good practices, ideas and most importantly - share experiences. Through the open schooling approach students find meaning and motivation to participate and learn since they embark on tackling real problems that their community encounters outside of school with the vital contribution of local stakeholders.

#### **The second stage is “Analyzing and planning”.**

This stage includes processes to be followed such as how to analyse and plan how you can reach stakeholders, how school students can get contribution from each other and from stakeholders, and how to organize the time process for effective cooperation in the school environment. The questions below can be used for this stage:

- Which stakeholders are affected or affect the problem/issue identified by the students, the processes of the project and/or the outcome?
- Which stakeholders or citizens of the community (e.g. parents) are interested in the project and wish to be involved?

#### **The third stage is “Strengthen Engagement capacities”.**

This stage is the most important stage. In particular, it is necessary to find alternative ways to make stakeholders encouraged to contribute effectively. To receive their response to an issue, school staff should develop internal skills. These skills should be clarified in order to set effective communication with stakeholders. For that reason, it is needed to identify in advance the activity/role each stakeholder can partake and explore possible ways on how to convince them about the benefits of their participation for their community.

#### **The fourth stage is “Designing the process & Engaging”.**

At this stage, one of the most effective ways of engagement should be determined. As school staff, you can design the process to be implemented. Encouraged stakeholders would be ready to offer the necessary contributions in the open schooling environment. This stage requires communication with the identified stakeholders to inform them about the project and the role they can have in it. Find common ground between their expectations and your goals. As you start working on your project, consider the dynamic aspect of your collaboration; as your project starts to take shape, the way you collaborate with stakeholders might change, too. Be ready to make adjustments and explore possible fruitful communication channels that will enhance their engagement. You can collaborate with someone during a certain task or during the entire project. Be open to suggestions and constructive feedback. There are many ways to keep the communication with your partners: field study-visits, skype meetings, phone calls, emails etc.

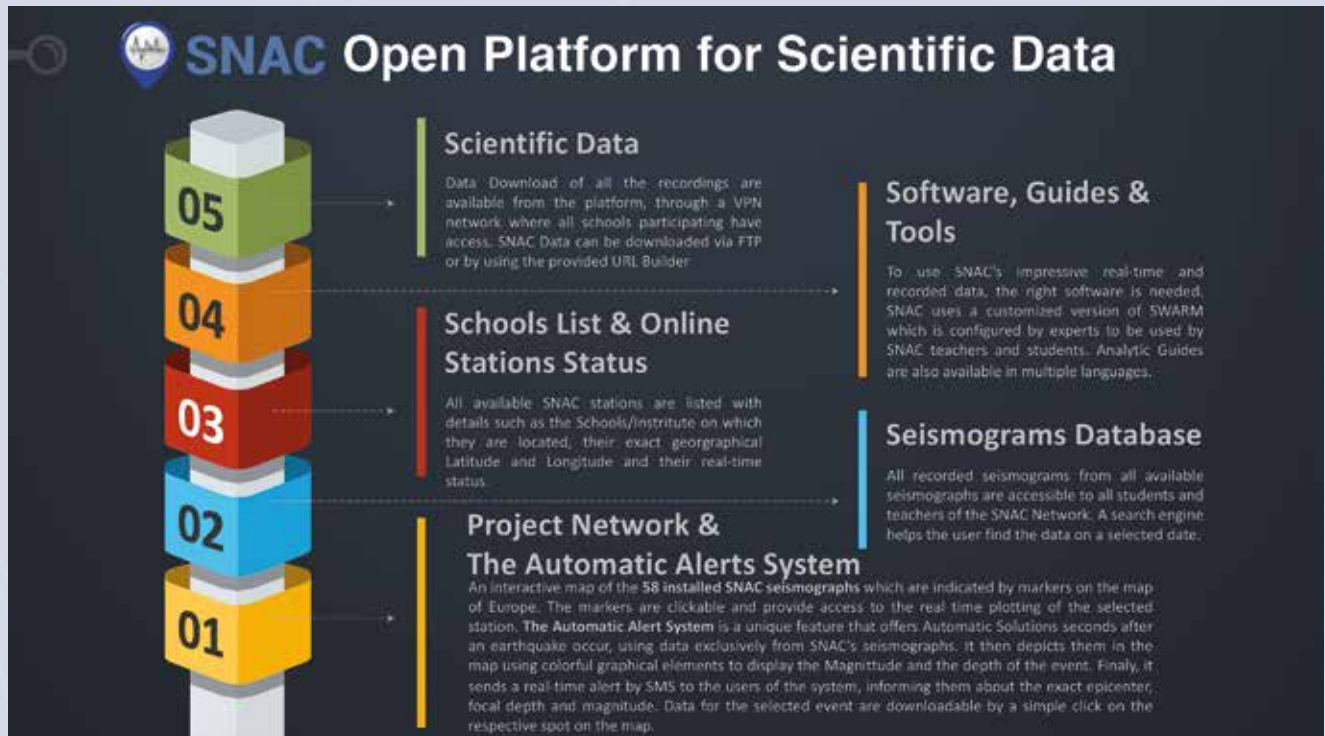
#### **Final Stage: “Act, Review and Report”.**

This is the stage where the engagement process is evaluated. At this stage, follow-up planning should be discussed and scheduled with the schools transformation committee. In addition, it is necessary to put forward some results, such as how the relationships among students, teachers and stakeholders were, what the problems were, and which ways of engagement worked best. The experiences, gained by school staff, will contribute to the development of the next cycle more effectively. Make sure that you involve them in some way in the outcomes of your project (e.g. in a conference or by mentioning their organization on your poster) so that they feel like their work and guidance was recognized and appreciated.

### **2.3. SNAC Open Platform for Scientific Data (Intellectual Output 3)**

The SNAC Open Platform for Scientific Data presents Network of School Stations, their data and seismograms and software to process and experiment, using state of the art seismological tools. Teachers and students are able to easily share the data they collect with their installed devices. A dedicated software tool/plugin

has been developed to facilitate this process. All the data collected by the foreseen installed instruments are continuously uploaded and stored in a central public data bank, hosted by the National Observatory of Athens. The main components of SNAC’s Open Platform for Scientific Data are presented in the following figure:



To reach SNAC’s Open Platform for Scientific Data use the following link: <https://snac.gein.noa.gr/>

**SNAC ERASMUS School Network Alerts Citizens**  **School Networks Alert Citizens protection**

Home Project Network Seismograms Database Schools List Online Stations Status SOFTWARE Data Download

HOME

**Welcome to the School Network Alerts Citizens (SNAC)**  
**EU-ERASMUS project webpage**

 **School Networks Alert Citizens protection**

**New: SNAC Network Automatic Alerts System**

**Project Coordinator :**  
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The data are available in standard seismological format (sac files) and will be freely available not only to the schools of the network but also to schools, researchers and scientists worldwide. The platform is hosted on a Linux server at the facilities of the Institute of Geodynamics, of the National Observatory of Athens (NOA).

On the same server runs the acquisition software that acquires in real time seismological data from the network of school stations. The acquisition software is called 'SeisComp3' and can also be used as a processing software.

There are two categories of Raspberry devices:

- the Raspberry Pi devices connected to TC1 seismometers, running SeisComp3 and
- the Raspberry Shake devices.

The Raspberry Pi devices have been programmed at NOA. The SeisComp3 software has been compiled and installed and a plugin has been developed that allows data acquisition between the TC1 seismometer and the SeisComp3.

The Raspberry Shake device has SeisComp3 pre-programmed from the company and it communicates with its own built in sensor. All school stations are provided with a Raspberry device which is connected with a seismometer that also runs 'SeisComp3' software, which acquires the data from the connected seismometer and sends them at the main server at NOA.

### 2.3.1. Project Network of Seismometers

The SNAC network of School Seismometers consists of **58 stations in total** (28 TC-1 seismometers (4 of which are dial-up stations) and 30 Raspberry-Shake seismometers) distributed in the partner countries (Turkey, Cyprus, Greece, Italy and Bulgaria), as well as one seismometer is installed in Israel and one in Portugal (see appendix 5.3). An interactive map of the installed SNAC seismometers is always online, indicated by markers on the map of Europe.

The markers are clickable and provide access to the real time plotting of the selected station. The project's schools' seismometer network is accessible here: <https://snac.gein.noa.gr/project-network/>.

In the SNAC platform, schools have access in real-time seismic data which they can download and analyze with the use of the SWARM software which can be downloaded for free from the website.

All the data and necessary information for all the hardware and software tools available for all interested schools are accessible in the platform.

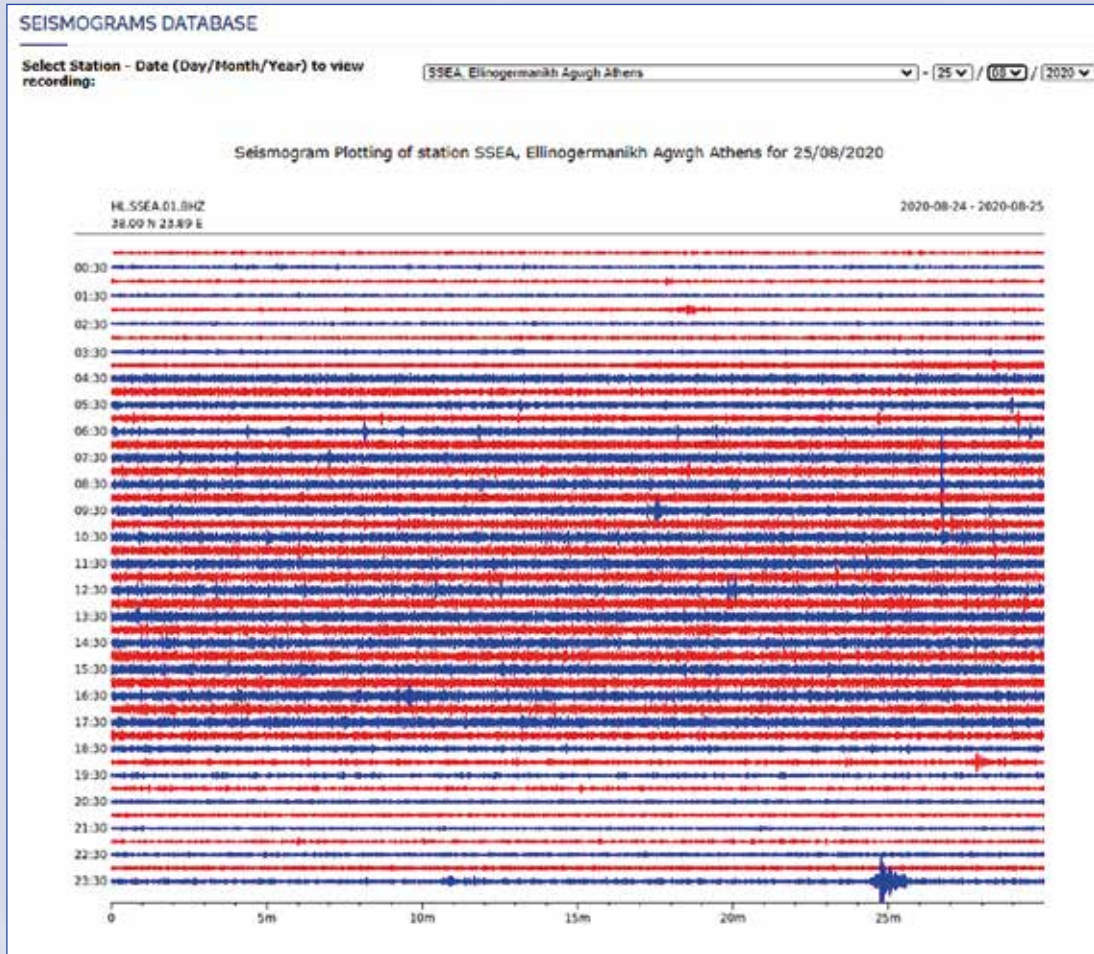
The schools chosen for the installation of seismometers met the basic requirements for the operation of the seismometer (e.g. quiet room on ground floor/basement, access to internet) and their location was optimal for distributing the equipment in various areas of Cyprus.

The rest of the schools of the SNAC Network (41 more schools, reaching 94 in total) participated by utilizing the seismic data available in the SNAC platform recorded by all the schools of the project.

The creation of the platform also facilitated teachers' work after the closing of schools due to the covid-19 virus which made the physical access of seismometers unavailable. It provided an opportunity for teachers and students to continue monitoring earthquakes and to implement activities from their home with the use of real-time data.

### 2.3.2. Seismograms Database

All recorded seismograms from all available seismographs are accessible to all students and teachers of the SNAC Network. A search engine helps the user find the data on a selected date.



In the Figure above, we see an example. We have selected the seismograph that is installed in the premises of the school Ellinogeraniki Agogi, which has the code name SSEA and we wanted to see the recording on the 25<sup>th</sup> of August 2020. We enter this information in the search engine on the top of the page and the required seismogram appears. We see a small earthquake that took place at 23:00 Greenwich time.

### 2.3.3. Schools List & Online Stations Status

All available SNAC stations are listed with details such as the Schools/Institute on which they are located, their exact geographical Latitude and Longitude and their real-time status.

SCHOOLS LIST					
Station	Latitude	Longitude	Location	Seismometer	Connection <small>Public-Info-are-obsolete</small>
AMR1388	39.681494	20.850677	10 Perivalliko Skoleio Iamminon	Raspberry-Shake	Online
AMR1822	38.823160	24.052090	Moutiko Skoleio Chanion	Raspberry-Shake	Online
AMR206C	37.776093	20.801645	10 Dimotiko Skoleio Rizas, Filitis, Zakynthos	Raspberry-Shake	Online
AMR2AE2	42.892962	23.893258	Gymnasium for Natural Sciences and Mathematics, Bobevgrad, Bulgaria	Raspberry-Shake	Online
AMR4043	42.438188	25.609586	Roman Roland Foreign Language School - Stara Zagora	Raspberry-Shake	Online
AMR4EE2	34.922837	20.471328	Periferiako Skoleio Giotou, Pefos, Cyprus	Raspberry-Shake	Online
AMR4DA1	43.844808	25.950344	High School of Mathematics "Baba Tonka", Ruse, Bulgaria	Raspberry-Shake	Online
AMR4EB6	37.977797	23.719412	NOR Athens	Raspberry-Shake	Online
AMR4ECA	42.607671	23.099096	High School "Simoneo Radev", Pernik, Bulgaria	Raspberry-Shake	Online
AMR473D	36.033658	23.837138	10 Gynnasio Vlassian	Raspberry-Shake	Online
AMR52CE	38.483472	27.066504	Imir Ozel Turk College	Raspberry-Shake	Online

ONLINE STATIONS STATUS					
SNAC ERASMUS Online Stations Status					
Last Update: (Day,Time -UTC-): 267, 07:16:9					
Click on each station status to see its real time plotting.					
Name	Network	Status	Time of last recording (Day,Hour)	Time delay (Day, Hour)	Location
SARG	HL	Station is OK	267, 07:16:08	0, 0:0:1	Lyceum Argostoli, Kefalonia
SART	HL	Station is OK	267, 07:16:09	0, 0:0:0	Gymnasium Agnanta, Arta
SAVL	HL	Station is OK	267, 07:16:07	0, 0:0:2	Lyceum Avlonari, Evia
SAZR	HL	Station is OK	267, 07:15:42	0, 0:0:27	Emiliano De Antrante School, Azores
SIGU	HL	Station is OK	267, 07:16:06	0, 0:0:3	3rf Gymnasium, Igoumenitsa
SINST	HL	Station is OK	267, 07:15:57	0, 0:0:12	ALKEV School, Istanbul

### 2.3.4. Software, Guides & Tools:

To use SNAC’s impressive real-time and recorded data, the right software is needed. SNAC uses a customized version of SWARM which is configured by experts to be used by SNAC teachers and students. Analytic Guides are also available in multiple languages. SNAC students and teachers can download the customized version of the SWARM software, the simple step by step guide that the SNAC project team has created as a PDF document and as a video tutorial, the Official User Guide of SWARM, Instructions for installing Raspberry-Shake and the Java Runtime Environment that is required by SWARM.

### 2.3.5. Data Download

Data Download of all the recordings are available from the platform, through a VPN network where all schools participating have access. SNAC Data can be downloaded via FTP or by using the provided URL Builder.

**DATA DOWNLOAD**

Write online Data Download is available from all the network stations.

The download is available using the following builder:

**SeisComp3 FDSNWS DataSelect - URL Builder**

Basic selection:

Start Time:   
 End Time:

Channel selection:

Station:   
 Network:   
 Location:   
 Channel:

Service specific selection:

Quality:   
 Minimum Length:   
 Sample Rate:   
 Inflation:

Output format:

Format:   
 To Data File:

URL:

<http://192.228.221.80:8080/SeisComp3/DataSelect/URLBuilder.jsp>

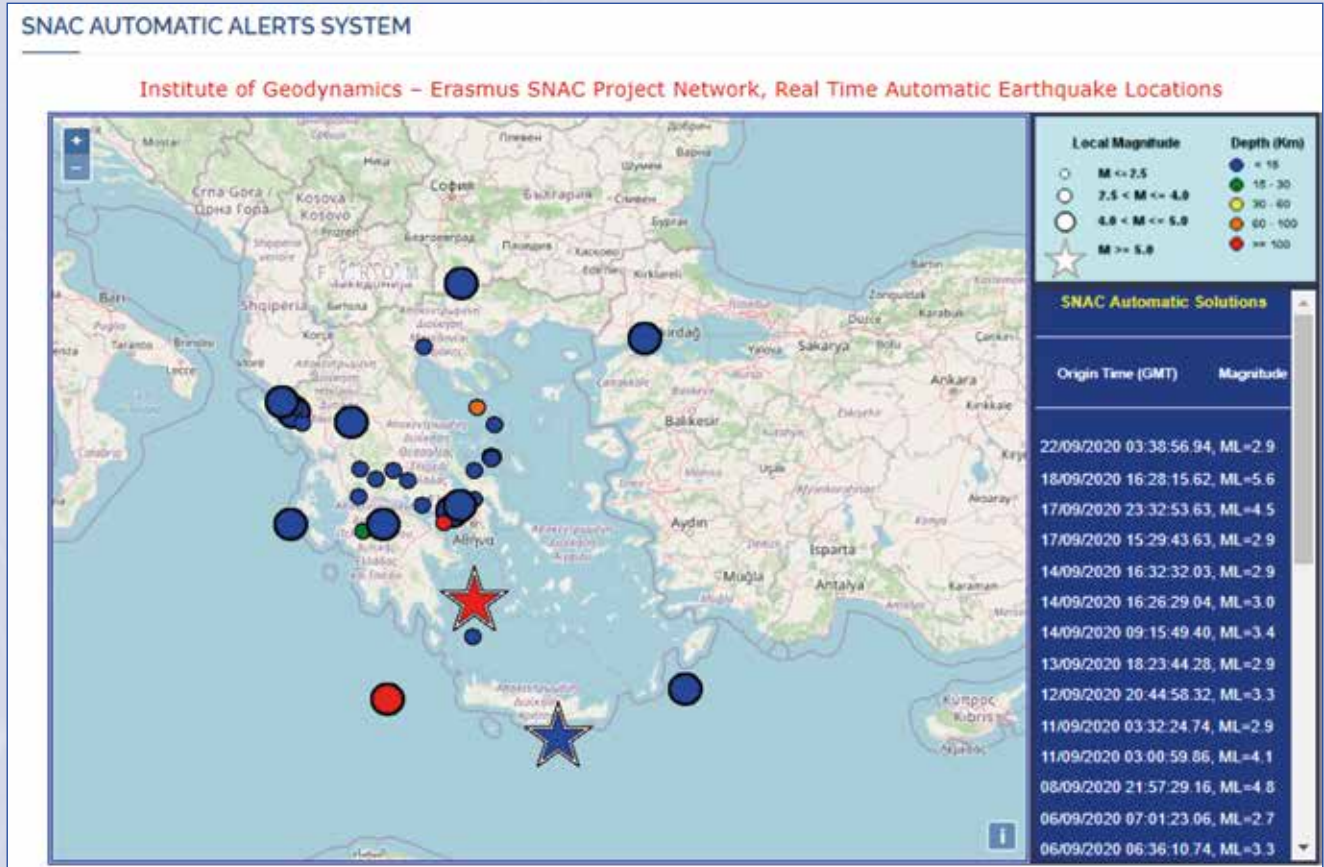
Click here to go to the data select builder.

Note: In order to access the data builder you need first connect to the Platform's SNAC VPN network. VPN connection is available only for the project participants and the access information has been sent to email.

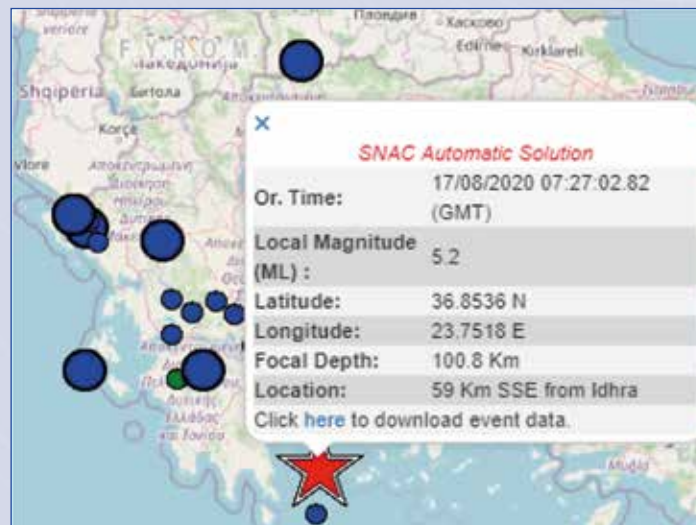
Data Download instructions: Select the Start/End Time of the data you are looking for, enter the station name (the example SARG or SART) and click at the end of the page. You will be asked to save a file to your computer. The default filename is: SeisComp3\_FDSNWS\_StationID\_StartTime\_EndTime. To refresh the station name and the date, repeat the same procedure for all the stations needed. All these files can be opened and processed by SeisComp3 - Java (Fiji).

### 2.3.6. The Automatic Alert System

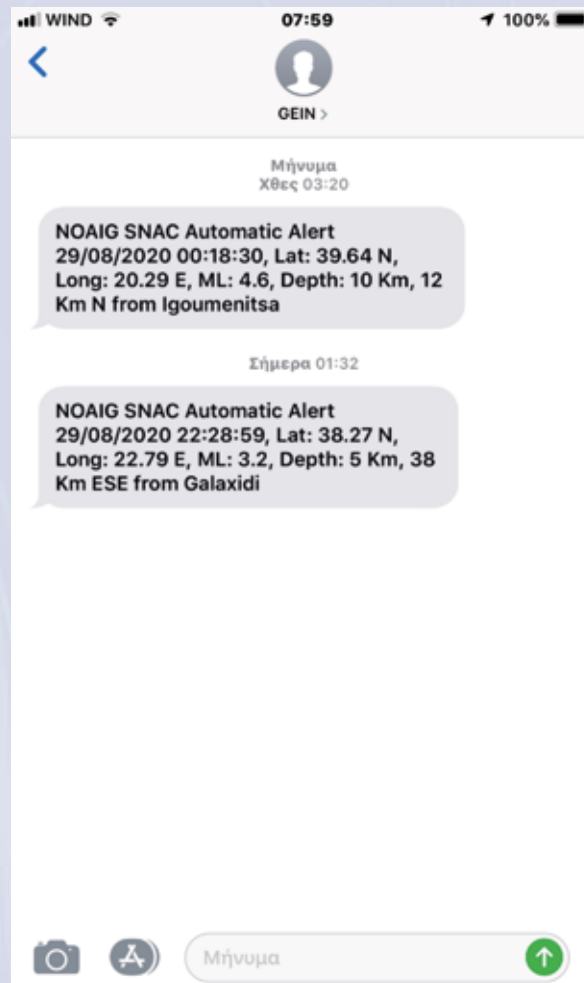
A unique feature that offers Automatic Solutions seconds after an earthquake occur, using data exclusively from SNAC’s seismographs. It then depicts them in the map using colorful graphical elements to display the Magnitude and the depth of the event.



Data for the selected event are downloadable by a simple click on the respective spot on the map.



Finally, it sends a real-time alert by SMS to the users of the system, informing them about the exact epicenter, focal depth, magnitude and distance from the nearest city.



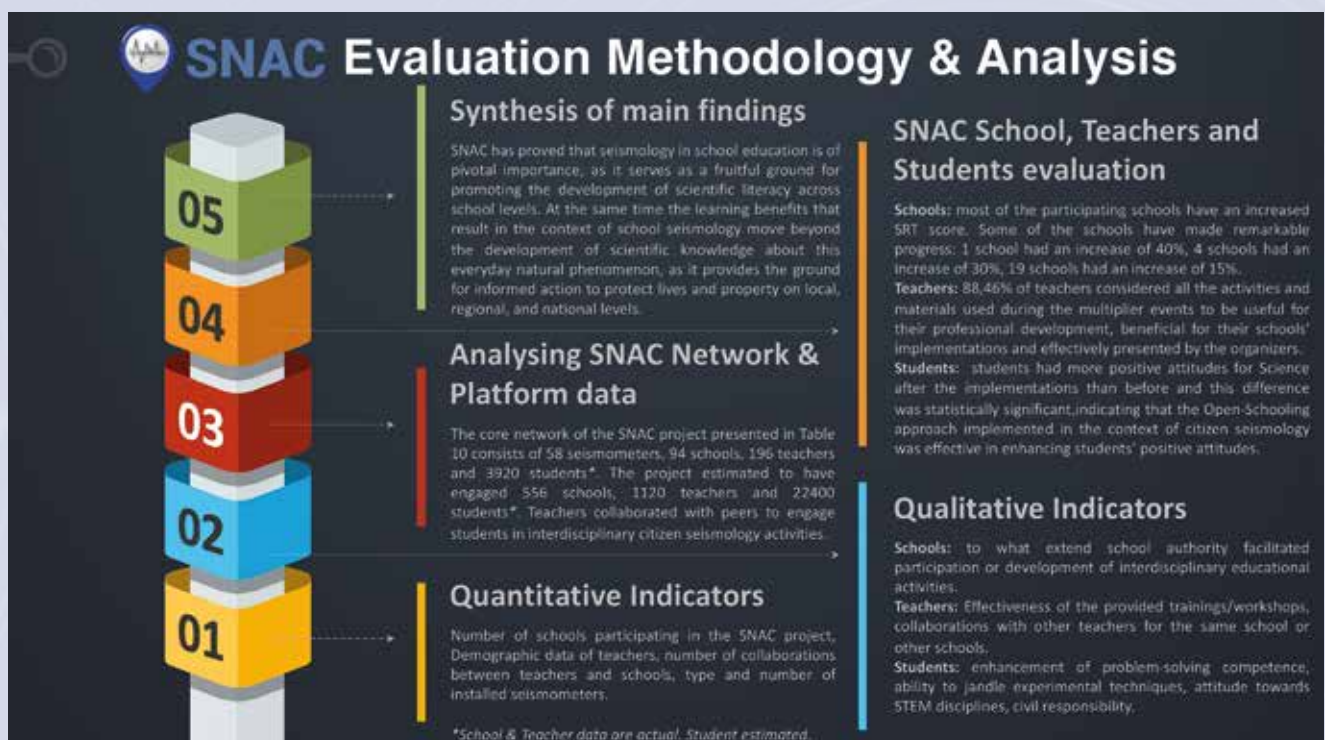
## 2.4. Evaluation Summary (Intellectual Output 4)

In the Intellectual Output 4: Evaluation Methodology, Analysis of Results, the consortium developed and described a detailed comprehensive evaluation and validation plan and methodology to assess the impact and effectiveness of all work realized during the time span of the SNAC project. More specifically, the goal was to measure the effectiveness and quality of the offered training guides and handbooks, e.g. the pedagogical framework, the methodological guidebook with respect to implementation in schools and the use of the offered hardware sensors and related software tools, but also the effectiveness, quality and impact of the offered teacher induction seminars and training hands-on workshops. This output is divided in two sections. The first section concerns the development and presentation of the evaluation methodology of the project. The evaluation methodology mainly aims to map the impact and the effectiveness, both quantitatively and qualitatively, of the SNAC project at three levels, namely at *student level*, at *teacher level* and at *institutional/school level*. Various evaluation tools and methods were employed to adequately evaluate the project at these three levels (e.g. reports, excel sheets, questionnaires, ongoing communication with the participating schools). The quantitative data were analyzed with the use of IBM SPSS Statistics and Excel (using the Analyse-IT plugin) and the qualitative data were analyzed with the open coding method.

In order to successfully evaluate the impact of the project, the development and implementation of the evaluation and quality plan was divided in different tasks organized in three phases: The tasks of the first phase concern the development of the evaluation methodology, the second phase refers to the tasks that were executed during

the school implementations and the last phase entails the data analysis and presentation of the main findings. The tasks of each phase are presented and described in detail in the IO4 Intellectual Output. To evaluate the SNAC project and to ensure its sustainability, the outcomes and the overall impact is measured based on quantitative and qualitative indicators summarized below and presented in detail in the IO4 Intellectual Output.

**The core SNAC School Network consists of 94 Schools with 58 stations in total** providing the opportunity to the participating schools to become open hubs of innovation, education, training and information to their local society. SNAC schools formed Communities and were informed on how to integrate open schooling in their practices in order to gradually become an equal social partner of their community. Furthermore, SNAC Schools completed a PRE (SNAC Implementation) and POST self-reflection tools (SRT) questionnaires as a means to measure and compare innovation and systemic change in schools before and after SNAC Implementation. The citizen science angle behind the network was also examined and the ways it can work for the society's interest. The role of students and teachers acting as citizen



scientists generating open research data in cooperation with scientists from the field of seismology and the big data was highlighted. Being part of a network of similarly pioneering schools across countries has also enhanced their culture towards innovation and helped them to foster or influence a bottom-up driven change or needed reforms in the educational systems and current STEM curricula.

The majority of the teachers found the organized multiplier events to be effective for their professional development and upcoming implementations in various aspects which possibly motivated them to participate in the implementation phase of the project and to introduce open-schooling in their everyday practice.

The motivation of teachers and the introduction of an open schooling environment provided the opportunity to develop and implement innovative projects by utilizing scientific instruments and methods and creating the need to communicate the outcomes of the project with the wider public. Hence, by promoting the active participation of students in all the stages of the project, an enhancement of a variety of students' skills and understanding related to scientific inquiry, problem solving, interdisciplinary thinking and civic responsibility were identified.

In the following paragraphs we present the quantitative and qualitative indicators we used to evaluate the project activities.

### 2.4.1. Quantitative Indicators

The **quantitative indicators** concern achieving these numbers, as well as the gathering of information regarding the schools/teachers drop-out rate, gender-balance and the number of collaborations within the school and with other schools. Specifically, the following information was collected and presented:

- Number of schools participating in the SNAC project as:
  - (i) The Core Network of SNAC Schools which were followed for the whole duration of the academic year and
  - (ii) The Evaluated Schools that submitted both the pre and post questionnaires which were created to evaluate the progress of their own management and their teachers and students.
- Information about the core SNAC school network: name, country, city, number of participating teachers and their subject discipline(s), students' grade and their seismometer installation status (if they installed a seismometer, whether it is a raspberry shake or a TC-1 and if it is available on the SNAC platform).
- Information about the teachers participating in the multiplier events (gender, previous participation in the SSE project, administrative duties and subject discipline) and estimation of drop-out rate during the schools' implementation phase.
- Number of collaborations between teachers of the same school or with other schools.
- Approximate number of participants (schools, teachers and students) in multiplier events organized in each country.
- Information about other communication channels for dissemination purposes.
- Basic information about the SNAC seismometer network (type and number of seismometers installed).

The following Table presents the exact numbers of Schools, Teachers and Students which were followed during the whole academic year and which took part in the evaluation process of the project.

	Core SNAC Network	Participated in the Evaluation
<b>SCHOOLS</b>	94	72
<b>TEACHERS</b>	202	196
<b>STUDENTS</b>	4040	2229 <sup>1</sup>

### 2.4.2. Qualitative Indicators

The **qualitative indicators** that relate to the three levels of participants (schools, teachers, students) are presented in detail section 1.2.1 of IO4 and are summarized below:

#### (i) Schools level:

For evaluating the indicators concerning the school level, the **School Development Plan (SDP)** and the **Self-Reflection Tool (SRT)** were used<sup>2</sup>.

<sup>1</sup> In total we have collected 5329 questionnaires from students: 2917 "pre" and 2412 "post". From the 2412 paired questionnaires, after the quality control, 2229 were accepted as suitable.

<sup>2</sup> Both the SDP and the SRT questionnaires were developed by the Open Schools for Open Societies H2020 Project, Grant Agreement Number 741572 ([www.openschools.eu](http://www.openschools.eu)).

The **SDP** consists of three main parts (1. School details, 2. Insight – Where are we now, 3. Vision – Where do we want to go) with open-ended questions to facilitate the development of a clear picture of the school's status and future goals regarding open schooling.

**SRT** includes three levels (management level, process level, teacher professional development level) with eight aspects each, which concern relevant issues (e.g. leadership, vision, school strategy). For each one of the eight aspects in each level the school has to choose one statement out of four that corresponds to the actual situation at the time.

These were the used indicators:

- to what extent school authority encouraged or facilitated participation of its staff teachers in trainings and teacher development programmes.
- to what extent school authority encouraged or facilitated development of interdisciplinary educational activities e.g. by altering school's timetable so that teachers from different STEM disciplines can work together.
- to what extent schools collaborated or plan to collaborate in the future with other schools in their area/ region/country or other countries.
- to what extent the participation of the schools in the SNAC project was considered as recognition or distinction of achievement and further facilitated the participation in other projects and initiatives.

#### **(ii) Teachers level:**

The main data source for the evaluation at this level was the on-line questionnaire which consisted of multiple choice and open-ended (non-mandatory) questions to be answered by the participating teachers after the completion of the workshops.

The first section of the questionnaire concerned demographic information of the participating teachers (country, gender, subject discipline etc.) which regard to the quantitative indicators.

The second section of the questionnaire included questions / statements regarding teachers' opinion about the effectiveness of the workshops and their intentions regarding the implementation phase of the project.

The open-ended questions embedded in this section served as an opportunity to clarify/explain the answer to the previous question/statement and to provide more extensive feedback to the partners. The questionnaires were anonymous and translated in the native language of the participants.

The data were analyzed quantitatively by the partners to mainly identify the effectiveness of the workshops and the initial intentions of the teachers to participate in the implementation phase of the project and to collaborate with others to engage their students in interdisciplinary activities concerning citizen seismology.

These were the used indicators:

- how effective were the offered training seminars and workshops.
- to what extent participant teachers developed interdisciplinary educational activities.
- to what extent participant teachers collaborated with other teachers in their school or other schools.

#### **(iii) Students level:**

The evaluation instruments that were employed for each qualitative indicator with regard to students' evaluation level are presented in the following Table

Level: Students		
No.	Indicator	Means of data collection
S11	enhancement of students' <b>problem-solving competence</b> and <b>interdisciplinary thinking</b>	Schools' reports and students' artifacts
S12	students' ability or enhancement to <b>code, record and analyse data</b> with the offered hardware sensors and software tools	
S13	students' ability to <b>handle and operate experimental techniques</b> to conduct a scientific investigation/inquiry	
S14	creation and/or change and/or enhancement of a <b>positive attitude towards STEM disciplines</b>	"My Science classes" questionnaire (Schreiner, Sjøberg, 2004)
S15	creation and/or change and/or enhancement of <b>critical thinking and understanding of civic responsibility</b>	1.Civic Responsibility Survey – Level 2 & 3 (Furco, Muller, & Ammon, 1998)

Students' artifacts and schools' reports<sup>3</sup> served as the main data sources for the evaluation of the project at this level and specifically for Students' Indicator 1 (S11), S12 and S13. It was expected that all SNAC teachers, with the on-going support of the partners and materials of the project, would have engaged their students in inquiry and project-based activities concerning citizen seismology.

### 2.4.3. Quantitative Indicators Results

The core network of the SNAC project presented in Table 3 consists of **94 schools** and **196 teachers**. We also estimate that a minimum of 20 students per teacher were involved in SNAC activities.

Country	Schools	Teachers	Students (Estimation: Teachers X20)
Greece	33	79	1580
Cyprus	14	28	560
Turkey	14	32	640
Italy	11	19	380
Bulgaria	20	38	760
Portugal	1	3	60
Israel	1	3	60
<b>TOTAL</b>	<b>94</b>	<b>202</b>	<b>4040</b>

Basic information about the schools' network (i.e. name of school, city, number of teachers per school and their subject disciplines, age of students and whether they installed a seismometer in their premises) for each country is presented in Table 11-15 the Intellectual Output IO4 document. Apart from the core SNAC network, an additional number of schools, teachers and citizens joined the SNAC project's network through the use of the available materials, actions, objectives etc. and were involved in various activities of the project through a variety of multiplier events (20 in total) organized in local and national level by partners and/or participating schools. The SNAC school network is estimated to have engaged **593 schools and 1196 teachers**. (see Table 16 of the Intellectual Output IO4 document for details). Most of the teachers participating (77%) were not part of the previous seismology project ran by the partners (SSE project) and so new schools and teachers became part of the updated SNAC school network

<sup>3</sup> Schools' reports are available in "Intellectual Output 5: Recommendations for Future Use" of the SNAC project.

and got to involve their students in citizen seismology. Also, a relative gender balance was achieved with both male and female teachers (59% male, 41% female) from various subject disciplines and educational levels participating. Most of the teachers did not have an administrative role in their school but through the multiplier events and the support of the partners informed their schools' administration and their peers through presentations during in-school meetings. Most of the participating teachers teach physics (n=71) and science (n=45) but teachers from other STEM related disciplines participated as well. In almost all the schools of the SNAC network (n=61) teachers collaborated with peers to engage students in interdisciplinary activities regarding citizen seismology. Physics and Science dominate the disciplines of SNAC teachers, followed by Math and Environmental Awareness. Two schools, one in Turkey and one in Greece also collaborated in a project regarding the sonification of seismic waves. The SNAC platform also facilitated the collaboration between schools and the development of school hubs by providing the opportunity to access for free and easily real-time seismic recordings of schools' seismometers in different countries which would otherwise be a difficult process for most of the schools. SNAC network consists of **58 stations in total** (28 TC-1 seismometers (4 of which are dial-up stations) and 30 Raspberry-Shake seismometers) distributed in the partner countries (Turkey, Cyprus, Greece, Italy and Bulgaria), as well as one seismometer is installed in Israel and one in Portugal. The network is described in detail in Intellectual Output IO3 and section 2.1.3 of Intellectual Output 4.

**2.4.4. Quantitative Indicators Results**

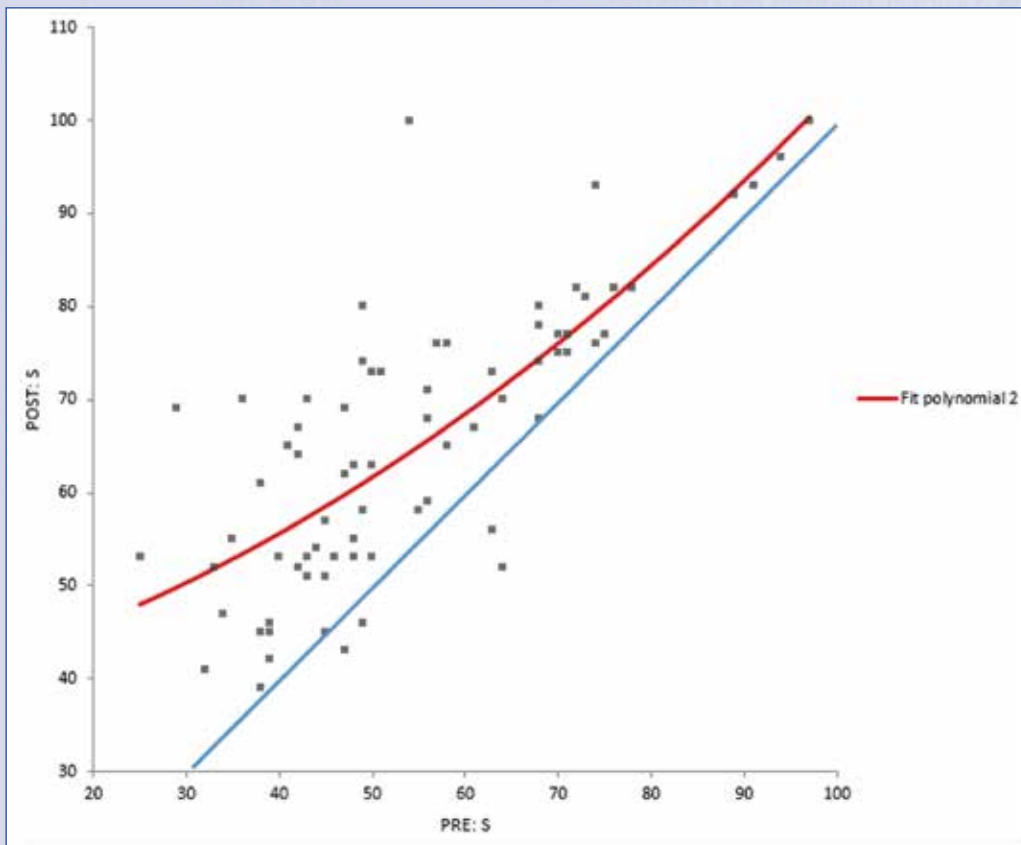
**(i) Schools' evaluation level**

Most of the participating schools have an increased SRT score. Some of the schools have made remarkable progress: 1 school had an increase of 40%, 4 schools had an increase of 30%, 19 schools had an increase of 15%. These are depicted with a diagonal line going upwards from the left to the right side of the diagram.

The following function depicts the increase that a school will see on its SRT score, if it implements the SNAC open schooling approach:

$$(POST: S) = 39,07 + 0,2601 (PRE: S) + 0,003836 (PRE: S)^2.$$

Where, (POST:S) is the post SRT score and (PRE:S) is the pre SRT score. The following figure depicts the above equation graphically:



A school that scored low in the pre SRT (for example 40%) is easier to see an increase than a school that scored high in the pre SRT (for example 60%).

Schools score regarding the “teacher professional development sub-level” after the implementations in the context of the SNAC project was increased (mean=64,51, SD=16,97) compared to their score before the implementations (mean=54,24, SD=16,94). Given that this difference is statistically significant ( $t = -6,9$ ,  $df = 58$ ,  $p < .001$ ), it can be implied that teachers’ implementations of earthquake-oriented activities with their students impacted on their professional development. This finding indicates that school authority facilitated the participation of its staff teachers in development programs of the SNAC project and that through this support the teachers were able to develop their professional capacity.

Schools score after the implementations regarding “teacher process sub-level” in the context of the SNAC project was increased (mean=66,10, SD=17,05) in comparison with their score before the implementations (mean=54,87, SD=17,54). This difference was statistically significant ( $t = -7,14$ ,  $df = 58$ ,  $p < .001$ ), indicating that the implementation of project’s activities affected schools’ culture in terms of adaptations and modifications of their ordinary settings (e.g., altering school’s timetable so that teachers from different STEM disciplines can work together).

Based on the SRT scores of the participating schools, we were able to compare schools that had an installed seismometer with schools that did not have an installed seismometer. As seen from the results, there was an increase of 10,6% (mean pre SRT score: 52,1%, post SRT score: 62,7%).

There was a slightly bigger increase in SRT scores of schools without seismometers in comparison with schools with an installed seismometer. Given the fact that increasing SRT scores is harder when the starting point is higher<sup>4</sup>, it can be assumed that having a seismometer positively affects the results.

While looking into these results, it is assumed that the main drivers of the increase of the average scores are the Process Level (from 52,6 to 64,6%) and the Professional Development Level (from 54,6% to 65,7%). The Management Level had the smallest impact (increasing from 55,3% to 65,9%).

Schools with installed seismometers scored almost 5% higher than schools without seismometers. Examining the sub-levels and comparing them with the total, we see that the Professional Development level had a higher increase (from 56% to 68,1%), in these schools.

Having a seismometer seems to help teacher achieve better results. On the other hand, we see that the difference is not broad which means that the project has provided the required data, tools and resources to all participating schools, in order to minimize the disadvantage of not have a seismometer installed at their premises.

## (ii) Teachers’ evaluation level

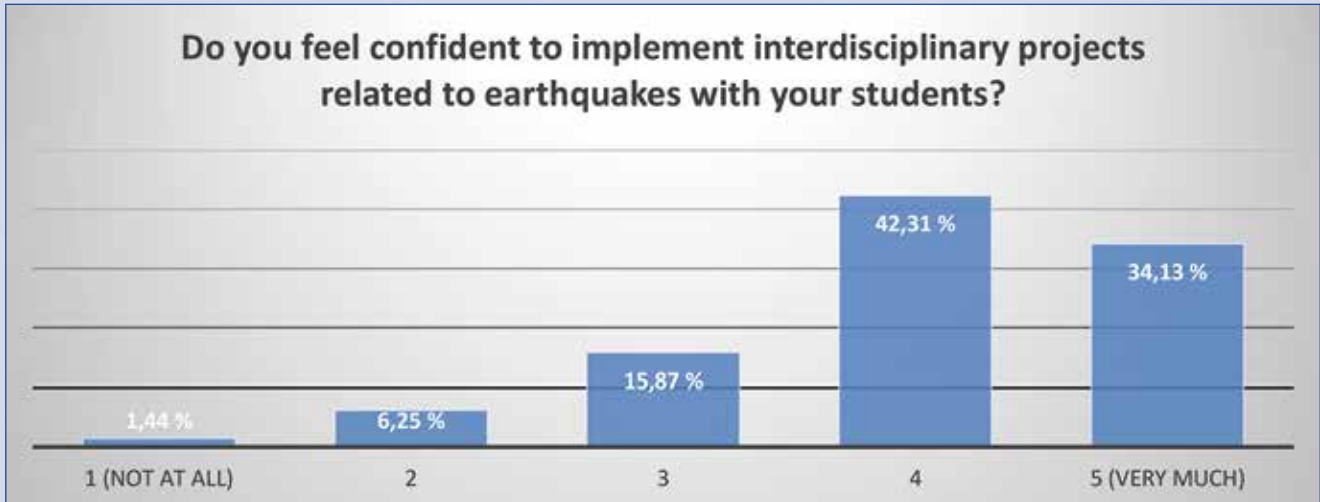
The main data sources for the evaluation at this level were the on-line questionnaires completed by teachers in all participating countries. In total, **196 teachers filled in this questionnaire** in their native language prior to their schools’ implementations. Information acquired during on-going communication and support throughout their implementations and schools’ reports served as additional data for this evaluation level as well.

Through the multiplier events (seminars, workshops etc.) teachers were introduced to citizen seismology, innovative approaches to teaching (inquiry and project-based learning, utilization of real-time data and scientific software and hardware etc.) and open-schooling. The majority of the teachers found the organized multiplier events to be effective for their professional development and upcoming implementations in various aspects which possibly motivated them to participate in the implementation phase of the project and to introduce open-schooling in the everyday practice.

Regarding the open schooling approach presented to teachers, the majority (85.1%) considered that the workshops developed their understanding of this approach (see Figure 18) and the 86.54% felt more motivated to integrate it to their everyday school practice (see Figure 19) which was one of the main goals of the multiplier events.

<sup>4</sup> A school that scored low in the pre SRT (for example 40%) is easier to see an increase than a school that scored high in the pre SRT (for example 60%).

Prior to schools' implementations, teachers were asked through the on-line questionnaires whether they felt confident enough to implement interdisciplinary activities with their students in the context of citizen seismology. As evident, from the figure below, most teachers (76.44%) stated that they were confident enough in up taking such projects with their students.



Also, a great number of teachers (88,46%) found the educational approaches (i.e. open schooling, inquiry-based learning etc.) suggested in the context of the SNAC project to be useful in understanding interdisciplinary learning and in implementing such projects with their students.

This initial motivation in implementing interdisciplinary activities was put into practice by most of the SNAC schools. Most of the schools of the core SNAC network decided to involve more than one teacher of a STEM discipline to work in groups during their implementations to achieve better interdisciplinary connections during the activities and also to support a collaborative and open-schooling environment. Based on the schools' reports, through this collaboration teachers developed interdisciplinary projects with their students introducing concepts for various disciplines (e.g. physics: wave propagation, geography: tectonic plates, technology/engineering: coding and recording of seismic data) and thus, their students were able to enhance their interdisciplinary thinking.

The participating teachers wanted to collaborate in the context of the project with teachers from their school or other schools, considering that the schools which installed seismometers in their premises functioned also as hubs for the other schools mainly through the provision of the real-time seismic data from the area available in the platform. Almost all the teachers (92%) declared in the on-line questionnaire that they will collaborate with other teachers during their school's project in various ways: 42,71% declared that main way they intended to collaborate with their peers was by sharing materials and ideas with them and the rest of the teachers stated that they will collaborate either by actively involving them in the implementation phase of their projects (e.g. to teach a related concept or support an in-school action) or by developing activities related to seismology and their subject discipline (27,60%).

### (iii) Students' evaluation level

#### **Enhancement of students' problem-solving competence and interdisciplinary thinking:**

We have identified four types of projects that were implemented by students in their effort to respond to specific problems/issues that concerned the local community: Investigation of Seismic parameters, Development of Seismographs, Designing of educational and communication materials for raising awareness and other projects like the sonification of seismic waveforms. SNAC communities in the OSOS platform host 55 of these projects and links for each one are available on Appendix 5.2. Of course, there many other projects that have been implemented and not uploaded.

The findings that were revealed from the data analysis clearly indicate that SNAC engaged students from all participating countries in employing real problem-solving skills, handling and studying situations, and participating in meaningful and motivating science inquiry activities. Through all these type projects, it became evident that students enhanced their ability to handle and operate experimental techniques, to develop problem-solving competencies and their interdisciplinary thinking. Students dealt with real seismic data that have acquired themselves through the installed network of school seismometers.

The “investigation of seismic parameters” type of project followed inquiry-based investigation processes and created moderate interdisciplinary links since teachers showcased and engaged students in the holistic aspect of the concept of earthquakes in a more sporadic way than the other type of project. The “designing materials for raising awareness” type of project facilitated the development of strong interdisciplinary links between various disciplines, mainly Physics, Geology, Language disciplines and Arts, since they included on-going in-school collaborations for designing and effectively disseminating the materials, as well as for supporting any dissemination events.

#### **Ability to code, record and analyse data with the offered hardware sensors and software tools:**

The most frequent type of activity regarding the seismic data coding, recording and analyzing with the SWARM software was clustered at the moderate level of proficiency (i.e. identification of an earthquake in the recordings, date and time of the event, localization of epicenter and estimation of magnitude).

Activities of the higher level of proficiency were implemented mainly when an important seismic event in their region was occurring and the students were very interested in investigating and reporting to their peers the characteristics of a certain earthquake. In addition, higher level of seismic analysis was implemented by schools which their projects were more directed towards investigating concepts related to physics or geography. Such an example is the project of the Istanbul ALKEV School (Turkey) in collaboration with the Greek school Ellinogermaniki Agogi which focused on the similarities and differences of earthquake waves with sound waves and as a result, various in-depth types of analysis of earthquake data were employed.

#### *Early Warning System*

Using P-wave information, students created code (in the Python programming language) that can provide warning before the Secondary (S)-wave arrives, bringing the strong shaking that usually causes most of the damage. This alert system can give enough time to slow trains and taxiing planes, to prevent cars from entering bridges and tunnels, to move away from dangerous machines or chemicals in work environments and to take cover under a desk, or to automatically shut down and isolate industrial systems. Taking such actions before shaking starts can reduce damage and casualties during an earthquake. SNAC organized a “Hackquake” (see section 4.5.2) giving the opportunity to SNAC teachers to attend a unique workshop for students, university students and teachers who love algorithm design and open source development for problem solving. The problem they had to solve was simple: “What can you do with a few seconds of warning?”

#### *The sound of Earth*

To detect earthquakes, scientists use seismometers. Seismometers produce seismograms. Sound is a wave. SNAC Teachers provoke the curiosity of students by asking: “Earthquakes arrive to us in waves also. Could we listen to earthquakes? To hear the vibrations of earth’s solid crust? Would you like to synthesize your own melody of the earth using data from a seismogram?”. Most earthquakes have frequencies <20Hz - we cannot hear them. The sound we hear during earthquakes derives from the oscillation of buildings and their internal structures (glass, bookcases etc). Through sound editing applications, we can change the frequency of the seismic wave so that it can be heard by the human ears and with the help of a synthesizer software the seismic waveform is converted to musical notes and the sound of the earth is compiled. (see section 4.9.1).

#### **Ability to handle and operate experimental techniques to conduct a scientific investigation/inquiry**

The majority of students’ projects concerned the investigation of seismic parameters and thus, the experimental techniques employed by students concerned the use of the SWARM software and the analysis

of waveforms to locate the epicenter and estimate the magnitude of an earthquake. Their hypotheses/questions derived from an initial observation of seismograms of the same seismic event. Their conclusions and reports of the events were then generated by students (especially for important local earthquakes) which were then shared by different means (e.g. posters, social media posts).

Projects concerning the development of seismographs which were also based on scientific investigations followed the Design Thinking approach (described in detail in Intellectual Output 1).

These projects lasted for weeks and included some sort of collaboration within an open-schooling environment (e.g. support from university researchers and seismologists, in-school collaboration with peers and utilization of the SNAC platform and the recordings of other schools) which inevitably enhanced students' ability to handle and operate experimental techniques to conduct a scientific investigation/inquiry.

### **Creation and/or change and/or enhancement of a positive attitude towards STEM disciplines**

For evaluating whether students' participation in the SNAC project impacted on their attitudes towards STEM disciplines, the "My Science classes" questionnaire was administered to the students before and after the schools' implementations. In total, 1477 questionnaires were completed before the implementations and 1194 were completed after the schools' implementations.

An increase in mean score of the raw data from pre- to post- administration of the test is evident for all countries indicating that students' engagement in the various activities and projects that were carried out in the context of the SNAC project had a positive impact on students' attitudes with regard to STEM disciplines:

Country	Mean Score	
	PRE	POST
Greece	<b>2,18</b> (n= 612)	<b>3,22</b> (n=420)
Cyprus	<b>2,80</b> (n=309)	<b>3,21</b> (n=317)
Turkey	<b>2,90</b> (n=238)	<b>2,97</b> (n=169)
Bulgaria	<b>2,68</b> (n=70)	<b>2,93</b> (n=29)
Italy	<b>2,81</b> (n=248)	<b>2,82</b> (n=259)
<b>AVERAGE</b>	<b>2,67</b>	<b>3,03</b>

Further statistical analysis of the data collected was performed with the use of IBM SPSS Statistics to check if the differences from pre- to post- administration are statistically significant. It is important to state that data from students who completed one of the two questionnaires were omitted, as well as data from students who did not respond to more than the 10% of the items

### Creation and/or change and/or enhancement of critical thinking and understanding of civic responsibility

For evaluating this Students Indicator, the “Civic Responsibility Survey” questionnaire was administered to the students before and after the schools’ implementations, in collaboration with the participating teachers. In total, 772 questionnaires of Level 2 (Upper Elementary and Middle school) and 758 questionnaires of Level 3 (High school) were collected before the implementations and after the schools’ implementations 668 Level 2 were collected and 460 Level 3 questionnaires.

Further statistical analysis of the data collected was performed with the use of **IBM SPSS Statistics** to check if the differences from pre- to post- administration are statistically significant. It is important to state that data from students who completed one of the two questionnaires were omitted, as well as data from students who did not respond to more than the 10% of the items.

As seen in the Table below, students’ civic awareness, civic efficacy and connection to community were significantly improved ( $p < .001$ ) after the schools’ implementations for both educational levels. SNAC project aimed at supporting schools in introducing Open Schooling in their everyday practice and becoming open hubs of innovation, education, training and information to their local society.

			<b>Mean</b>	t	<b>SD</b>	p
<b>Connection to community</b>	L2	pre	<b>3.69</b>	-18.00	<b>1.31</b>	<.001
		post	<b>4.81</b>		<b>0.86</b>	
	L3	pre	<b>3.38</b>	-10.98	<b>1.086</b>	<.001
		Post	<b>4.20</b>		<b>1.014</b>	
<b>Civic Awareness</b>	L2	pre	<b>4.07</b>	-15.64	<b>1.41</b>	<.001
		post	<b>5.10</b>		<b>0.94</b>	
	L3	pre	<b>3.43</b>	-11.31	<b>1.01</b>	<.001
		post	<b>4.21</b>		<b>0.95</b>	
<b>Civic Efficacy</b>	L2	pre	<b>3.78</b>	-18.03	<b>1.22</b>	<.001
		post	<b>4.89</b>		<b>0.91</b>	
	L3	pre	<b>3.25</b>	-9.89	<b>0.96</b>	<.001
		post	<b>3.93</b>		<b>0.94</b>	

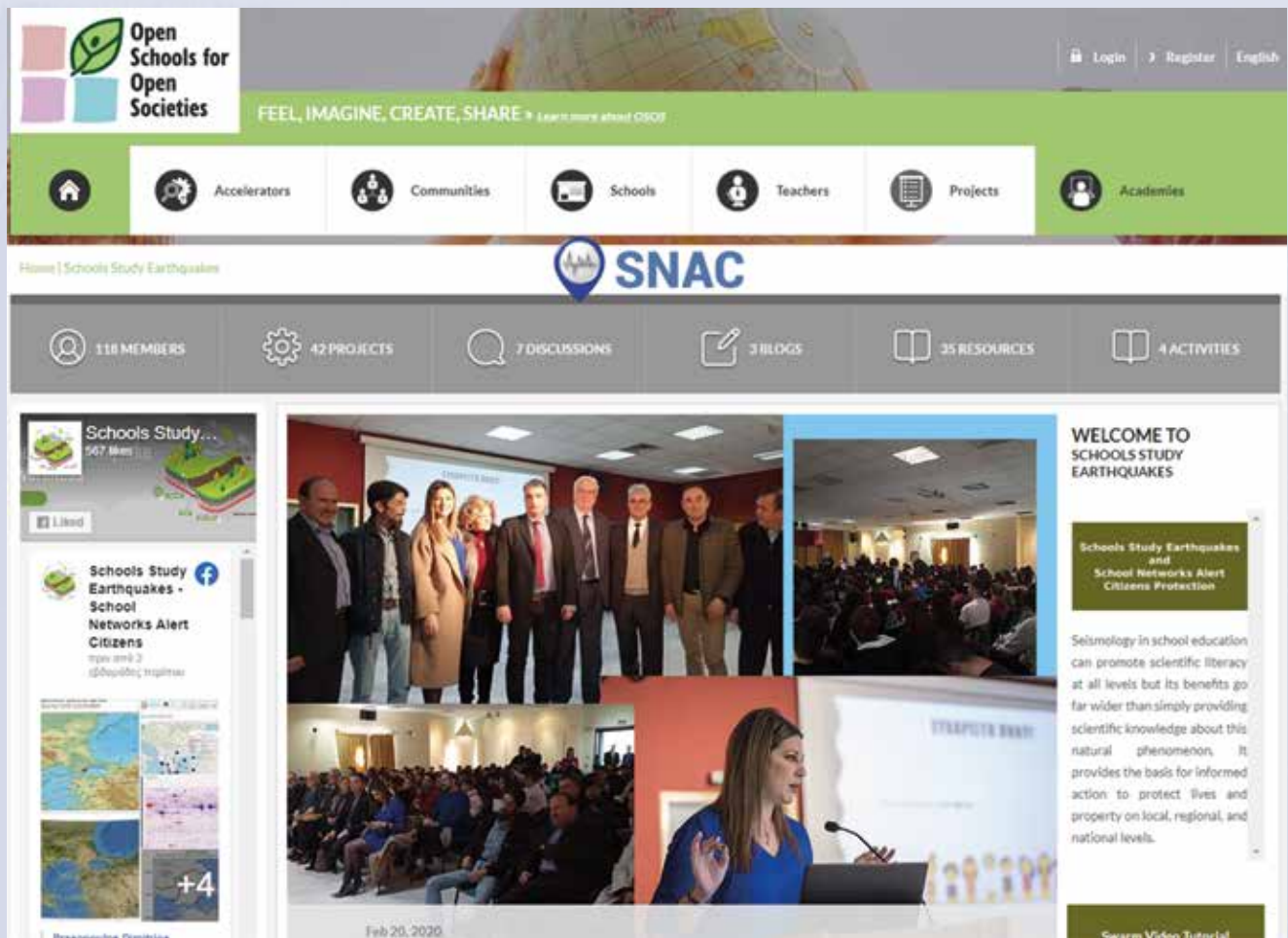
Through this approach, students had the opportunity to connect and interact in a meaningful way and as equal partners with the local community through innovative projects which based on these results seem that facilitated the enhancement of their understanding of civic responsibility. Students’ civic

awareness, civic efficacy and connection to community from all the countries was improved after the implementations.

## 2.5. Recommendations for Future Use (Intellectual Output 5)

The Recommendations for Future Use, Intellectual Output 5 (this document), gives a concise and thorough overview of the project’s overall framework and results and to guide and support anyone interested in it, from teachers and teacher educators to all individuals and stakeholders involved in educational processes to effectively follow the project approach in developing and offering innovative educational activities and teaching practices. In this document we present the main guidelines, lessons learned and recommendations of designing and implementing an innovative STEM project in the best possible way in order to guarantee results and avoid common pitfalls.

Therefore, in Chapter 1, this document addresses all the necessary information behind SNAC’s philosophy, goals and strategy from its early phase until its implementation in school classrooms. In Chapter 2, it summarizes all the work done by teachers and schools in the participating countries, while identifying and presenting show cases of best-practice and achievements beyond expectations (in the following paragraphs of this chapter), examining in parallel the effects of these activities on the participating schools, teachers and students through the outcomes of the Evaluation phase in Chapter 2.4. In Section 4 of this document we present in detail all the activities, events and workshops that stood out during the implementation of the project in the five countries. SNAC teachers have created OSOS Communities in order to upload resources and give the opportunity to their students to upload their projects. SNAC’s Open Schooling Communities can be accessed through the following link: <https://portal.opendiscovery.eu/en/community/schools-study-earthquakes-849203>



Furthermore, in APPENDIX 6.1, distinguished activities performed by the participating SNAC schools in each country, are being presented.

School	Themes/Actions/Outcomes
<b>1<sup>st</sup> Technical High School of Karditsa</b>	<ul style="list-style-type: none"> <li>• Collaboration of three teachers: Physics, Math and Engineering.</li> <li>• Organisation of Student Conference with participants from the local society</li> <li>• Connection with the local University</li> <li>• Use of Arduino to make replica of the first ever seismograph from China</li> <li>• Coding in Python</li> <li>• Publications to local press</li> </ul>
<b>5th Primary School of City of Rhodes</b>	<ul style="list-style-type: none"> <li>• Collaboration of four teachers: Math, Science, ICT and Engineering.</li> <li>• Visit from the local Civil Protection Agency, Regional policymakers and the Municipality of Rhodes</li> <li>• Connection with seismologists</li> <li>• Creation of STEM corner in the classroom and Youtube channel</li> <li>• Publications to local press</li> </ul>
<b>American Agricultural School of Thessaloniki</b>	<ul style="list-style-type: none"> <li>• Creation of posters to inform the local society about earthquakes</li> <li>• Introduction to seismology for high school students</li> <li>• Creation of Seismograph by using LEGO robotics</li> <li>• Coding in Mindstorms</li> </ul>
<b>Izmir Istek Private High School</b>	<ul style="list-style-type: none"> <li>• Collaboration of three teachers: Physics, Art and Geography</li> <li>• Creation of brochure which was distributed to the local community</li> <li>• Earthquake Rescue team visited the school</li> <li>• Exploration of the SWARM software</li> </ul>
<b>Istanbul ALKEV School</b>	<ul style="list-style-type: none"> <li>• Collaboration of four teachers (Chemists, Physicists, Music and Science)</li> <li>• Analysis of seismic waves</li> <li>• Conversion of seismic waves to musical notes</li> <li>• Collaboration with other local schools and a school from another country</li> </ul>
<b>DEUZEM-75.Yil</b>	<ul style="list-style-type: none"> <li>• Collaboration of three teachers (2 science and one ICT)</li> <li>• Connections with local University and Seismological Institution.</li> <li>• Use of drones to compare pictures before and after an earthquake</li> <li>• Programming in Javascript and Python</li> </ul>
<b>American Academy, of Larnaca</b>	<ul style="list-style-type: none"> <li>• Collaboration of two teachers: Geography and History</li> <li>• Connection with local university</li> <li>• Study of school building in their area</li> <li>• Development of posters and 3D models</li> <li>• Introduction to seismology and volcanos</li> </ul>

<b>Makedonitissa Gymnasium</b>	<ul style="list-style-type: none"> <li>• Collaboration of two physics teachers</li> <li>• Questionnaires to parents and local stakeholders</li> <li>• Participation in a national contest on Edmondo</li> <li>• Articles to the school's newspaper</li> <li>• Creation of a board game about earthquakes</li> </ul>
<b>Polemida High School</b>	<ul style="list-style-type: none"> <li>• Collaboration of four physics teachers</li> <li>• Connection with the national Civil Protection Organisation</li> <li>• Connection with the local university</li> <li>• Creation of posters</li> <li>• Implementation of earthquake drills</li> </ul>
<b>High School of Mathematics "Paisiy Hilendarski"</b>	<ul style="list-style-type: none"> <li>• Collaboration of two teachers: Physics and ICT</li> <li>• Connection with the local university</li> <li>• Development of communication plan to connect with the local community.</li> </ul>
<b>Istituto Statale di Istruzione Secondaria Superiore Guglielmo Marconi</b>	<ul style="list-style-type: none"> <li>• Collaboration of two teachers: Physics and ICT</li> <li>• Collaboration with local Municipality</li> <li>• Collaboration with local Research Centre</li> <li>• Use of SWARM software even with closed schools due to COVID.</li> </ul>
<b>Istituto Superiore G. Minutoli – Liceo S. Quasimodo di Messina</b>	<ul style="list-style-type: none"> <li>• Collaboration of two teachers: Physics and Math</li> <li>• Collaboration with local University</li> <li>• Connection with teachers from other local schools</li> <li>• Connection with the National Association of Physic Teachers</li> </ul>
<b>Liceo Scientifico Statale Arturo Labriola di Napoli</b>	<ul style="list-style-type: none"> <li>• Collaboration of two Science teachers</li> <li>• Collaboration of teachers and students with the parents of the school</li> <li>• Connection with local University</li> <li>• Students presented projects to their local community</li> <li>• Event to promote the installation of a seismograph to the school.</li> </ul>

### 3. Project Implementation Overview

#### 3.1. Overall

The core network of the SNAC project, consists of **94 schools, 202 teachers and 58 installed seismometers**. We also estimate that a minimum of 20 students per teacher were involved in SNAC activities.

Country	Schools	Teachers	Students (Estimation: Teachers X20)
<b>Greece</b>	33	79	1580
<b>Cyprus</b>	14	28	560
<b>Turkey</b>	14	32	640
<b>Italy</b>	11	19	380
<b>Bulgaria</b>	20	38	760
<b>Portugal</b>	1	3	60
<b>Israel</b>	1	3	60
<b>TOTAL</b>	<b>94</b>	<b>202</b>	<b>4040</b>

The participating schools, gradually become open hubs of innovation, education, training and information to their local society. SNAC offered schools in all countries the opportunity to expand their horizons and perspectives of collaboration with other schools in their own country or other countries, to apply, implement and adopt non-traditional educational methods and activities in STEM education, to increase their awareness of cutting-edge trends and developments in science, technology and education that all have greater impact to society as a whole. SNAC schools connected with their local society through on site and online multiplier events, workshops and webinars.

#	Name of School	Country
1	High Foreign Language School “ <b>Akad. Liudmil Stoyanov</b> ” - <b>Blagoevgrad</b>	Bulgaria
2	“ <b>Simeon Radev</b> ” High School - <b>Pernik</b>	Bulgaria
3	<b>Romain Rolland</b> Foreign Language School - <b>Stara Zagora</b>	Bulgaria
4	High School Matematicheska Gimnaziya “ <b>Baba Tonka</b> ”, Russe	Bulgaria
5	National Gymnasium for Natural Sciences and Mathematics	Bulgaria
6	Gymnasium for Natural Sciences and Mathematics, <b>Botevgrad</b> , Bulgaria	Bulgaria
7	High School of Teaching <b>Foreign Languages “Ivan Vazov”</b>	Bulgaria
8	High School of Mathematics “ <b>Paisiy Hilendarski</b> ” - “Sofia, Bulgaria”	Bulgaria
9	High School of Mathematics and Natural Sciences “ <b>Acad. Ivan Tsenov</b> “ - <b>Vratsa</b>	Bulgaria
10	“Akademik <b>Boyan Petkanchin</b> ” High School - <b>Haskovo</b>	Bulgaria
11	“ <b>Hristo Botev</b> ” Fifth primary school - <b>Kyustendil</b>	Bulgaria
12	<b>English</b> Language School “ <b>Geo Milev</b> ” АЕГ “Гео Милев” – Русе	Bulgaria

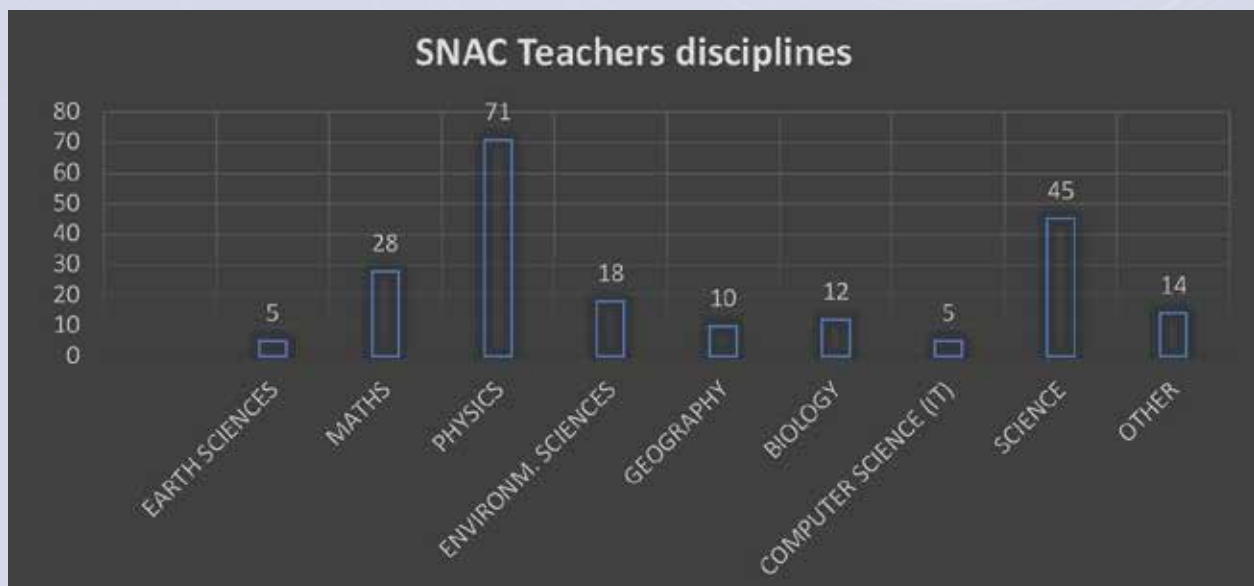
13	Secondary School “St. St. Kiril and Metodiy” <b>Kozloduy</b>	Bulgaria
14	Secondary School “St. St. Kiril and Metodiy” <b>Radomir</b>	Bulgaria
15	125 High School “Prof. <b>Boyan Penev</b> ” 125 СУ „Проф. Боян Пенев“ - София	Bulgaria
16	High School of <b>Mathematics and Natural Sciences “Ivan Vazov”</b> ПМГ “Иван Вазов” Димитровград	Bulgaria
17	Professional High School “ <b>D-r Nikola Vasiliadi</b> ” ПТГ „Д-р Никола Василяди“ – Габрово	Bulgaria
18	Secondary School “ <b>Neofit Rilski</b> ” СУ „Неофит Рилски“ - Долна баня	Bulgaria
19	High School of Mathematics - <b>Lovech</b> Природо-математическа гимназия – Ловеч	Bulgaria
20	Primary School “ <b>Aleksander Georgiev - Kodzhakafaliyata</b> ” ОУ „Александър Георгиев-Коджакафалията“, Бургас	Bulgaria
21	High School of <b>Polemida</b>	Cyprus
22	2nd Primary School of <b>Liopetri</b>	Cyprus
23	Junior High School of <b>Engomi</b> Kyriacos Neocleous	Cyprus
24	Junior High School of <b>Apostolos Pavlos</b>	Cyprus
25	Perifereiako Sxoleio <b>Giolou, Pafos</b> , Cyprus	Cyprus
26	<b>American</b> Academy	Cyprus
27	<b>Forum</b> Greek Private School (former Potamia. Cyprus)	Cyprus
28	Junior High School of <b>Makedonitissa</b>	Cyprus
29	2nd Primary School of <b>Avgorou</b>	Cyprus
30	Regional Junior High School and High School of <b>Lefkara</b>	Cyprus
31	Regional Junior High School of <b>Kiti</b>	Cyprus
32	Regional Junior High School of <b>Kokkinotrimithia</b>	Cyprus
33	1st Primary School of <b>Palouriotissa</b>	Cyprus
34	<b>Laniteio</b> High School	Cyprus
35	1st Experimental Primary School of <b>Ioannina</b>	Greece
36	1st High School of <b>Kos</b>	Greece
37	Junior High School of <b>Moudros</b> “Argyrios Moschidis” <b>Limnos</b>	Greece
38	Music School of <b>Therisso, Chania</b>	Greece
39	Juniior High School of Intercultural Education <b>Sapes</b>	Greece
40	1st Junior High School of <b>Corfu</b>	Greece
41	7th Junior High School of <b>Trikala</b>	Greece
42	2nd Primary School of Riza <b>Zakynthos</b>	Greece
43	4th High School of <b>Lagkadas - Thessaloniki</b>	Greece
44	1st Junior High School of <b>Vrilissia</b>	Greece
45	Ekpaideutiria Panou, <b>Patra</b> (bought with own funds)	Greece

46	Ellinogermaniki Agogi, <b>Attiki</b>	Greece
47	Junior High School of <b>Loggas Messinia</b>	Greece
48	Protypo High School Evaggeliki Sholi Smyrni	Greece
49	Special Junior High School <b>Thessaloniki</b>	Greece
50	2nd High School of <b>Sparta</b>	Greece
51	3rd Junior High School of <b>Igoumenitsa</b>	Greece
52	High School of <b>Vamos</b>	Greece
53	2nd High School of Argostoli	Greece
54	1st Laboratory Center of Karditsa	Greece
55	Lyceum Avlonari, <b>Evia</b>	Greece
56	Ekpedeftiria Geitona, <b>Attiki</b>	Greece
57	Ekpaideuthria Nea Genia Ziridi, <b>Attiki</b>	Greece
58	EKPE Magnhsias, <b>Volos</b>	Greece
59	3rd Lyceum <b>Kifisia</b>	Greece
60	Gymnasium Agnanta <b>Arta</b>	Greece
61	Junior High School of Emporio Santorini	Greece
62	High School of <b>Nisyros</b>	Greece
63	Primary School of <b>Giannitsochori</b>	Greece
64	1st High School of <b>Patra</b>	Greece
65	1st High School of Nafplio - <b>EKFE Argolidas</b>	Greece
66	Public Vocational Training Institute of <b>Veroia</b>	Greece
67	2nd Primary School of <b>Mandra</b>	Greece
68	ISIS <b>Guglielmo Marconi</b>	Italy
69	Liceo scientifico <b>Arturo Labriola</b>	Italy
70	IIS Liceo <b>Albert Einstein</b> Torino, Italy	Italy
71	Istituto Superiore Giuseppe Minutoli	Italy
72	IIS Santorre di <b>Santarosa*</b>	Italy
73	Liceo Scientifico e <b>Linguistico Vittorini*</b>	Italy
74	Istituto Tecnico Tecnologico <b>Giordani-Striano*</b>	Italy
75	Liceo scientifico statale <b>Galileo Galilei*</b>	Italy
76	IC 28 Giovanni XXIII - <b>Aliotta</b>	Italy
77	Istituto Superiore Statale <b>Artemisia Gentileschi</b>	Italy
78	Liceo Scientifico Statale <b>Renato Caccioppoli</b>	Italy
79	<b>İstek College</b> (İzmir İstek Anadolu Lisesi)	Turkey
80	<b>İzmir Özel</b> Türk Koleji	Turkey

81	<b>TED GAZİANTEP KOLEJİ</b>	Turkey
82	<b>DEUZEM</b>	Turkey
83	<b>ALKEV Özel Anadolu</b> ve Fen Lisesi	Turkey
84	<b>Bahçeşehir Bornova</b> Koleji	Turkey
85	<b>Karabulak</b> Regional Boarding Secondary School	Turkey
86	<b>Makbule</b> Süleyman Alkan Ortaokulu	Turkey
87	<b>Davutlar</b> Vali Kadir Uysal Ortaokulu	Turkey
88	<b>Ebru Nayim</b> Fen lisesi <b>Tekirdağ</b>	Turkey
89	<b>Fırınlı</b> Ortaokulu	Turkey
90	<b>Yunus Emre</b> Ortaokulu	Turkey
91	<b>4 Temmuz Şehit</b> Hüseyin Güldal	Turkey
92	<b>Buca Sınav</b> Koleji	Turkey
93	Escola Secundária <b>Jerónimo Emiliano de Andrade</b>	Portugal
94	Itzhak Navon Quiryat <b>Motskin</b>	Israel

SNAC Teachers learnt to develop educational projects that are proposing solutions to the needs and challenges of their local communities. The citizen science angle behind the network was also examined and the ways it can work for the society's interest. The role of students and teachers acting as citizen scientists generating open research data in cooperation with scientists from the field of seismology and the big data was highlighted. Being part of a network of similarly pioneering schools across countries has also enhanced their culture towards innovation and helped them to foster or influence a bottom-up driven change or needed reforms in the educational systems and current STEM curricula. The motivation of teachers and the introduction of an open schooling environment provided the opportunity to develop and implement innovative projects by utilizing scientific instruments and methods and creating the need to communicate the outcomes of the project with the wider public.

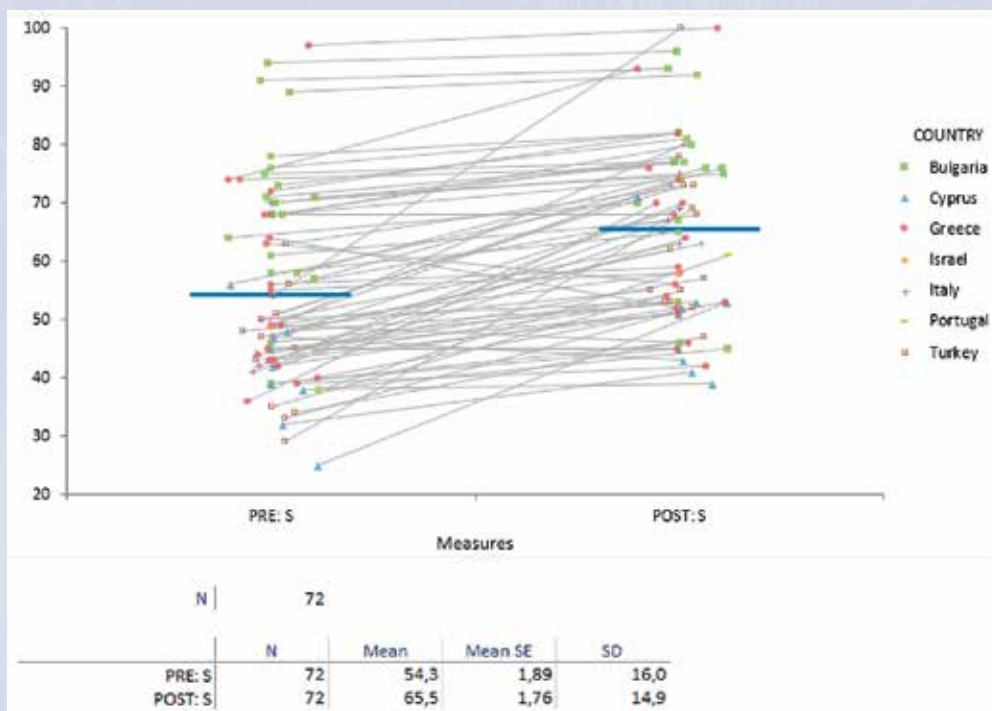
Hence, by promoting the active participation of students in all the stages of the project, an enhancement of a variety of students' skills and understanding related to scientific inquiry, problem solving, interdisciplinary thinking and civic responsibility were identified. In almost all the schools of the SNAC network teachers collaborated with peers to engage students in interdisciplinary activities regarding citizen seismology. The disciplines of SNAC Teachers are presented in the following Figure:



For evaluating the indicators at School level, we used the *Open School Development Plan (SDP)* and the *Self-Reflection Tool for Schools and Teachers (SRT)*<sup>5</sup>. In total, **38 SDPs** were collected. In analyzing the data, the schools that did not complete either the pre or the post SRTs were excluded from the dataset, resulting to 72 schools in total (see appendix 5.2).

In general, SNAC schools scored similarly to typical OSOS schools regarding their progress between one full academic year which is approximately an increase of 10% in their SRT score. On average, an increase of 11,2% in pre and post SRT questionnaires of SNAC Schools has been yielded: The pre SRT questionnaires score was 54,3% and the post SRT score reached 65,5%.

The following Figure depicts this increase, representing the average scores with the blue straight line and the details for each participating country in colored dots.



### 3.2. Implementation Overview in Greece

In Greece 19 schools have directly participated in SNAC evaluation and submitted both pre and post questionnaires. The increase of SRT scores from one year to the next was 8,4%, below average (from 55.4% to 63,8%). Greek schools also start from a higher pre SRT point that the other countries (except from Bulgaria).

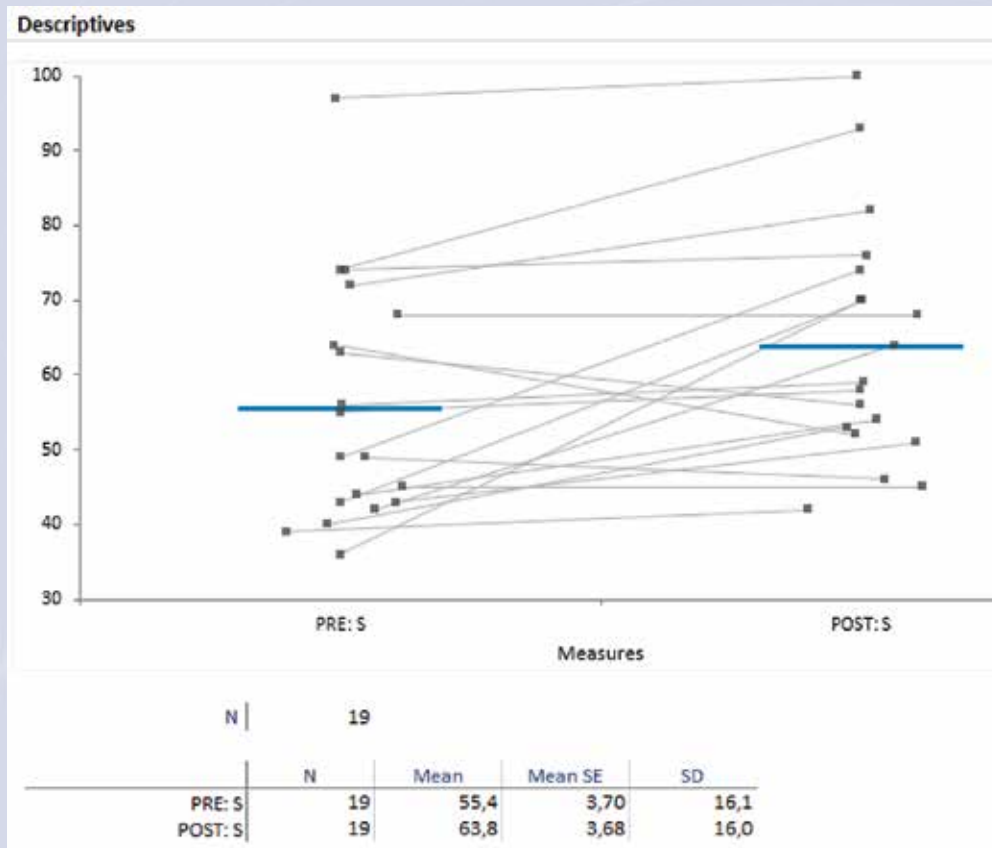
Through the participation in the SNAC activities and the implementation of the OSOS principles in the school life, the participating schools encouraged and supported collaboration among staff for teaching through team teaching and sharing of teaching resources. The OSOS platform was used to establish cross-schools' networks and to support a culture of collaboration between teachers. In this way, the Greek SNAC Schools supported the professional development of the school staff, creating opportunities for the teachers to engage in school-to-school networks and to share expertise and teaching resources. The adoption and retainment of the SNAC Open Schooling approach will encourage Greek teachers to seek and participate in trainings and teacher development programs in the future, not only around Seismology but on other subjects also.

In Greece, the national educational system and its regulations do not fully allow autonomy to schools to develop as a learning organization. On the other hand, schools are not fully prevented to uptake initiatives that promote school innovation. Throughout the implementation of SNAC, the collaboration with

<sup>5</sup> Both the SDP and the SRT questionnaires were developed by the Open Schools for Open Societies H2020 Project, Grant Agreement Number 741572 ([www.openschools.eu](http://www.openschools.eu))

the Institute of Educational Policy of the Ministry of Education through the OSOS project, has provided opportunities to engage, discuss and explore how Greek SNAC schools need to evolve and transform.

SNAC Greek Schools facilitated open, effective, and efficient co-design, co-creation, and use of educational content (both from formal and informal providers), becoming hubs of innovation and communication with their local societies. The active participation of Greek teachers from all over the country to the organized webinars, workshops and summer schools during the project, validates the abovementioned argument.



SNAC enabled students to continue learning outside the classroom, drawing on family members, peers, local experts, and online references as sources of research and critique. Apart from the proposed benefits in terms of promoting scientific literacy, civil responsibility and transnational cooperation, SNAC assisted students in developing skills in problem analysis, solution formulation and entrepreneurship. In order to achieve this, students were exposed to real-world problems so that they learn to develop, evaluate and select solutions.

To do that they collaborated with researchers, civil protection agencies and volunteers who are supporting the local authorities in cases of large earthquakes. The implementation of the project required the close cooperation among Hubs and other connected schools in their country or abroad to make sure that the data from the seismic activity are always available for all.

Most of the projects that are documented at the OSOS Platform were dealing with the construction of seismographs with the use simple materials. Students had the opportunity to learn through the basic principles of natural sciences how a seismic vibration is created and transmitted. They have also learned the principles of seismograph operation and attempted to construct experimental seismograph. Through the process of construction, students were able to contact seismologists and see functional seismographs in actions. In many cases they also used more advanced resources such as Arduino microcontrollers, Lego Mindstorms and Raspberry-Pi mini PCs. In some cases, they learned and used basic programming principles.

Even though the main projects implemented in Greece concerned creation of seismographs, other projects were implemented as well. For example, a group of Greek students wanted to investigate earthquakes

that originate from Volcanos. They were inspired by OSOS Accelerator called "Restless Earth", located at: <https://portal.opendiscoveryspace.eu/en/osos-project/restless-earth-853277> and the OSOS Community Citizen science monitors volcanoes located at <https://portal.opendiscoveryspace.eu/en/community/citizen-science-monitors-volcanoes-850043>. To present their work and results, students created photos and videos of their seismographs which they then published in blogs (e.g. 7th Gymnasium of Trikala: <https://eqbusters.blogspot.com/>, Multicultural Gymnasium of Sapes <https://snacsapon.blogspot.com/>), Instagram, Facebook and twitter pages and posts and also tried to share their experience with the local community through local newspapers, radios and tv and with the global community through the social media and the web.

In some cases, students also organized information days on earthquakes in their area, with guests' eminent seismologists in order to diffuse their experience on the one hand this activity on the other hand to inform the local community about protection measures how to react during an earthquake. Also, through various events organized (e.g. Installation of seismometer and Workshop at Vrillissia High School in Athens and Sapes High school, TEDx Patras) teachers and students were able to present their work to wide range of stakeholders, parents, teachers, researchers etc.

In Greece, the most preferred projects were based on the use of the SWARM software. Following the guidelines provided by NOA in the form of an online manual, a printed book and online videos, dozens of teachers and students in Greece learned how to import three seismic waveforms either from the huge database maintained by NOA or from the seismographs of the SNAC network, regardless if an actual seismograph was installed in their premises. Using SWARM, they were able to locate the P and S waves find the epicentre and estimate the magnitude of any earthquake. Some schools were also able to witness the small differences on the arrival of the waves in each seismograph and use this delay to program (in Python) a virtual alert system.

Students understand that the scientific instrument under their supervision must always be operational, providing the right data as the proper estimation of the magnitude and location of each earthquake depends on their own seismograph. The activity (as in the actual study of earthquakes by scientists) requires collaboration between schools that share data and results. Many students plan additional activities with their teachers e.g. turning earthquake data into musical notes and composing melodies giving a more artistic and creative approach to studying earthquake phenomena.

Greek partners (NOA & EA) and Greek teachers have created 32 educational resources of various types: Lesson Plans, Handbooks, Scenarios, mini-games, Python programming and video tutorials, such as the simple SWARM tutorial located at:

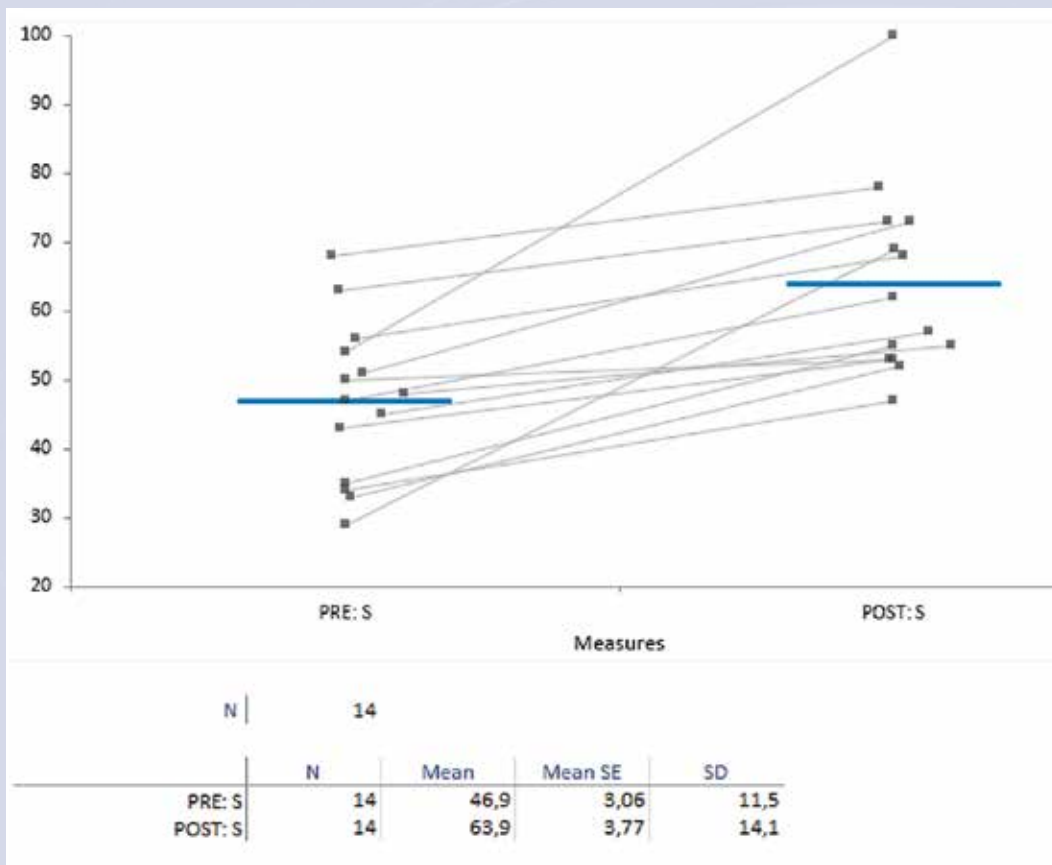
<https://portal.opendiscoveryspace.eu/en/community/schools-study-earthquakes-849203>.

### 3.3. Implementation Overview in Turkey

In Turkey 14 schools have directly participated in SNAC evaluation and submitted both pre and post questionnaires. Starting from a low score (46.9%), Turkish schools have managed to increase significantly (by 17%) their scores to 63.9%, much higher than the average.

The management staff of the schools was involved in the SNAC project's implementations effectively by providing the necessary assistance and support to the participating teachers. SNAC project was not only carried out within the scope of schools, but it was also implemented on a wider scale. For example, the Turkish partner (DEU) received an official invitation from the Narlıdere District Directorate of National Education to organize a SNAC workshop for their teachers which shows the recognition of the successful implementations in Izmir.

In this workshop, DEU collaborated with Ellinogermaniki Agogi (Greek partner) to inform teachers how they can collaborate for further projects with Greek teachers and institutions and how they can join international summer schools for their professional development. As a result, help and support from school directors and the city directorate of education was provided.



There are two important examples in Turkey which showcase how STEAM teachers came together to create successful student projects within the SNAC project: The first project was to create an early warning system by using seismometers. For that reason, science, math and computer teachers collaborated with university staff to reach this objective. This project was sent to an international and popular science competition in Turkey.

The project was accepted for a presentation in Gaziantep after passing two important scientific review steps. This project shows how SNAC offer the opportunity to students and teachers to create successful scientific projects. The last step of competition will take place in Gaziantep in the 22<sup>nd</sup> – 27<sup>th</sup> of September 2020 (<https://www.teknofest.org/en/>).

The second project was to listen to earthquake sounds using data obtained from SNAC School seismometers. In the second project, science, physics, music and computer teachers collaborated together to create a music product. Successful online meetings and workshops for students and teachers were organized to facilitate collaboration with Greek teachers and students, as well as with other schools in Turkey, mainly through the utilization of the SNAC platform.

**In Turkey**, the success of schools in a national contest (<https://www.teknofest.org/en/>) is a great example of recognition and achievement. Students will continue to work with their friends, teachers, scientists and the local authority to find alternative solutions for scientific problems and to change their schools as innovation hubs which was the main aim of the SNAC project. Concepts such as earthquake, historical view, seismometer, epicenter, magnitude, waves etc. were investigated by students using inquiry-based learning methods.

The projects implemented in the schools were mainly focused on designing materials (e.g. brochures, LCD screen in front of school to show earthquake waves) as a mean to gain knowledge about seismology and to disseminate their work to their school and local community. In most of the schools, civil defense organizations were invited to present and inform about the suggested measures before, during and after an earthquake.

The schools organized conferences to present this information to the rest of the students and teachers. Also, most of the teachers collaborated with University researchers to effectively implement their projects.

Overall, most of the schools used their social media channels to inform their local community about the project. Apart from the main objective of designing materials to raise awareness, more unique projects existed as well.

For example, during a project, students with the support of relevant organizations tried to develop a system which when a drone got signal from a seismometer, it will fly the drone automatically to take photos of damaged areas to be sent to local authorities. In another project, the students and teachers collaborated with Greek Schools to learn how earthquake waves can be transformed to the sound.

**In Turkey**, most of the students shared real-time earthquake data using the WhatsApp message of the social media platform after checking for seismic activity during school time (during breaks etc.). They used the SNAC platform when they needed data to study a specific earthquake that occurred within the Turkey region.

For example, the students in Alkev schools retrieved earthquake data to study a major earthquake that occurred in February 2020. Most teachers also utilized the SNAC platform to show examples of seismograms and recordings of different seismic waves (P, S, surface waves). In addition to the SNAC Platform, the Turkish partner created a learning module on the Learning Management System (oys.deu.edu.tr – username and password protected) to provide information about the project's materials and tools, related concepts etc. as an alternative option to learn about the project and its initiatives in Turkish language.

### 3.4. Implementation Overview in Cyprus

In Cyprus, 7 schools have directly participated in SNAC evaluation and submitted both pre and post questionnaires. As depicted in Figure 7, the increase of SRT score was lower than average at 8.5% (from 41.3% to 49.8%). The low SRT scores in Cyprus are totally justifiable due to the fact that Cyprus was not an OSOS country. Nevertheless, the increase is remarkable for schools that had to adjust to the OSOS approach.

The SNAC project's implementation plan (i.e. workshops, implementations in schools etc.) was approved by the Centre of Educational Research and Evaluation (CERE) and the Ministry of Education and an open call was sent to all Cypriot schools with the relevant information.

Thus, the schools' administrations were the first to be informed about the project and if they were interested, they developed a strategy to firstly encourage participation and then to facilitate it, mainly through providing time to participating teachers for preparation, as well as facilitating the identification of relevant stakeholders for collaboration. Most of the schools involved in the project two or more teachers (11 out of the 14 schools of the core SNAC network in Cyprus) in order to facilitate the development of interdisciplinary activities in the context of educational seismology.

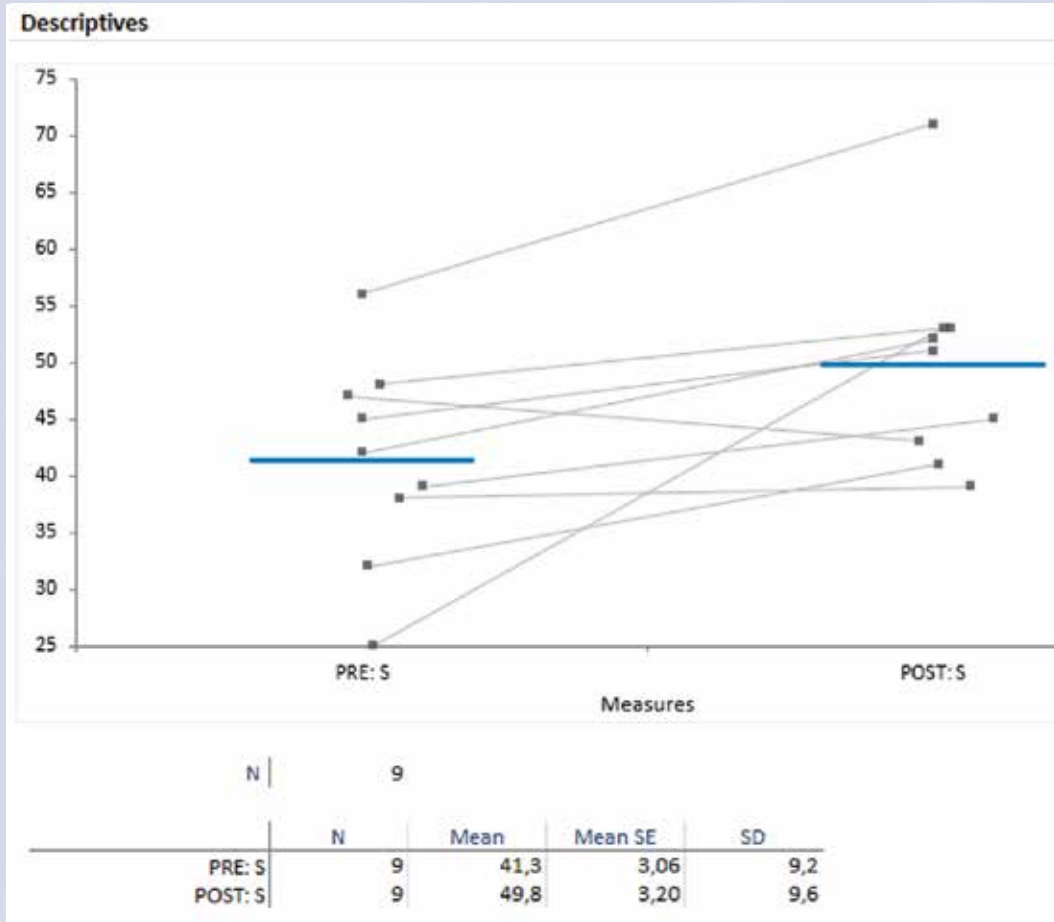
Also, the schools encouraged collaborations between different stakeholders (e.g. parents, civic protection organizations, researchers, seismologists) to introduce the subject of earthquakes in various ways.

Also, it is evident from the schools' reports that most of the projects developed, were interdisciplinary in nature (see SI1 for more information).

The schools which installed a seismometer became open hubs for their area and through the SNAC platform they were able to easily share real-time waveforms with other schools and communities interested in seismology. Also, through OSOS communities, teachers were able to become part of a network and share resources and ideas with other teachers participating in the project.

Most schools, expressed their interest in future participation in the project and utilization of the platform and the network of schools established in Cyprus and abroad.

In Cyprus, since schools' implementations were project-based, the final outcome (e.g. posters, research findings, presentations, participation in contests, posts on websites and platforms) was shared with the rest of the school and the community, a process which provided to students a sense of purpose and a



subsequent sense of achievement. This experience will motivate teachers and students further to continue to implement educational seismology activities and to participate in similar initiatives in the future.

Most of the schools adapted the resources available on OSOS and the project’s deliverables. The main focus of the schools’ projects was to raise civil awareness in their schools and communities through the designing and dissemination of materials. Students’ projects followed an inquiry-based approach by firstly posing a research question in the context of the project.

During the research stage, most of the schools collaborated with the University of Cyprus for facilitating this process and support the use of seismometers and the SNAC platform. Also, based on the main goal of their projects, schools collaborated with seismologists (mainly for presentations in schools and for raising questions regarding the content) and/or civil protection organizations for collecting materials and presenting relevant information in schools.

All the schools integrated in their project an earthquake drill. The most common deriving artifacts were posters and presentations regarding protection measures during an earthquake and the provision of basic information regarding the seismic activity in the region.

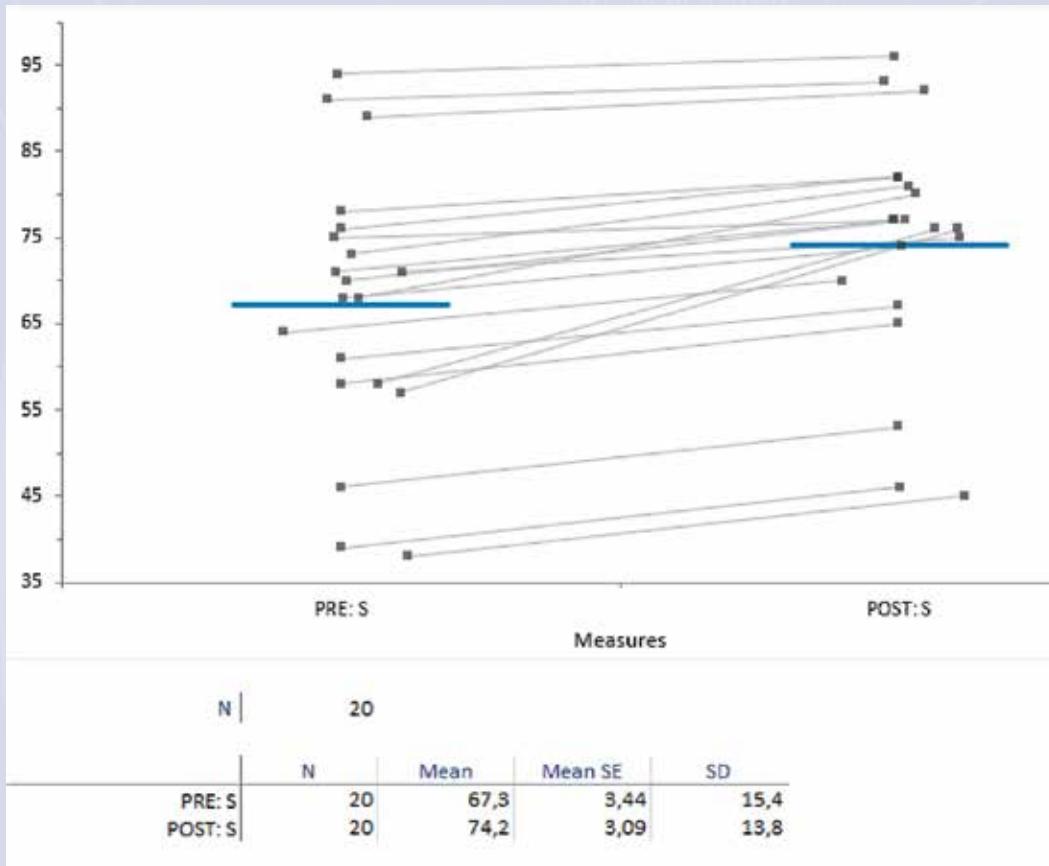
Most of the schools also presented their work in their school magazine/newspaper and planned to participate in a yearly students’ conference and/or festival which were cancelled due to the unforeseen circumstances of covid-19 (i.e. closing of the schools and cancellation of all public events).

Finally, all schools utilized the SNAC platform and the real-time data and the SWARM platform to localize the epicenter of earthquakes occurring in the European region and compared their estimations with the information provided in relevant databases (e.g. EMSC).

The SNAC platform also provided the opportunity for comparing different seismograms of the same events to investigate and discuss how different parameters (e.g. distance) affect these recordings.

### 3.5. Implementation Overview in Bulgaria

In Bulgaria 20 schools have directly participated in SNAC evaluation and submitted both pre and post questionnaires. As Figure 6 depicts, the increase in the SRT scores of Bulgarian schools was below average at 6.9% (from 67.3% to 74.2%). An important remark here is that all Bulgarian schools were already OSOS schools when they started SNAC implantation. This fact justifies the higher scores (the pre SRT score average is 67,3% compared to the average 54,3%. This also justifies the smaller increase of the post SRT tests, since, as already mentioned, it is more difficult for a school with a high pre SRT score to see a big increase at the post SRT score.



In Bulgaria, it is quite important to acquire the statute of the so called “innovative schools”. The innovative schools could be related to learning content, studying plans, curricula, innovative teaching methods, educational environment, innovative management and organization of the learning process, innovative teacher qualification and teacher cooperation.

In this aspect projects like SNAC are quite important as they cover exactly most aspects related to bringing innovation to schools and therefore the School Heads are very supportive to include teachers in specific training like seismology practices and using innovative equipment like seismographs in the school curricula. The list of current innovative schools in Bulgaria could be found at <https://www.ischools.bg/> and is changes every year with new schools with new innovation ideas, where SNAC project could be of great help.

The program of the Ministry of Education and Science for innovative schools encourages working in communities and teachers that work professionally for the success and improvement of the learning process in classrooms and school. The innovative schools have the opportunity to implement schools innovation like joint classes and modified curricula so working of teachers from different STEM disciplines is quite easy to implement and teachers have the opportunity for professional development in an environment of continuous improvement, lifelong learning and respect for the qualities of the other.

From the participating SNAC schools 50% (i.e. 10 schools) already have the statute of “innovative school” while the others could successfully use SNAC experience to include in their innovation plans for the next application so that all SNAC and OSOS elements support the thesis that they encourage and implement class innovations.

Schools are very active in both exchanging school innovative practices and multiplying useful teacher training experience due to various qualification programs supported with structural funding and Erasmus+ program initiatives. Due to the COVID-19 pandemic crisis and the massive switch of Bulgarian schools to distance learning methodologies it is become quite natural and easy to organize joint practices and trainings of many schools together and the process was facilitated by the Ministry of Education and Science who made special agreements with huge vendors like Microsoft and Google and could freely use their collaboration tools such as Office 365 with Microsoft Teams, Google Classroom with Google Meet etc. so that this concept could be easily continued and facilitated further and SNAC seismic network is a perfect demonstration of cloud based collaborative effort as long as the seismic waves could be shared both by schools that have installed seismographs and those who have not.

The schools involved in SNAC develop open schooling culture and thus facilitate a learning and school environment in which students feel safe, supported by their teachers and classmates so that they better cope with the challenges they face. Parts of SNAC projects are involved in schools’ innovation plans and the existing programs are modified so that future training is adapted, comprehensive, motivating and consistent with the PPP and state educational standards.

High standards of classroom learning are introduced due to the implementation of latest technology (like real seismographs in schools’ environment) and students are engaged in active intellectual and emotional activities and developing critical thinking skills. All innovations implemented through SNAC aim at improving the quality of education and SNAC project involvement is good quality assurance for the potential of the school staff to participate in further innovation initiatives and projects.

In order to raise civic awareness in the community, all projects concerned the development of understanding of concepts related to earthquakes (i.e. seismic waves, tectonic plates movements, waveforms), familiarization with the seismometers and the SWARM software and analysis of regional earthquakes for identifying epicenters and estimating magnitude. In Bulgaria, the projects were supported either by NRN Association staff or by scientists from universities, especially Sofia University “St. Kliment Ohridski” to showcase to students the nature of the earthquakes and the impact on environment, buildings and society.

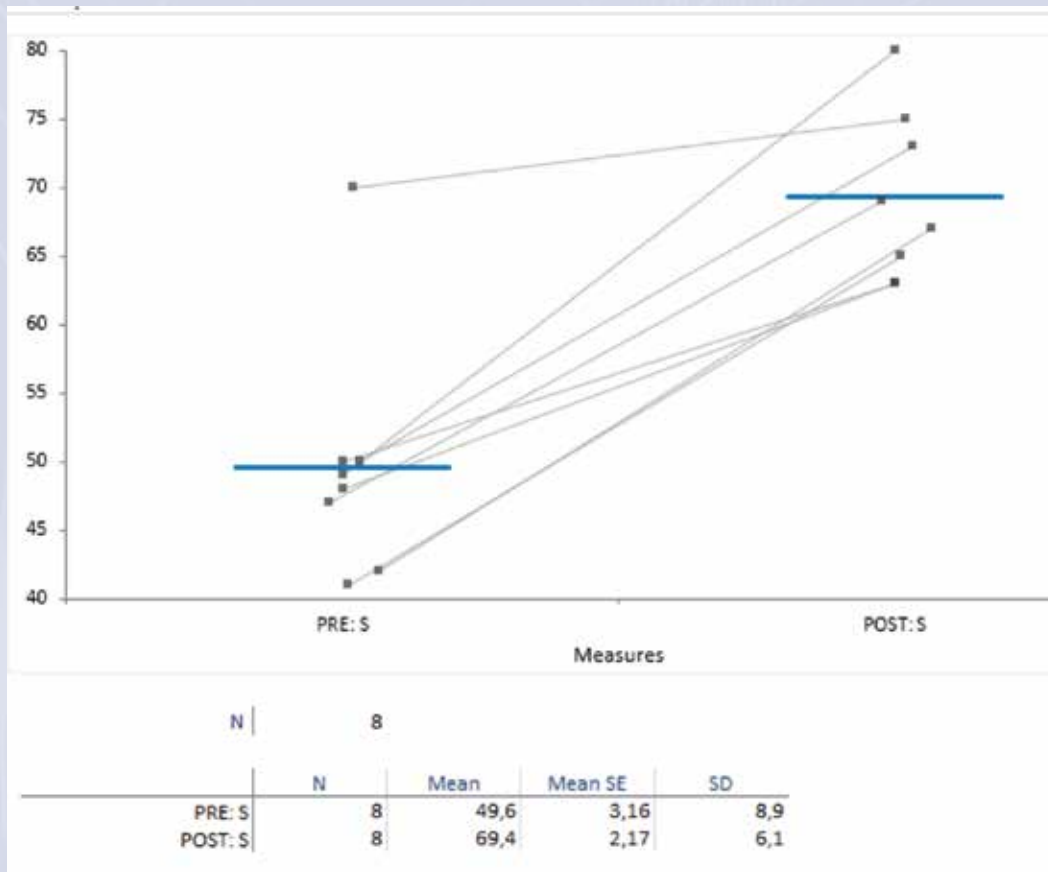
In some of the schools, the students prepared their own presentations that were shared with other students and their parents during the online Teams meetings on the topics of what is an earthquake, the causes of earthquakes, identifying earthquakes using seismic activity data from the SNAC web platform, and the impact of earthquakes on the geology of an area and on community and society.

In Bulgaria, most of the activities carried out related mostly to identifying possible seismic events on different recordings by the SNAC seismometer network and using the SWARM software for further analysis. Due to the COVID-19 outbreak and the seizure in the typical on-premise educational process in schools, most of the activities were carried out online, mainly using Microsoft Teams and Office 365 collaboration tools, which are deployed for all the schools in Bulgaria (due to special agreement of Microsoft and the Ministry of Education and Science) and other platforms like Zoom and Adobe Connect for online collaboration. The Bulgarian government took decision to close officially all schools till the end of the school year and using the online research and educational opportunities, provided by the SNAC network turned to be a successful demonstration of new technologies and collaborative research efforts.

Most students were able to monitor seismic activities all over the world not just through their school seismometer but through the whole network created by SNAC partnering schools and institutions. Eight Bulgarian schools were actually part of the SNAC seismometer network, but all the rest were also able to access the data and use it in their classes. In order not to compromise the measurements, the NRN SNAC Team decided to buy one additional Raspberry Shake 1D seismometer, which was not installed at a school, but was used for demonstration purposes during the online trainings to demonstrate its basic functions and possibilities.

### 3.6. Implementation Overview in Italy

In Italy 8 schools have directly participated in SNAC evaluation and submitted both pre and post questionnaires. The increase of SRT scores from one year to the next was much higher than the average, at 19,8% (from 49.6% to 69.4%). This is justified by the low starting point (at 49.6%).



The participation of the teachers to training and development programs was strongly encouraged both at National level through numerous initiatives of the Italian Ministry of Education and through the attribution of special professional awards to teachers who were particularly active in these areas, as well as at local level meaning the management of multiple activities related to schools, entrusted to specific regional bodies (Uffici Scolastici Regionali). In this perspective, many school heads were glad to let their schools join the SNAC project and participate in the activities envisaged within it. For all the Italian schools involved in the project the first contact had been teachers, mainly in science or physics, who were already in touch with the Italian partner organization since they were involved in previous projects.

The development of the so-called transversal skills in basic individual training represents one of the cardinal objectives of the Italian education system strongly promoted and encouraged by the Ministry of Education. In this perspective, the cooperation between teachers of different disciplines in the development of experiences and projects with broader objectives than those related to the curricular lessons becomes a practice that widely involves both teachers and pupils even during extra-school hours. Participation in experiences of this type often gives pupils special awards (crediti formativi) which reinforce the school curricula of the students themselves. Once the school heads consented to the participation of their schools in the SNAC project, the transversal aspects of the experience were rather enhanced by the initiative of the teachers involved solicited by the contact person of the partner organization. In several cases, the interdisciplinarity of the activities carried out was promoted by the joint participation of physics teachers with computer science teachers, or science teachers with physics teachers.

The two main institutions responsible for the management of school activities, namely the Ministry of Education and the Regional School Offices, promoted twinning activities between different schools through the promulgation of specific calls, in particular on the occasion of major cultural events or celebratory. Similarly, collaboration between schools in different countries takes place both within specific European programs (mainly Erasmus+) and through ministerial and regional calls, such as those already mentioned above.

The participation of the schools to SNAC could be considered both as a recognition and as a distinction of achievement since many of the activities carried out by the schools in the framework of SNAC integrated wider experiences usually performed or already scheduled by the schools themselves.

For instance, the presentations of the educational activities in seismology to non-school audience were carried out by students during Open School Days which schools organize each year, and the beneficiaries of which are represented by non-school audiences (parents, relatives and, more in general, citizens). Similarly, the multiplier events carried out within SNAC have also been included in the cultural programming of schools among the events that usually involve non-school societal actors, such as stakeholders or cultural associations.

In order to raise civic awareness in the community, all projects concerned the development of understanding of concepts related to earthquakes (i.e. seismic waves, tectonic plates movements, waveforms), familiarization with the seismometers and the SWARM software and analysis of regional earthquakes for identifying epicenters and estimating magnitude.

All this information was gathered in order to present their work in various ways to the rest of the school and the local community in order to raise awareness and inform about the seismic activity of the area. In Italy, the activities carried out in class were presented to citizens, mainly families, local authorities and municipal councilors, attending open days held in the schools in December 2019 and January 2020. Students in Italy were trained in seismic monitoring and learned recognize the waveforms of real occurred earthquakes from the background noise on the continuous recordings available on the platform.

Moreover, they learned to identify the seismic parameters of an earthquake and to compare the significant differences in seismicity in different regions of south-eastern Mediterranean, as well as to locate the seismograms of significant earthquakes once they got news from the media.

Many of the teachers taught their students how to utilize the seismic data acquirable from the SNAC platform with the use of SWARM software, and some of these classes produced seismic reports about earthquakes which occurred during the first months of 2020 in Italy and in other countries which are part of the SNAC seismic network.

## 4. SNAC Outreach, Awareness & Connection to the Society Activities

SNAC partners have been extremely active regarding the valorisation of project results. Multiple events, competitions and workshops have been organised either face to face or virtual and all possible types of communication channels have been used. Many times, these activities were blending implementation with dissemination, such as the events organised for the installations of seismographs to schools, which stakeholders from the local communities attended. In the following paragraphs we present an overview of these activities.

### 4.1. Workshops and Events

#### 4.1.1. European Researchers' Night

EA and NOA participated in the European Researchers' Night on 28 Sep 2018 (hosted at NCSR Demokritos in Athens) and on 27 Sep 2019 (hosted at Foundation Hellenic World) with posters and exhibition booth demonstrating educational seismometers and activities with analysis of earthquakes.

([https://ec.europa.eu/research/mariecurieactions/actions/european-researchers-night\\_en](https://ec.europa.eu/research/mariecurieactions/actions/european-researchers-night_en))



#### 4.1.2. Creating conditions for Deeper Learning in Science

In the framework of the International Conference “Creating conditions for Deeper Learning in Science” organized on 29-30 Jun 2019 in EA, Pallini an introductory seminar to Seismology and training workshop for science teachers in primary and secondary schools was presented by NOA and EA. (<http://deeperlearning.ea.gr/>)



#### 4.1.3. TEDx Patras 2019

Dr Chouliaras from NOA and Ms Kyrioti from EA were invited by the school “Ekpaideutiria Panou” to give talks on a special TEDx Patras section on the topic of School Seismographs. Apart from the participating teachers, all teachers and other interested people had the opportunity to watch, in live broadcast, everything that took place at the TEDxPatras Central Stage, at the University of Patras Conference Center.



The event took place at the 7<sup>th</sup> of December 2019 and more details can be found here:

<https://www.ted.com/tedx/events/33767>

Teachers, School students and their families had the opportunity to attend three lectures on school-hosted seismographs:

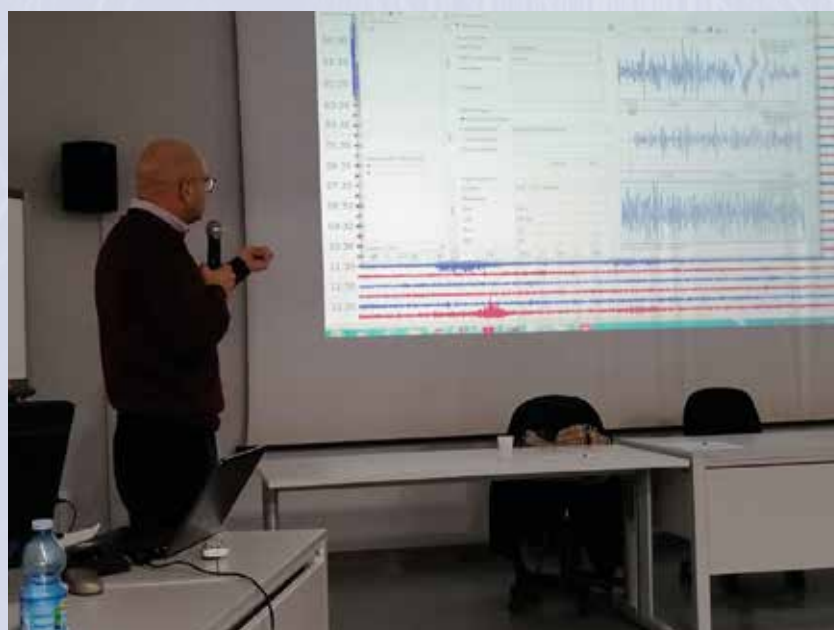
- Dr. Gerasimos Chouliaras (Seismologist, Research Director of the Geodetic Institute of the National Observatory of Athens) on: “The Scientific Knowledge in the School Laboratory - The Earthquake Phenomenon - The Development of the 5th Seismographs Network since its Operation” .
- Ms. Eugenia Kypriotis (Head of the OPEAIRE project in Greek-German Education) - Educational Scripts Using School Seismographs on “Students as Researchers - Analyze, Study, Present, Publish” and
- Mr. Akis Panagis (Civil Engineering Officer of Earthquake Harilaos Trikoupi) on “The Seismic Design of Large Infrastructures”.



This event showcased in the best way that a school’s educational design should not be limited to the school’s educational community but should seeks to reach a wider audience throughout the region. Schools open to the public through the windows of the community and therefore “chat” with state-of-the-art institutions such as TEDx, and actively participate in cultural events, organizing a range of cultural activities and events.

#### 4.1.4. Instituto Minutoli of Messina: Cooperation of local School with local University

On January 30<sup>th</sup> 2020, 14 people - teachers, parents of the pupils of the school and two researchers of the University of Messina - attended the event.



During the event a representative of Fondazione Idis – Città della Scienza showed to the participants the general features of the project, the educational seismic network and trained them in the use of the software SWARM to analyse the seismic data and carry out educational activities with classes.

#### **4.1.5. Open Day in Liceo Labriola, Naples, Italy**

On December 11th, 2019 the representative of Fondazione Idis carried out a training meeting with the students of a 12° degree class of Liceo Scientifico Labriola and their teacher in science, and showed them the general features of the SNAC platform. The following December 14th, during the Open Day of the school, a smaller group of these students experienced the activity of seismic monitoring allowed by the SNAC platform during the Open Day of the school. Most of the participants to the event were parents and family of the students but also local citizens.



#### **4.1.6. Introduction to SNAC for the students of Istituto di Istruzione Superiore Marconi,**

An introductory meeting about the SNAC Platform was carried out on January 11th, 2020 involving a couple of teachers and a class of Istituto di Istruzione Superiore in Vairano Patenora, department of Caserta, Italy.



In this case also the participants have been trained in the use of the data gathered by the SNAC platform and currently they are independently developing some educational projects exploiting these data.

#### 4.1.7. SNAC Course in Forum – Innovative Practices: Science-Based-Learning Approach

A SNAC Training Course for teachers was organized on 30.11.2019 within a Forum – Innovative Practices: Science-Based-Learning Approach – and in the form of training seminar for teachers. Forty nine (49) teachers participated in the training, which was held in the Center for Preparing Students for Olympiads of the Ministry of Education and Science. The training seminar aims to familiarize teachers with the basic seismological principles of earthquakes and their registration; to develop skills for analyzing seismometer data and measures to protect the citizens. Within the training Mr. Ilian Iliev presented to the participants the process of installing the seismometers and working with seismic software – SWARM. A detailed report on the training was prepared and sent by Mrs. Boyka Aneva.

More details can be found here: <https://mediabricks.bg/в-софия-се-организира-безплатен-форум/>, while photos from this event are presented below:



#### 4.1.8. Teacher Workshops in Izmir

Face to face and digital platforms (Sakai-Learning Management System) were used to train Turkish teachers for SNAC Project implementations. All the teaching materials that teachers especially need are placed in the learning management system (LMS). In addition to the LMS, Turkish SNAC promotional videos to inform a wide audience about the work ahead of SNAC project in Turkey was taken.

Turkey as well as in other partner countries, SWARM Programme was used to analyze the seismic data obtained from installed seismometers in Turkey Network. The teaching material for the use of the SWARM Program has been prepared by NOA, translated into Turkish and applied on teachers. Students and teachers used the SWARM Program in their learning and teaching processes. Students determined P and S waves with the help of their teachers. Using the P and S waves they obtained from at least 3 earthquake stations, they easily acquired the information about the earthquake.

The largest earthquakes occurred in this process in Turkey and this situation increased students' interest to SNAC project. When an earthquake occurred, students accessed the SNAC web page (<https://snac.gein.noa.gr/>), where instant data of the SNAC project was provided. They shared the information they obtained in whats up groups and made discussions about the magnitude and all of the other information about the earthquake.

Some photos are provided below how students engaged to SNAC teaching and learning environments in their schools.



Another example, is one of the workshops was prepared and implemented in Izmir – Turkey. Below, some photos can be found from teacher training workshop held in Izmir. In this teacher training programme, one of the SNAC project partner, Ellinogermaniki Agogi, partly attended to the training as online and gave important information about usage of OSOS platform.



SNAC Schools distributed SNAC project information, in the form of brochures and posters



#### 4.1.9. Educational Seismology presentation in Cypriot schools

An open call through the Ministry of Education was disseminated to all the Primary and Secondary schools of Cyprus regarding the organization of the SNAC multiplier event. The event and brief information about the project was also posted in the facebook page (<https://www.facebook.com/ReSciTEG/>) and web page (<https://www.ucy.ac.cy/resciteg/en/research/research-programmes>) of the the ReSciTEG group of the University of Cyprus.



*Ms Pavlou from UCY introducing SNAC in Cypriot teachers*

The event was organized in the premises of the University of Cyprus during the 9<sup>th</sup>, 16<sup>th</sup> and 23<sup>th</sup> of October 2019. During the event, participating teachers through presentations and hands-on activities were introduced to the project and its objectives and familiarized themselves with the pedagogical framework (i.e. inquiry and project-based learning), suggested educational activities and the hardware (TC-1 seismometer and RaspberryShake) and software tools (e.g. SWARM) in order to be able to exploit

them during their lessons. In total, 40 teachers participated in the multiplier event (29 secondary and 11 primary school teachers). These teachers then presented the project to teachers of their schools in order to collaborate in different actions.



#### 4.1.10. Dissemination event for in-service and pre-service Cypriot teachers and school heads

Dr. Sofoklis Soteriou was invited to give a plenary talk at the University of Cyprus in the context of a science event focusing on open schooling. During his talk he presented the idea of open schooling and presented learning outcomes that derived from the SNAC project. The event was organized in the premises of the University of Cyprus at the 7<sup>th</sup> of December 2019 and approximately 40 people participated in the event.

## 4.2. Installation of Seismographs

In most of the participating schools, during the deployment of the seismometer in their premises, an introductory talk was given to the students, with the main objective of increasing their curiosity about issues related to seismology and, in particular, how seismic waves are recorded and what information can be retrieved from their study. This introductory talk is complemented in this case by a hands-on session in which the data acquired in each school are inspected.

### 4.2.1. Sapes Intercultural Education School

On January 31, 2020, in the context of the installation of a school seismograph at the Sapes<sup>6</sup> Intercultural Education High School, Dr. Gerasimos Chouliaras and Dr. Sophocles Sotiriou went to the school to install the seismograph, to train the school teachers in its utilization and to present in detail the actions of the Network, not only to the teachers, the parents and the students of the school but also to the whole the local community, which was represented by the Mayor Mr. Konstantinos Sarikopoulos as well as by teachers and school principals of the area.

Additionally, on February 17, 2020, an event on “Earthquake study for schools” was held at the Cultural Center of Vrilissia<sup>7</sup>, in the presence of the **Deputy Minister of Education, Ms. Sofia Zacharaki**. The Network was represented by Dr. Gerasimos Chouliaras by and from Dr. Sofoklis Sotiriou. The 1<sup>st</sup> High School of Vrilissia is one of the schools participating in the program in order to increase students’ interest in science and to create incentives for teachers to adopt innovative methods of supporting and renewing science. Also present was the Mayor of Vrilissia, Xenos Maniatogiannis, who welcomed the participation of the school in the Network of School Seismographs and warmly thanked the students and parents. The event was also attended by teachers and school principals from nearby areas.

In her statement, the Deputy Minister of Education, Ms. Zacharaki, stated that **“we support the initiatives that open the school to the world and to the rapidly changing conditions”**.

### 4.2.2. Vrilissia High School

An excellent workshop took place on the subject “Schools study earthquakes” at the Vrilissia Cultural Center in the presence of Deputy Minister of Education Ms. Sofia Zacharakis. SNAC was represented by Dr. Gerasimos Chouliaras from NOA and Dr. Sofoklis Sotiriou from EA. (see Figure 41)

The 1st High School of Vrilissia is one of the schools participating in the program, in order to increase students’ interest in science and how it affects their daily lives and to create incentives for teachers to adopt innovative methods of support and the renewal of science. In her address, Deputy Minister of Education Mrs. Zacharakis said that “we support the initiatives that open the school to the world and to the rapidly changing data”.

The Mayor of Vrilissia, Xenos Maniatogiannis, welcomed the participation of the 1st Vrilissia High School in the School Seismograph Network of SNAC and in the OSOS project. He warmly thanked the pupils and parents of the Vrilissia, Nea Ionia and Agia Paraskevi high schools in the implementation of the initiative.

The event was attended by Mrs Voula Arsenis Vice Mayor for Social Policy and Health Education, Mrs Toni Mitotakis, Minister of Public Administration, the Chairmen of the Vrilissia School Committees Mr Paraskevopoulou and Mr Engolopoulos, Mrs Kanella Exarchakou Assistant to the Deputy Minister Mrs Zacharakis.

<sup>6</sup> Sapes is a small town of Thrace, located at the North-East part of Greece

<sup>7</sup> Vrilissia is a municipality near Athens



From other schools of the area the following educational staff participated:

- Mr. Maria Fouseka Secondary School Principal of Vrilissia,
- Mr. Nikolaos Metaxas, 3rd Principal High School Vrilissia,
- Mr. Nikolaos Karageorgos 1st High School in Vrilissia,
- Mr. Anastasios Christis, Mr. Athanasios Anastasiou, Principal of the 1st High School of Agia Paraskevi,
- Ms. Kourmenou Natalia, the Principal of the 1st High School of Ionia Prefecture,
- Ms. Sarantoula Parlapani, the Principal of the 6th Ly of the Ionia Prefecture,
- Mr Lambros Georgas, Principal of Papagos Lyceum,
- Mr E. Kalogeraki Principal of the 1st Vrilissia Primary School,
- Mr Ioannis Kosmopoulos, Principal of the 4th Primary School of Vrilissia,
- Mr Hadjisavva Kalliopi, Principal Principal of the 5th Vrilissia Primary School,
- Mr. Sotiris Georgopoulos, 6th Vrilissian Mayor and
- Mrs. Vassiliou President of the 1st Vrilissia Parents and Guardians Association,

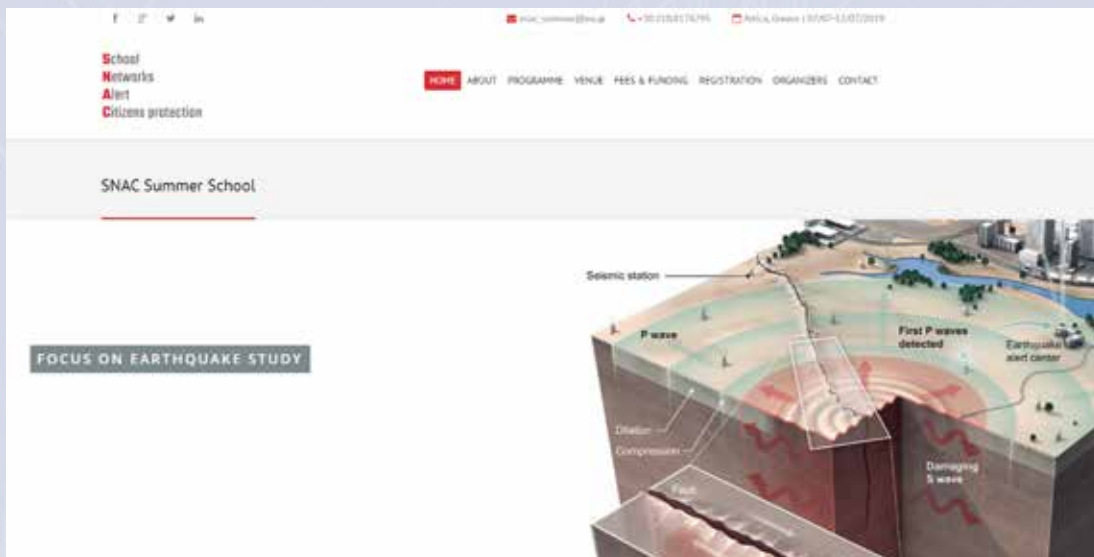


Greeting messages were also sent by the General Secretary of Technology Research Dr. Athanasios Kyriazis, the General Secretary of Civil Protection Mr. Nikos Chardalias and the President of the National Observatory of Athens, Professor Emmanuel Plionis.

### 4.3. Summer Schools

#### 4.3.1. SNAC Summer School 2019 in Marathon

Organization of the 1st SNAC Summer School for teachers (<http://snac.ea.gr/>) held in Marathon, Greece on 7-12 July 2019. Every year and during the first two weeks of July EA is organizing international teacher trainings and professional development programmes in science education, innovative pedagogical methodologies, open educational resources etc. In 2019 the summer schools were held in Marathon on 1-12 Jul.



In total about 200 teachers of primary and secondary education from 20 countries around Europe attended the lectures and training workshops. The SNAC project, its overall approach and objectives were disseminated to participants. It was also part of the training programme in the stream of Opens Schools for Open Societies during the week 7-12 Jul. More information can be found at <http://snac.ea.gr/>.

#### 4.3.2. Physics Summer School in Cyprus

In the Physics Summer School in Cyprus, which took place at the 4th of July 2019, a four-hour hands-on activity regarding the SNAC project and earthquakes engaged 9th-11th grade students.



In another Physics session, students presented to the rest of their peers the seismometer and seismic recordings of the SNAC network



### 4.3.3. SNAC Virtual Summer Schools

SNAC organized two summer schools in July 2020. The first one addressed Greek only teachers and the second one was international with participants from all over Europe, Brazil and Nigeria! Overall 40 teachers attended the two summer schools and were awarded with a certificate of participation.



Seismology Experts, Pedagogues, Curriculum Developers, Local Authorities, Advanced Educational Applications Developers and Schools joined forces during the project, to design, develop and validate an **innovative professional development program** for supporting the in-service training of teachers on topics related to Seismology education as a whole school approach. Thus, apart from Seismology, participants were familiarized with the **open schooling approach** that provides a powerful framework to engage, discuss and explore how schools can facilitate open, more effective and efficient **co-design, co-creation, and use of educational content tools** and services for personalized science learning and teaching and for citizens science

In the **Schools Study Earthquakes Virtual Summer School 2020**, the participants were introduced to the basics of seismology and the value of the studying of earthquakes for the science and for the community. Special emphasis was given to the use of School Study Earthquake Network's Data in class. This empowered participants to engage in innovative practices through personal and individualized support, in addition to the provision to the suite of supporting tools. Concurrently, there was a focus on the accurate presentation of the network of the seismographs along with its functions. All elements were displayed in detail and participants by the end of this webinar were able to use the interactive map, to obtain data from each of the stations, to download data (without possessing an instrument) and to follow and monitor the proper function of the network. Through the **Schools Study Earthquakes Virtual Summer School 2020** teachers, curriculum developers, policy makers and educational authorities:

- gained knowledge and skills in the design and implementation of innovative multidisciplinary educational activities.
- became developers of educational content and be able to integrate these innovative practices in their own classes.
- participated in the development of the specialized courses and the course material and thus acquire skills in conceptualizing, planning and evaluating their didactical approaches and methodology.

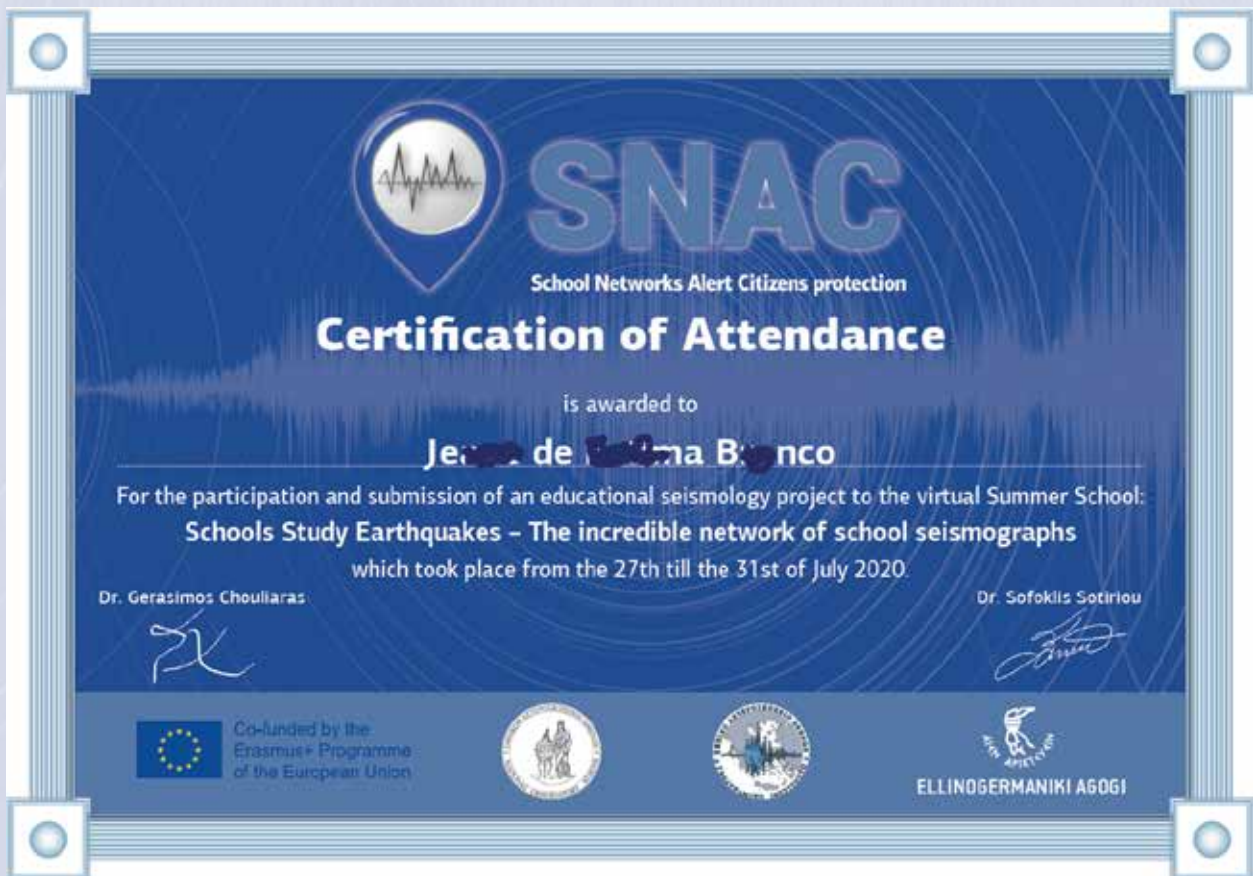
- gained knowledge, skills and experiences in organizing resources, uploading them on the SNAC Platform and facilitated their sharing and exchange with other teachers.
- gained experience on the use of educational technology in the classroom and provide interesting classroom experiences for their students.
- gained intercultural awareness through cooperation with partners from different European countries, adding a new dimension to their teaching that will be based on a new culture of sharing.

The teachers not were familiarized with a unique collection of open digital educational resources, but they were also trained to link them with innovative pedagogical practices, such as using real world learning activities, implementing resource based and project-based approaches, in order to design educational scenarios by repurposing existing eLearning tools

After registering to the **Schools Study Earthquakes Virtual Summer School 2020**, teachers were advised to follow the subsequent steps:

- **Register** to the **OSOS portal** (<https://portal.opendiscoveryspace.eu/en/osos>)
- See the [SNAC Accelerator](#) on the **Open Schools for Open Societies portal**
- Register to one of the following **SNAC Communities** on the **Open Schools for Open Societies portal**:
  - o [Greek teachers](#)
  - o [Turkish teachers](#)
  - o [Italian teachers](#)
  - o [Cypriot teachers](#)
  - o [Bulgarian teachers](#)
  - o [All other teachers](#)

During the Summer School, the participating teachers had the opportunity to design their own lessons, work with the presenters and receive comments and advice on them. Upon completion of the Summer School, as a final work to obtain certification, teachers were asked to complete their course, creating a presentation.



Therefore, participants are advised to prepare a lesson plan on which they will work during the Summer School. To prepare the course plan we asked them to:

- Visit the Community of the Seismograph School Network on the OSOS project portal (Open Schools for Open Societies) at the link: <https://portal.opendiscovery.space.eu/en/community/schools-study-earthquakes-849203>
- select a project (<https://portal.opendiscovery.space.eu/search-projects-in-community/849203>) and / or an educational script (<https://portal.opendiscovery.space.eu/en/search-resources-in-community/849203>) that they would like to use in their classroom
- Design a simple lesson plan based on these and create a presentation that they will present on the last day of Summer School.

To help them on this task, we have included in the Programme a series of webinars that include the “Open Schooling Roadmap” and “Building synergies around Europe with common projects”. Using the OSOS portal, we asked them to develop at least one school project that apply the open schooling approach and exploit the SNAC training material.

### **The SNAC Communities on the Open Schools for Open Societies Portal**

There are already existing SNAC Communities on the OSOS portal. During the summer school, teachers were asked to use these communities to upload their projects. To become a member of the community, they were asked to register to the OSOS portal (<https://portal.opendiscovery.space.eu/en/osos>) if they were not already a member.

### **SNAC accelerator**

Then we asked them to be inspired by the [SNAC Accelerator](#).

This would help them to develop their innovative ideas to new localised projects that could provide new solutions for the school and its community, for bringing the gap between formal and informal learning settings and creating new opportunities for personalisation at different levels (student, teacher, school).

They could also be inspired by other School projects that have already been uploaded on the OSOS portal, there are currently more than 1200.

### **Developing their project**

During the days of the summer school, participating teacher had the option to receive expert advice and work on their project, apply all the features and tools of the OSOS portal and uptake the role of their students in order to finalise the projects.

### **Presenting your project**

At the last day of the summer school, teachers were called to present their project and get valuable feedback from the trainers and other participating teachers.

## 4.4. Webinars

### 4.4.1. Presentation of the School Network of Seismographs

The National Observatory of Athens and Ellinogermaniki Agogi, organised a Webinar called “Presentation of the School Network of Seismographs”. The Webinar lasted more than 2 hours and was attended by 48 participants (a large percentage of teachers). It was a unique opportunity to present to Greek teachers the SNAC Network and related good practices from the teachers themselves.

The poster is for a webinar titled "Παρουσίαση Σχολικού Δικτύου Σεισμογράφων" (Presentation of School Network of Seismographs). It features a blue background with a large orange circle on the right side. The text is in Greek. At the top left, there is a logo with the word "webinar" written vertically. The main title is in large white and orange letters. Below the title, there is a paragraph of text describing the webinar's purpose. The date and time are prominently displayed in the center: "Τρίτη 5 Μαΐου 2020 | 16:30". Below this is the meeting link: "https://meetingsemea16.webex.com/meet/milopoulos". The coordinator's name and affiliation are listed: "Συντονιστής: Γρηγόρης Μηλόπουλος | Ελληνογερμανική Αγωγή". At the bottom, there is a detailed agenda with times and topics, and logos for the organizing institutions: ΕΛΛΗΝΟΓΕΡΜΑΝΙΚΗ ΑΓΩΓΗ, SNAC, and OpenAIRE.

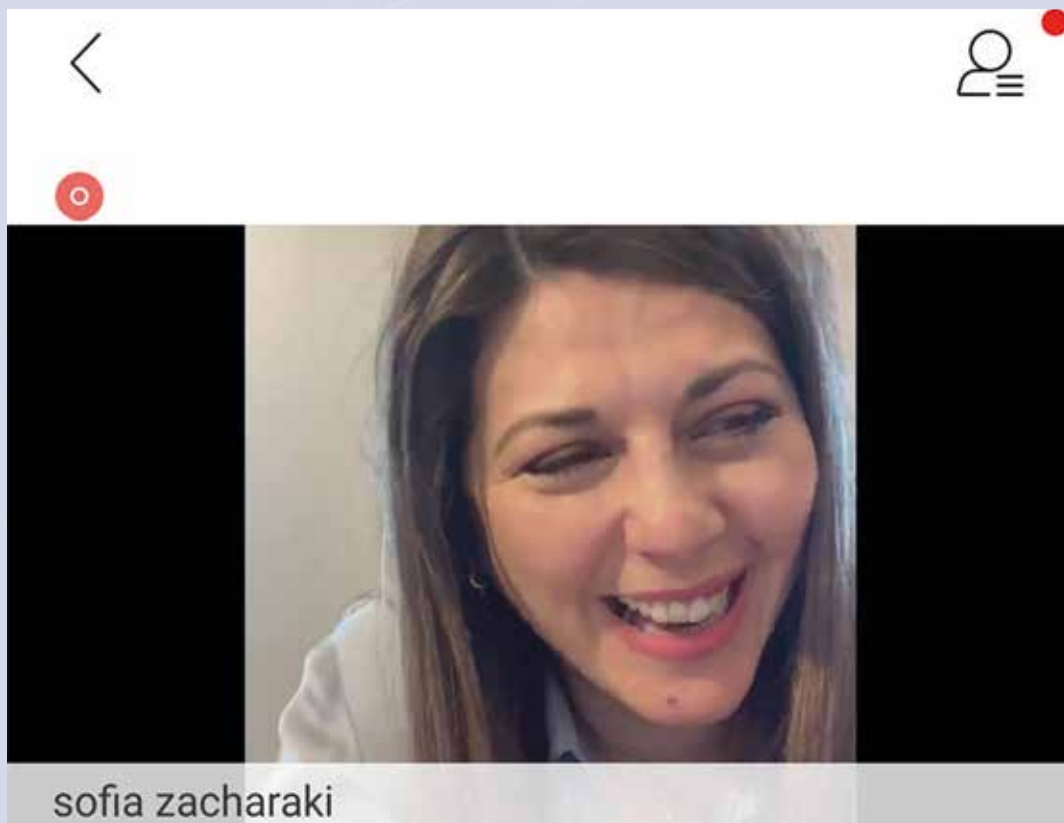
6.65 ptMr Gregory Milopoulos from Ellinogermaniki Agogi coordinated the Webinar.

The webinar agenda was the following:

- 16:30: Welcome
- 16:45: “Presentation of SNAC, Gerasimos Chouliaras, Research Director of the Geodynamic Institute of the National Observatory of Athens
- 17:15: “Good Practice”: Dimitris Prasopoulos, D.E. High School of Sapes
- 17:30: “Good Practice”: Serafeim Spanos, PEKES Thessaly & Mr. George Proias, University of Thessaly, on behalf of the TALOS Group
- 17:45: “OSJ - Students publish their research papers”, Eugenia Kyprioti, Ellinogermaniki Agogi

Professor Gerasimos Chouliaras, as the person in charge of the program, presented, among other things, the mechanisms that lead to an earthquake, the effects of the earthquake on our lives, the operation of seismographs and the method of calculating the epicenter and magnitude.

The Deputy Minister of Education and Religious Affairs, Ms. Sofia Zacharaki, addressed a greeting.



The Minister quoted:

***“This initiative proves that unique educational programs can be implemented even with closed schools. Because even in closed schools we must keep children’s minds open! Show them what we can do despite the difficulties. I hope the network continues to grow, to involve other teachers and to promote the science of seismology that is so directly connected to our daily lives “***

#### 4.4.2. SNAC Multiplier Event as a session on the online Conference “Distance education: the next day. The challenge of open education”

On May 29-31 of 2020, the Two-Day Conference (<https://elearnconf.ellak.gr/>) was organized by EELLAK with the title: “The challenge of open education: The next day of educating from distance”. <https://elearnconf.ellak.gr/>



The two-day conference was held under the auspices of the Ministry of Education, while the co-organization was attended by the National Higher Education Authority (ETAAE), the Institute of Educational Policy (IEP) as well as Universities and Research Centers from all over Greece, the educational community eTwinning and . The topics of the two-day conference covered all levels of Education while the program included 5 sessions and 19 workshops that took place in parallel in 3 different virtual rooms.

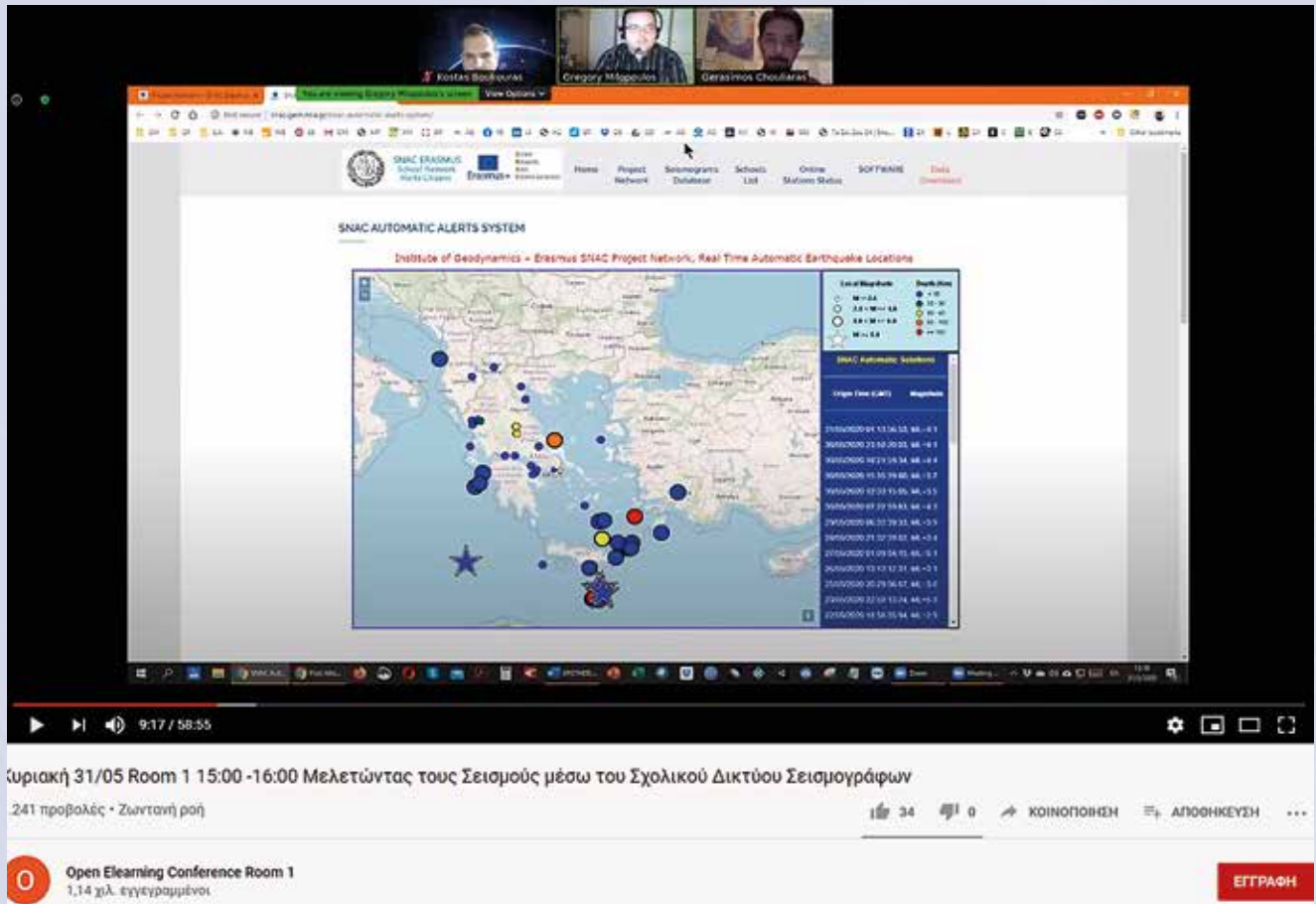
The sessions and workshops were attended by commentators, who had the role of facilitator as they conveyed the questions of the participants to the speakers, as well as rapporteurs made a summary of each topic. **The Conference was attended by more than 10.000 teachers of all levels**, there were 24 hours of live streaming which was watched simultaneously by more than 3,000 participants who submitted more than 750 questions. The videos of the lectures and workshops are freely available for viewing in the respective link of the virtual room where they took place (Main Room, Parallel Conference Room 1, Parallel Conference Room 2), while all presentations are available on the Two-Day website

2606 participants in the two-day conference answered the anonymous evaluation questionnaire with questions related to demographic data, speaker evaluation, evaluation of sessions and presentations / workshops, the organization and quality of the two-day conference, while submitting suggestions and opinions on the content and future actions. Of these, 85% were public education teachers and 5% were private education teachers. The remaining 10% were researchers and non-teachers. 88.38% of the respondents answered that they acquired important knowledge from the Internet Conference.

As part of the two-day event, on Sunday 31 May, the Multiplier Event of the European Erasmus + SNAC Project took place, in the digital Room 1, from 15:00 to 16:00. The exact name of the session was: “Closed Schools – Open Classrooms: Studying Earthquakes with the School Network of Seismographs”.

<b>SNAC MULTIPLIER EVENT – 31/05/2020</b> <b>«ΚΛΕΙΣΤΑ ΣΧΟΛΕΙΑ – ΑΝΟΙΧΤΕΣ ΤΑΞΕΙΣ – ΜΕΛΕΤΩΝΤΑΣ τους ΣΕΙΣΜΟΥΣ ΜΕΣΩ ΤΟΥ ΣΧΟΛΙΚΟΥ ΔΙΚΤΟΥ ΣΕΙΣΜΟΓΡΑΦΩΝ ΤΟΥ ΕΡΓΟΥ SNAC»</b>	
<b>Διάρκεια</b>	45 λεπτά
<b>Βαθμίδα</b>	2 <sup>ο</sup> -3 <sup>ο</sup> Γυμνασίου & 1 <sup>ο</sup> Λυκείου
<b>Περιγραφή</b>	<p>Αρχικά θα παρουσιαστεί το έργο SNAC. Έπειτα θα παρουσιαστούν σε απλά και κατανοητά βήματα όλες τις διαδικασίες που πρέπει να ακολουθήσουν οι εκπαιδευτικοί ώστε να εγκατασταθεί σωστά η επιστημονική εφαρμογή επεξεργασίας κυματομορφών SWARM.</p> <p>Στόχος του Multiplier Event είναι στο τέλος του οι εκπαιδευτικοί να είναι σε θέση να παρακολουθήσουν σε πραγματικό χρόνο τις καταγραφές των σειсмоγράφων του σχολικού δικτύου SNAC, να μελετήσουν κυματομορφές από σεισμούς που έχουν γίνει στο παρελθόν, να κατανοήσουν την χρονική διαφορά μεταξύ των σεισμικών κυμάτων (και πώς θα μπορεί αυτή να αξιοποιηθεί από σύγχρονα συστήματα ασφαλείας) και να μάθουν να εντοπίζουν το επίκεντρο και το μέγεθος κάθε σεισμού με διάφορους τρόπους.</p> <p>Πέρα από την παρουσίαση του λογισμικού, οι συμμετέχοντες θα κληθούν να παρουσιάσουν ένα δικό τους παράδειγμα πάνω στο οποίο θα έχουν ήδη δουλέψει τις προηγούμενες μέρες, αξιοποιώντας τον Οδηγό Χρήσης του SWARM, ο οποίος έχει δημιουργηθεί στα πλαίσια του Έργου SNAC σε μορφή κειμένου και βίντεο.</p>
<b>Βήματα μέχρι την πραγματοποίηση του σεμιναρίου</b>	<ol style="list-style-type: none"> <li>1. Αποστολή υλικού στους εκπαιδευτικούς</li> <li>2. Μελέτη υλικού από τους εκπαιδευτικούς</li> <li>3. Δημιουργία εργασιών</li> <li>4. Συγκέντρωση αποριών/ερωτήσεων/σχολίων από τους εκπαιδευτικούς</li> </ol>
<b>Χρονοδιάγραμμα</b>	<ol style="list-style-type: none"> <li>1. Παρουσίαση του Σχολικού Δικτύου Σεισμογράφων (5')</li> <li>2. Το λογισμικό SWARM – Παράδειγμα (15')</li> <li>3. Παρουσίαση εργασιών συμμετεχόντων (15')</li> <li>4. Ερωτήσεις – Απαντήσεις – Διάλογος (10')</li> </ol>
<b>Υλικό</b>	Οδηγός χρήσης SWARM (pdf): <a href="https://snac.gein.noa.gr/docs/SNAC%20GUIDE%20booket%20final.pdf">https://snac.gein.noa.gr/docs/SNAC%20GUIDE%20booket%20final.pdf</a> Οδηγός χρήσης SWARM (video): <a href="https://www.youtube.com/watch?v=Z3Nc9tM9S80">https://www.youtube.com/watch?v=Z3Nc9tM9S80</a>
<b>Προτεινόμενοι σεισμοί προς μελέτη</b>	<ol style="list-style-type: none"> <li>1. Κρήτη 2/5/2020 στις 12:51 6.0R</li> <li>2. Σαντορίνη 3/5/2020 στις 02:08 4.3R</li> <li>3. Ζάκυνθος 16/5/2020 στις 08:29 4.3R</li> </ol>

According to the analytics collected by the Conference Organisers, **782 persons watched the SNAC session live and up to the end of August 2020, the recording was seen by 1373 unique visitors**



The screenshot shows a video conference interface with three participants: Konstantinos Boukouras, Gregory Milopoulos, and Gerassimos Chouliaras. The main content is a presentation slide titled "SNAC AUTOMATIC ALERTS SYSTEM" from the Institute of Geodynamics - Erasmus SNAC Project Network. The slide features a map of Greece with various colored circles representing earthquake locations. A legend on the right side of the map lists earthquake magnitudes and depths. Below the map, there is a table of seismic data with columns for "Origin Time (UTC)", "Magnitude", and "Depth (km)".

Below the video player, the YouTube video title is "Τετάρτη 31/05 Room 1 15:00 -16:00 Μελετώντας τους Σεισμούς μέσω του Σχολικού Δικτύου Σεισμογράφων". The video has 241 views and 34 likes. The channel is "Open Elearning Conference Room 1" with 1.14 million subscribers. A red "ΕΓΓΡΑΦΗ" (Subscribe) button is visible in the bottom right corner.

#### 4.4.3. Targeted webinars for Greek SNAC teachers by NOA & EA

Three major webinars took place between Greek SNAC partners and teachers from Greek schools. The National Observatory of Athens was represented by Dr. Chouliaras and Mr. Boukouras and Ellinogermaniki Agogi was represented by Ms Kyrioti and Mr. Milopoulos.

The main topic of the workshops was the use of the SWARM platform.

These workshops took place at the following dates: 13/1/2020, 10/2/2020 and 18/2/2020.

#### 4.4.4. Webinar at Liceo Scientifico Labriola di Napoli) by IDIS

On March 30<sup>th</sup> 2020 a representative of Fondazione Idis carried out an online conference involving a couple of teachers of one of the schools hosting a seismometer (Liceo Scientifico Labriola di Napoli) aimed to train to monitor the seismic activity by mean of the SNAC network, to acquire the seismic data and to analyze them using the SWARM software.

The whole meeting was recorded, and it is available on You Tube to the following addresses:

Part 1: <https://www.youtube.com/watch?v=UhdXYNvdZIE>;

Part 2: <https://www.youtube.com/watch?v=y9MAW38TD-o>

#### 4.4.5. Webinars for Bulgarian Schools on the installation and use of the seismograph

On 04. 02.2020 an on-line training was carried out for the schools interested in working with seismometers under the SNAC project, for the installation of the Raspberry shakes and the corresponding software. 11 schools participated: 11 physics teachers, 6 IT experts and 2 scientists. On-line trainings were also provided to every school hosting a seismometer for the installation and use of the seismometer and the SWARM Software.

### 4.4.6. The Learning Management System (LMS) used in Turkey for webinars and online training

DEU used a Learning Management System for the training of Turkish teachers. A learning management system (LMS) is a software application for the administration, documentation, tracking, reporting, and delivery of educational courses, training programs, or learning and development programs (Wikipedia).



DEU developed teaching and learning modules for SNAC Project in order to give chance to teachers to learn deeply about earthquakes, seismometers and SNAC project implementations. The LMS had the following modules:

Modules	
OSOS Platform	Introduction
	Data Input To Self-Assessment Tool
	Creating A School Development Plan
	Joining The Turkish SNAC Group
	Creating Project
	SNAC Project For Students
Theoretical Information	Earthquakes
	Seismometers And Sensors
Application of SWARM	Installations for Windows
	Installations for MacOS
	Installations of JAVA
	VPN Settings
	Using of SWARM
	Case Study 1
	Data Import
Assessment of Training	Are You Ready To Do An Event?
	Case Study 2
	Let's Know The SNAC Platform
	Teacher Evaluation
	Student Evaluation

### 4.4.7. Reflecting for Change Online workshop

The Laboratory Centers of Natural Sciences (EKFE - Εργαστηριακά Κέντρα Φυσικών Επιστημών) are centers of organization, technical and pedagogical support of the laboratory teaching of Science, Chemistry & Mathematics of the Gymnasium and Lyceum. On the 10<sup>th</sup> of June 2020, the first and second EFKE organized a webinar to introduce the Reflecting for Change project. The title of the webinar was: “The Reflecting for Change Project (R4C): The role of science teaching in the formation of the open school”



The project Reflecting for Change (R4C - <https://reflecting4change.eu/>) aims at proposing an advanced support framework, as well as a set of core policy recommendations, to schools seeking to introduce a type of holistic change that will ensure a meaningful uptake of sustainable innovation, with an emphasis on achieving improved learning outcomes as set by the Europe 2020 strategy. R4C is a Forward-Looking Cooperation Project that promotes the use of self-reflection tools to support innovation and systemic change in education and training institutions. In the R4C approach, innovation is understood in terms of a school's pathway to digital maturity (e-maturity) and its comprehensive relationship to the use of ICT, as well as a school's pathway to openness demonstrated in its relationship with external stakeholders, in parental engagement, in fostering the well-being of its community as a whole, in its ability to combine the delivering of the curriculum with a study of local challenges, in its willingness and capacity to share its achievements with other schools.

Apart from Ellinogermaniki Agogi, other partners of the project are crucial policy makers such as:

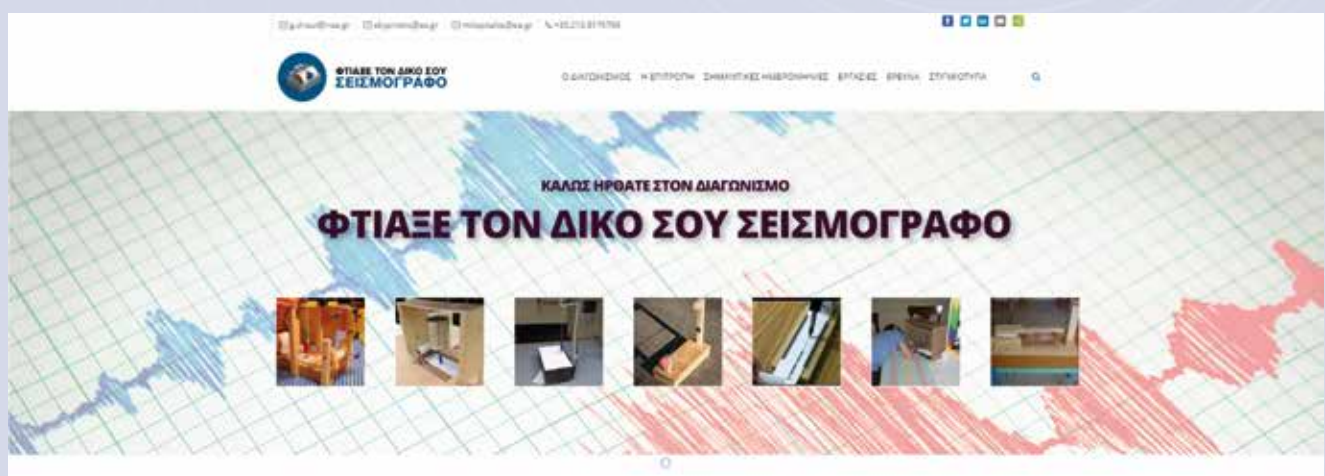
- ESHA: the European School Heads Association, is a professional non-profit organisation for European school leaders. Members of ESHA are national organisations for school heads and deputy school heads within (pre-) primary, secondary and vocational education.
- EDEN: The European Distance and E-Learning Network exists to share knowledge and improve understanding amongst professionals in distance and e-learning and to promote policy and practice across the whole of Europe and beyond.
- IEP: The Institute of Educational Policy is a scientific agency that provides support to the Minister of Education and Religious Affairs of Greece.

## 4.5. Competitions

### 4.5.1. Build your own Seismograph

The “Build your own Seismograph” contest is one of the most emblematic activities of the SNAC Project, continuing the legacy of the older Schools Study Earthquakes project. A specific webpage is dedicated to it: <http://seismografos.ea.gr/>

The “Build your own Seismograph contest: is a nationwide student competition in Greece, organised by NOA, EA and the Institute of Education Policy of the Greek Ministry of Education, under the Auspices of the Greek Presidency of Democracy. Each year the competition involves tens of teams from Greek schools, consisting of a scientific consultant (usually a teacher) and students that build their own seismograph.





The evaluation is being carried out by a Scientific Committee, which considers the quality, scientific accuracy and understanding of civil protection. Eventually the ten best works are selected and invited to the award ceremony in Athens during the Athens Science Festival ([www.athens-science-festival.gr](http://www.athens-science-festival.gr))<sup>8</sup>, which is one of the biggest celebrations of science and technology in Greece, with the participation of 6,000 scientific collaborators, 730 speakers, 350 artists and 1800 volunteers from the first year of its organization until today.

Furthermore, the teams that are awarded have the opportunity to publish articles with their work, after evaluation by peer reviewers, in the special designed for students European scientific journal **“Open Schools Journal for Open Science»**.

At the first award ceremony for the school year 2017-2018, the President of the Greek Democracy H.M Mr Prokopis Pavlopoulos greeted the winning teams and quoted:

***“This is an innovative form of teaching, Such a program shows the way for science teaching, how children should come in contact with scientific information, how to approach science, but also how to challenge the results of science. Because, we must not forget that the questioning of the results of science is what moves it forward”***

<sup>8</sup> The ASF started in 2014 and during these years it has been established as an institution, but also as a cultural event that concerns Science, Technology, Innovation and Art!. In addition to the large turnout, which in total in the six years of its organization has exceeded 120,000 visitors, the Athens Science Festival is proud that not only managed to achieve its original goals, but also to expand them.



Below we present some highlights from the last award ceremony for the school year 2018-2019. The ceremony of 2019-2020 has been cancelled and will take place online in November 2020.



Each year of the “Build your own Seismograph” we are really amazed by the variety and the quality of submitted projects, making it a very difficult task for the Scientific Committee of the competition to select the best 10 to be awarded. Below we present some examples of the creations of SNAC students:



From simple card boxes and pencils to Lego Mindstorms and microcomputers, the submitted projects are always impressive and unique, despite the fact that the competition has already ran for three consecutive schools years with tens of participations around Greece. Some of the teams also used innovative names, such the “Eartquake Busters”!



#### 4.5.2. HackQuake (Connection with EU Code Week)

The first Hackquake took place on Saturday, October 12 of 2019, at the premises of Ellinogermaniki Agogi. The participating teachers had the opportunity to attend an extremely interesting presentation by Dr. Houliaras, from the Institute of Geodynamics, during which the basic concepts of earthquakes were understood and the importance of early warning in emergencies was also highlighted.



Later, the HELIX team guided the participating teachers through the basic structures of HELIX in detail and worked together in the area that hosts open data from the school seismograph network that EA with the Institute of Geodynamics have developed in 5 countries.

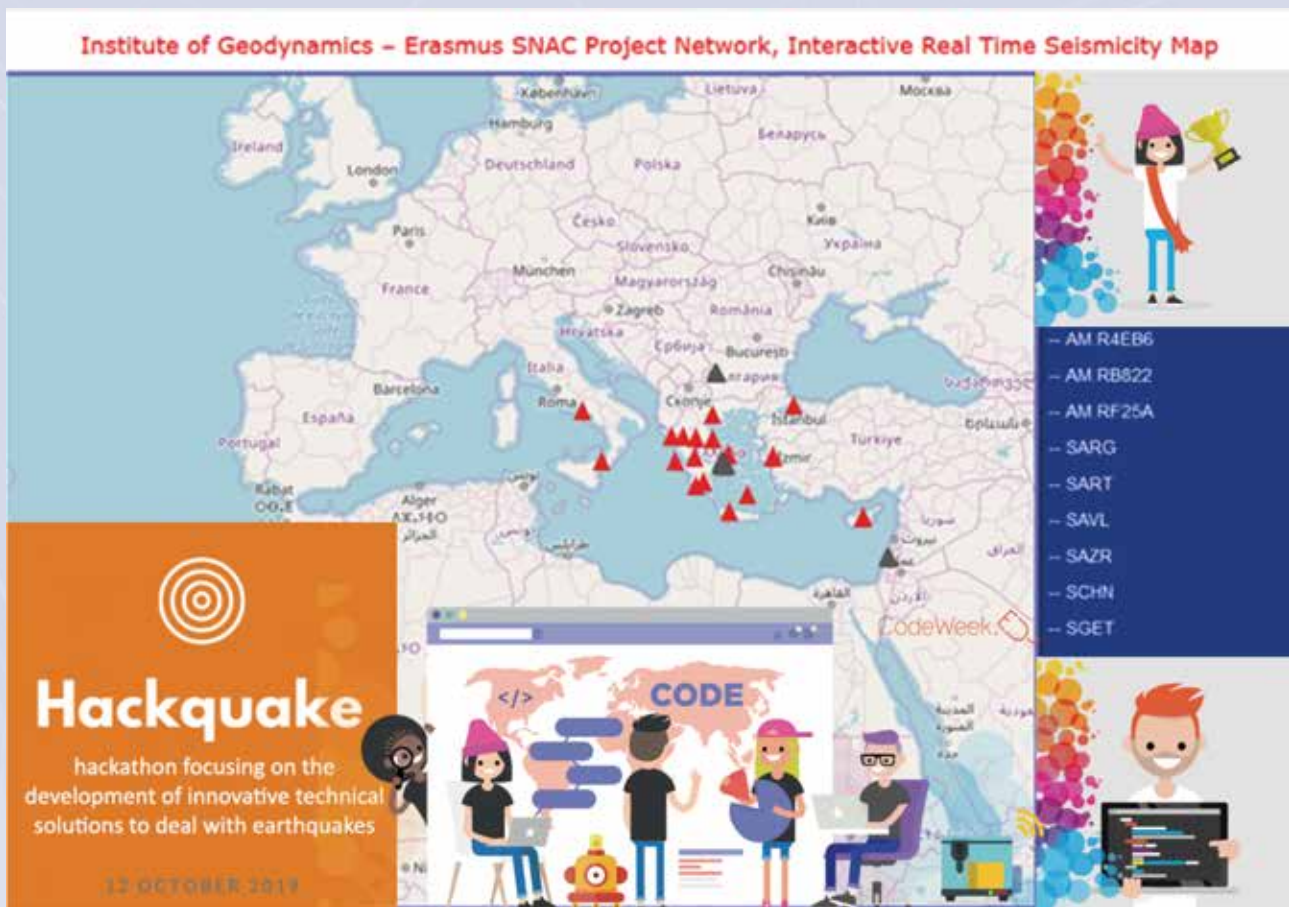
Data, which can be exploited in a variety of ways by the learning community, but on the Hackquake Day participants observed how this data through the Python programming language could develop an early warning system. Recent seismic vibrations in the Eastern Mediterranean region – as recorded by the National Observatory Seismograph School Network – SNAC – were available (in waveforms) to participants through the Hellenic Data Service HELIX to develop algorithms that look forward to an early warning system for earthquakes.



The first Hackquake was attended by 12 teachers from 10 schools and included problem presentation, analysis of parameters, presentation of examples and then implementation by the participants who worked in groups. The workshop was organized by the Institute of Geodynamics, the National Observatory of Athens, the ATHENS Research Center, the EELLAK Organization and Ellinogermaniki Agogi in the framework of SNAC, OPENAIRE and OSOS projects co-funded by the European Union.



Hackquake was also promoted through the OSOS portal:



The event was addressed by both non-experts and advanced users in order to develop and showcase innovative technical solutions to deal with earthquakes. Participants had access to open data hosted by the HELIX database and the seismograms of the network of SNAC seismographs.

The problem they had to solve was the following:

***“Seismic waves from the earthquake in Albania at 14: 04: 25.2 (UTC) on September 23rd , 2019 first arrived at the school seismograph in Igoumenitsa at 14: 04: 58.4 and after half a minute at the school seismograph in Athens at 14: 05: 36.0. Could Igoumenitsa’s school send a warning to the school in Athens before the earthquake arrived? Could the Tirana school be the first to alert the two schools?”***

Participants of the Hackquake were given an open set of time-reading data from the SNAC Seismograph Network and a challenge: develop an earthquake early warning application! Using any programming language they wanted, they had to develop algorithms for rapidly processing and analyzing seismic data to:

- identify earthquake signals and
- immediately send warning alerts that could be transmitted a few critical seconds before the arrival of the catastrophic S waves.

```

# loop over list of stations

# for each station read data and check if signal is above threshold
# (be careful each station may have different threshold value)

# if yes this is an alert candidate, find time of alert from
# this station (e.g TimeAlert1)

# if more than 2or3 stations are in alert find TimeAlert2 and
# TimeAlert3 then break loop and send alert warning to Athens

# Find the time of arrival of this earthquake in Athens
# (This can be defined as the time that a station located in Athens
# has its maximum signal)

# Compare time of alert (this is the latest time of the 2or3 time
alerts found above)

# Print your score = Time_ArrivalOfEarthquakeInAthens - TimeAlert
# (the higher the better!)

```

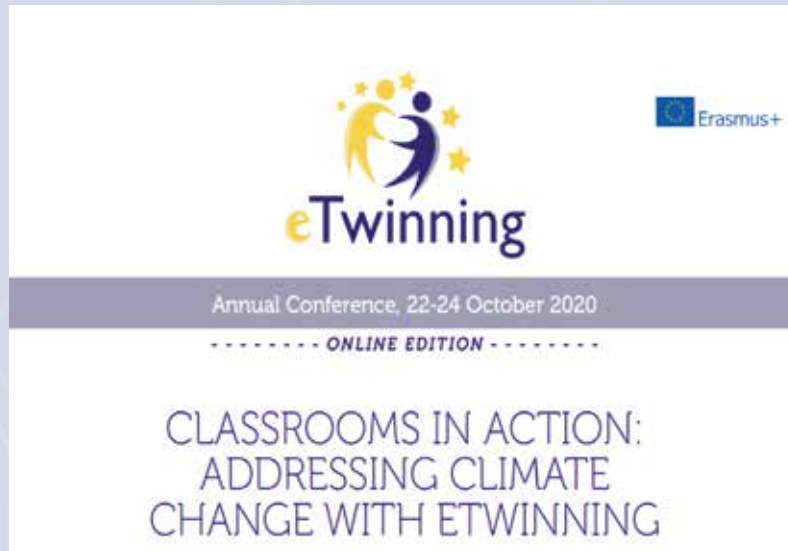
#### 4.6. Linking with the eTwinning Community ([www.eTwinning.net](http://www.eTwinning.net))

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 the Erasmus+, the European programme for Education, Training, Youth and Sport. It features 833.946 teachers, 210.736 schools and 109.989 projects. eTwinning promotes school collaboration in Europe through the use of **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.

SNAC has been connected with the eTwinning Community from the beginning of the project. All SNAC guides, databases and other resources are available to the eTwinning members in order to inspire the creation of innovative STEM projects and to build communities and networks of SNAC schools, starting from the teachers and students of the participating SNAC School Nodes and opening up to all European schools, through eTwinning activities.

Furthermore, in the major SNAC webinars many eTwinning teachers participated and learnt how to use OSOS to create seismology related eTwinning projects. In these workshops, teachers presented their plans to create new eTwinning projects and partnerships with other schools and with other teachers who participated on the SNAC webinars. Also two eTwinning Ambassadors in Greece followed the SNAC Summer Schools: Natalia Tzitziki and Nektarios Farasopoulos

This amfidromous relationship has created a bond that will sustain even after the end of SNAC. Dr Gerasimos Chouliaras, the Coordinator of SNAC along with Dr Sofoklis Sotiriou and Mr. Gregory Milopoulos from Ellinogermaniki Agogi were invited to present a workshop at the eTwinning Annual Conference 2020 that will take place online from the 22<sup>nd</sup> till the 24<sup>th</sup> of October.



The workshop will present this Network, its main components and the unprecedented technical and educational innovations it brings, providing inspiration for unique eTwinning projects and collaborations among European schools, teachers, students and local societies and stakeholders.

## WORKSHOP DISTRIBUTION

SESSION 1 Friday 23 <sup>rd</sup> October 13:00 – 14:30	SESSION 2 Friday 23 <sup>rd</sup> October 15:00 – 16:30	SESSION 3 Saturday 24 <sup>th</sup> October 10:30 – 12:00	SESSION 4 Saturday 24 <sup>th</sup> October 13:00 – 14:30
<b>European eTwinning Prizes:</b> Up to 6 winners- runners up presentation of projects	<b>European eTwinning Prizes:</b> 7-11 winners runners up presentation of projects	<b>European eTwinning Prizes:</b> 12-15 winners runners up presentation of projects	<b>European eTwinning Prizes:</b> 16-19 winners runners up presentation of projects
<b>Climate challenge - a quick prototyping workshop</b> (Kristine Sevik & Vibeke Guttoormsgaard)	<b>The Power of 3 R- Reduce-Reuse-Recycle in UNESCO Associated School</b> (Malwina Kordus)	<b>Schools study earthquakes for the environment</b> (Gerasimos Choullaras, Sofoklis Sotiriou, Gregory Milapoulos)	<b>Learning Online with your School Colleagues</b> (Elena Pezzi & Christina Nicolaita)
SDG in STEM Education & eTwinning projects using pedagogies which foster 21st century skills (Alexia Micallef Gatt)	<b>Up-cycling - new level of recycling</b> (Sylwester Zasoński)	<b>Up-cycling - new level of recycling</b> (Sylwester Zasoński)	<b>Actions to protect the Earth - local and global change Agents!</b> (Tomasz Ordza)
<b>Collaborative Art Projects to Save The Planet</b> (Alexandra Gabor)	<b>The Hatter's Clima-tea Party</b> (Maria O' Donovan)	<b>Enseigner le changement climatique et les défis environnementaux</b> (Bertrand Pajot)	<b>Digital Technologies for Climate Action</b> (Anjana Blažič)
Constructive journalism as a way of effective ESD teaching and building leadership skills (Malgorzata (Gosia) Luszczek)	<b>Europeana and sustainable development through citizenship</b> (Isabel Crespo)	<b>CLIMATE ACTION NOW! How can sustainable energy and behavior reduce climate change?</b> (Daniela Usmiani & Danijela Takač)	<b>Erasmus+ KA1 and KA2 projects</b> (Suzana Delić)

The SNAC eTwinning Toolkit consists on the available SNAC resources (see Appendix 6.2) and this document (Intellectual Output 5). It offers a structured set of recommendations, best practices and resources which can be a reference for a pan European roadmap for the introduction of relevant activities in schools. In this framework the aim of the consortium was to formulate a common set of guidelines and recommendations on how scientific work can be used to provide an engaging educational experience through the exploration of “real science”.

In this way the SNAC project contributes to a better understanding of science and the role that it plays in society. To this end, through this document (Intellectual Output 5) and the eTwinning Toolkit (Appendix 6.2) the project consortium has delivered a set of guidelines for the research and the educational policy communities to further explore and exploit the unique benefits of introducing scientific research in schools. This is the first step in a journey of educational reform. It is the map. The achievement of the high-quality science teaching requires the combined and continued support of all actors, researchers, policy makers and curriculum developers, science teachers, students and parents.

#### 4.7. Connecting with SCIENTIX ([www.scientix.eu](http://www.scientix.eu))

Scientix promotes and supports a Europe-wide collaboration among STEM (science, technology, engineering and maths) teachers, education researchers, policymakers and other STEM education professionals.



In its first stage (2009-2012), the project built an online portal to collect and present European STEM education projects and their results, and organised several teacher workshops. The main networking event was the Scientix conference, held in May 2011 in Brussels. The goal of the second phase of the Scientix project (2013 – 2015) was to expand this community to the national level. Through a network of National Contact Points (NCPs), Scientix reached out to national teacher communities, and contributed to the development of national strategies for wider uptake of inquiry-based and other innovative approaches to science and maths education.

This activity is continued in the third stage of Scientix (2016-2019), which is funded by the Horizon 2020 programme of the European Union for research and innovation. Scientix was originally born at the initiative of the European Commission and has, since its inception, been coordinated by European Schoolnet, a Brussels-based consortium of thirty ministries of education, which is a driving factor for innovation in teaching and learning and fosters pan-European collaboration of schools and teachers.

The main stakeholders of Scientix are teachers, researchers and project managers in STEM education, and policymakers. Each of these groups can benefit from Scientix activities and events.

SNAC is one of the projects that participates to this community for science education in Europe. You can find it here: <http://www.scientix.eu/web/guest/projects/project-detail?articleId=819604>

The screenshot shows the SNAC website interface. At the top, there is a navigation menu with links for HOME, SCIENTIX LIVE, COMMUNITY, EVENTS, PROJECTS, CONFERENCE, NEWS, RESOURCES, and ABOUT. The main content area features a breadcrumb trail: Home > Projects > SNAC School Networks Alert Citizens protection. The title of the project is 'SNAC SCHOOL NETWORKS ALERT CITIZENS PROTECTION'. Below the title, there is a 'Share this project' section with social media icons for Twitter, Facebook, and LinkedIn. A tabbed interface is visible with three tabs: 'BASIC INFORMATION', 'RESEARCH INFORMATION', and 'TEACHER INFORMATION'. The 'BASIC INFORMATION' tab is active, displaying the project name in a stylized font and a description: 'The SNAC project promotes open education and innovation in schools and their communities, supports the development of key competences for students who are developing projects and activities serving their communities, and presents innovative whole-school approaches that support teachers' professional development through collaboration, networking and exchange of good practices.' On the right side, there is a sidebar with a blue button labeled 'READ THE INSTRUCTIONS!' and a list of links under the heading 'In your country', including 'Observatory', 'Scientix Moodle', 'Scientix Webinars', and 'Scientix blog'.

SNAC had a continuous communication with Scientix Ambassadors in Greece and they were often invited in the online SNAC webinars that took place, especially during the period that schools were closed due to the pandemic.

#### 4.8. Cooperating with Openaire ([www.openaire.eu](http://www.openaire.eu))

The mission of OpenAIRE is closely linked to the mission of the European Commission: to provide unrestricted, open access to research results.



Ellinogermaniki Agogi, within the framework of the running OpenAIRE project, is responsible for the utilization of open research data in education, but also for the implementation of citizen science projects in schools throughout Europe. One of OpenAIRE's main citizen science activities, is about supporting and funding the growth of a school's network with advanced new seismographs that can monitor seismic activity around Europe and deliver that data to a open access repository. The goal is to introduce and educate students and educators on Open Science, its value, applications and philosophy and at the same time create a learning path over Open Data, collection and proper metadata management of data, analysis of data, insights from data, services that can be build for common good.

The first cooperation between SNAC and OpenAire, was the earthquake hackathon “Hackquake” which was organized by OpenAIRE’s partner, Ellinogermaniki Agogi, with close cooperation and support by Athena Research and Innovation Center (ARC), HELIX-the National Hellenic Research Data Infrastructure, National Observatory of Athens and Open Technologies Alliance (GFOSS). The event was organized as part of Open Schools for Open Societies Open Day on October 12, 2019, at EA’s premises.

SNAC is also present at the Open School Journal for Open Science. The Open Schools Journal for Open Science (OSJ) is published electronically and with Open Access through the eJournals platform of the National Documentation Center (of Greece) and is the first European journal designed with the specifications of a regular student science journal. The journal accepts original papers written by primary and secondary school students from all over Europe, under the guidance of their teachers, and covers topics from the full range of science, engineering and technology.





SNAC is featured here:

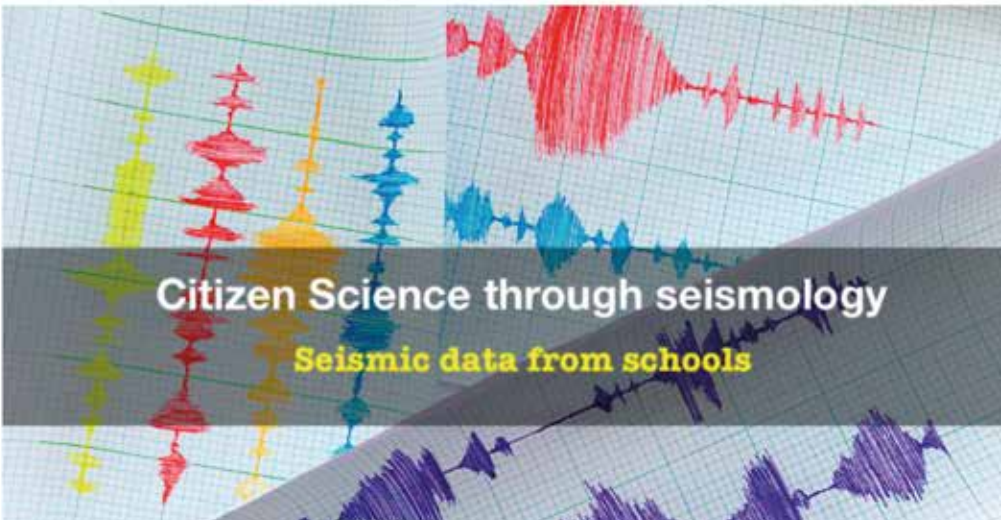
<https://www.openaire.eu/blogs/citizen-science-through-seismology-school-seismograph-network-webex>

On the SNAC Webinar of the 5th of May 2020 (section 4.4.1), Greek teachers were invited to an inspirational presentation of the School Seismograph Network. During the event Dr. Gerasimos Chouliaras, who is responsible for the technical features regarding the network, presented in detail the basics of seismology and the value of society’s interaction with that field of science. Later, two teachers who host seismographs in the premises of their schools presented good practices of involving the use of seismograph and the seismic data in their daily routines through educational activities. Last, Eugenia Kyriotis completed the webinar by presenting Open Science Journal and suggested to participants to consider their involvement as it could work as the final step of students’ scientific research: that of publishing the work. Almost 50 enthusiastic teachers were exposed to the beauty of citizen science through seismology in a dynamic webinar that lasted nearly 2 hours with participants’ interest, attention and curiosity staying intact during the whole time.

1 MINUTE READING TIME (192 WORDS)

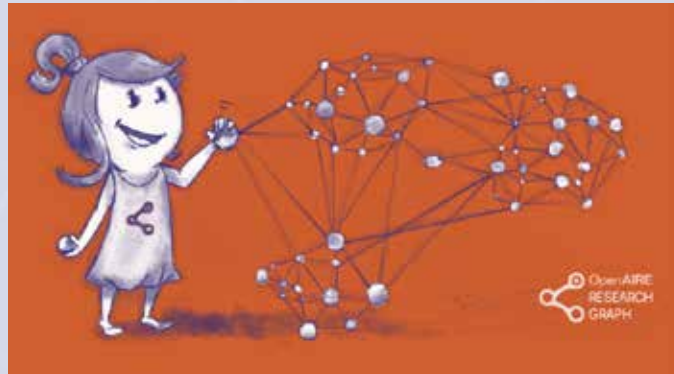
## Citizen Science through seismology: School Seismograph Network WEBEX

presentations & publications  Eugenia Kyriotis  19 May 2020  812 Hits  0 Comments



Citizen Science through seismology  
Seismic data from schools

Finally, SNAC can contribute its vast database of old and real-time seismograms to the OpenAire Research Graph. The OpenAIRE Research Graph is one of the largest open scholarly record collections worldwide, key in fostering Open Science and establishing its practices in the daily research activities. Conceived as a public and transparent good, populated out of data sources trusted by scientists, the Graph aims at bringing discovery, monitoring, and assessment of science back in the hands of the scientific community. Imagine a vast collection of research products all linked together, contextualised and openly available.

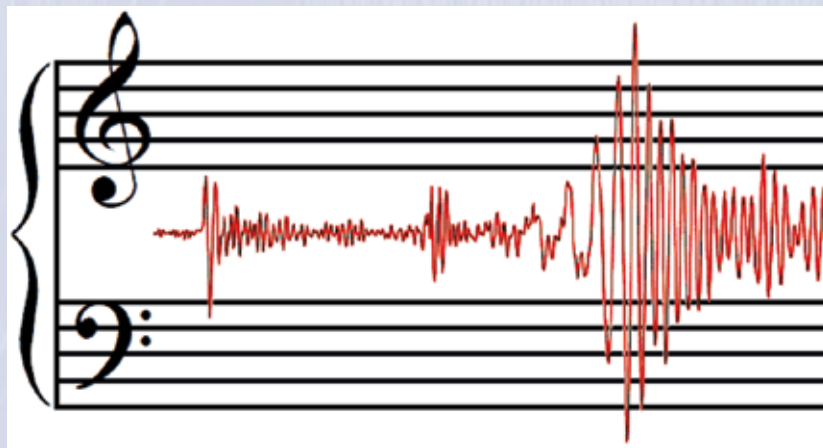


The OpenAIRE Research Graph currently aggregates around 450 million of metadata records with links collecting from 10,000 data sources trusted by scientists! After cleaning, deduplication, and fine-grained classification processes, they narrow down to almost 100 million publications, 8 million datasets and 200 thousands software research products linked together with semantic relations. More than 10 million full-texts of Open Access publications are mined by algorithms to enrich metadata records with additional properties and links among research products, funders, projects, communities, and organizations. Thanks to the mining algorithm, the graph is completed with 480 million semantic relations.

## 4.9. Collaborations between schools from different countries

### 4.9.1. Listening to the Sound of the Earth

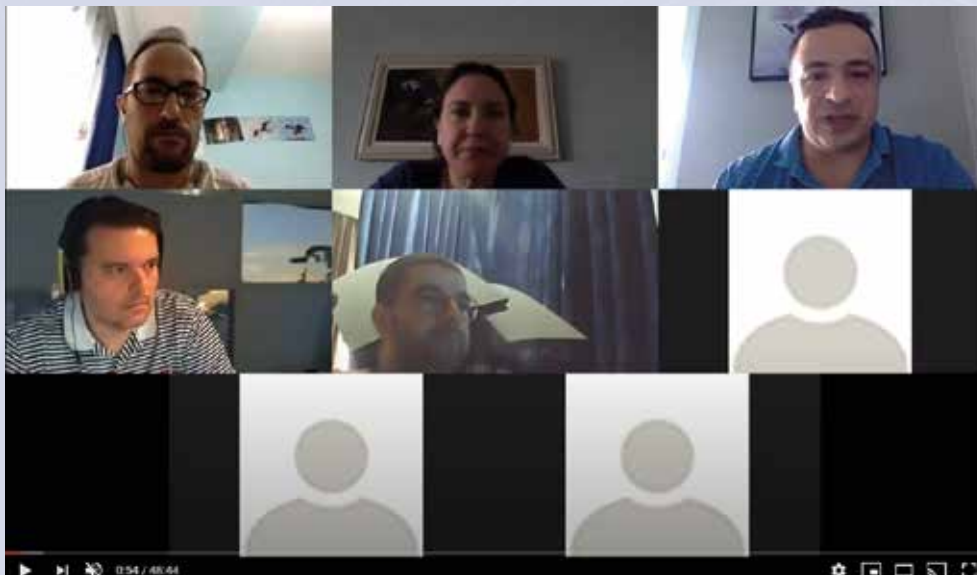
To detect earthquakes, scientists use seismometers. Seismometers produce seismograms. Sound is a wave. SNAC Teachers provoke the curiosity of students by asking: “Earthquakes arrive to us in waves also. Could we listen to earthquakes? To hear the vibrations of earth’s solid crust? Would you like to synthesize your own melody of the earth using data from a seismogram?”. Most earthquakes have frequencies  $<20\text{Hz}$  - we cannot hear them. The sound we hear during earthquakes derives from the oscillation of buildings and their internal structures (glass, bookcases etc).



Through sound editing applications, we can change the frequency of the seismic wave so that it can be heard by the human ears and with the help of a synthesizer software the seismic waveform is converted to musical notes and the sound of the earth is compiled. In Appendix 6.1.2 you can find the link to the related resources and lesson plans. Proposed Procedure: (i) Divide students in groups, (ii) Use one or more seismograms, (iii) Use a piece of paper and create Cartesian x-y axes matching the axes of the seismogram. Match the axis  $y=0$  with note C4 (optional), (iv) Define 12 equal spaces for the positive y-semi axis and another 12 for the negative semi-axis. Match each space with a note so that in the 12 spaces, we have change by one octave. (v) Choose your preferred instrument, (vi) Define BPM at value=60, (vii) Transfer your notes to the online sequencer and make your own melody.



Teachers and students from Greece & Turkey worked together to implement this amazing activity. Firstly, Greek teachers provided a workshop to their Turkish colleagues and then the knowledge was transferred to the Turkish students through online workshops. Then the results were presented in another webinar where both teachers and students from both countries participated.



The recordings of these webinars are available here:  
<https://youtu.be/fL8zA6oQC2I> and <https://www.youtube.com/watch?v=Hq1nEDs1IIE&t=3321s>

#### 4.9.2. Finding the largest earthquakes and their impact in Greece & Turkey

The extreme measures for schools during the Pandemic, did not stop students from Greek and Turkish schools to work together. Their teachers asked them to research the major earthquakes that took place in the two countries and present, through Webex, the outcomes. Students did an impressive job and a more impressive presentation of their findings, other from their homes and other from their classes. The collaborative workshop between Turkish with Greek SNAC students on the major Earthquakes in Greece & Turkey can be found in this link: <https://youtu.be/gwJlg0QhSBk>



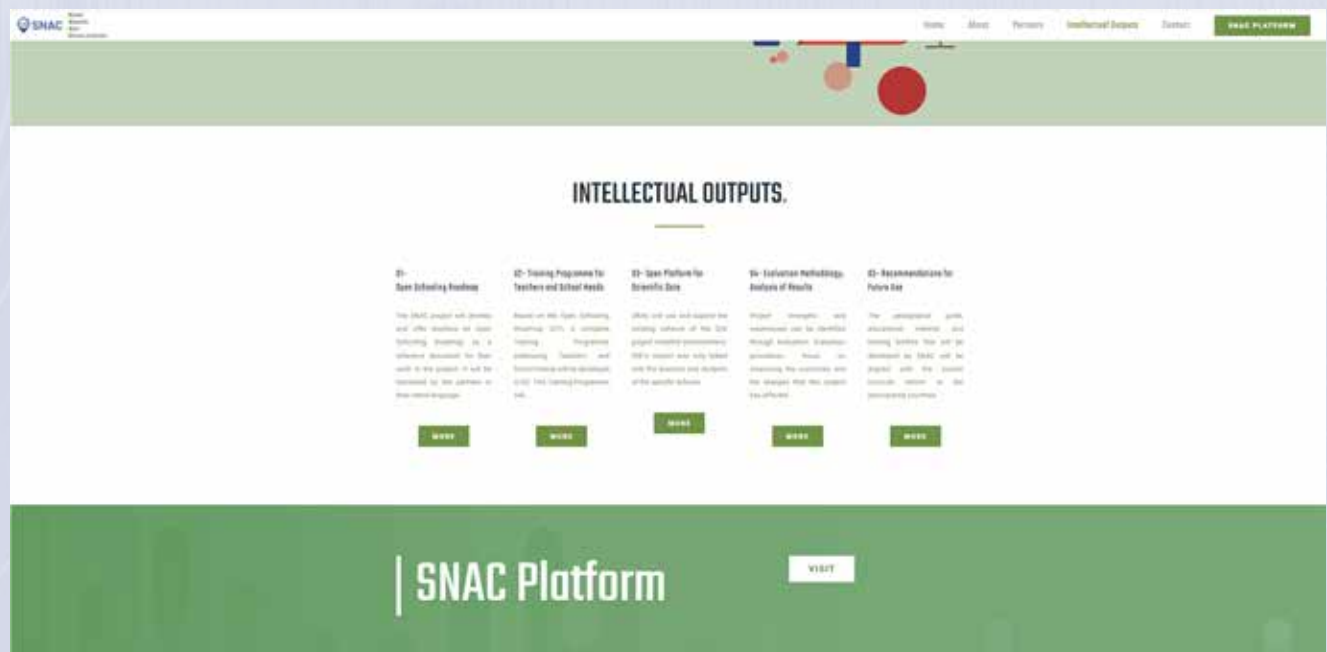
## 4.10. SNAC Presence in the WEB, Social Media, Radio, TV and press

### 4.10.1. SNAC Main Website

The official website of the SNAC project is located at: <http://snac-project.ea.gr/>



The visitor can find useful information about the project, its consortium, its intellectual outputs and ways of communicating with its partners.

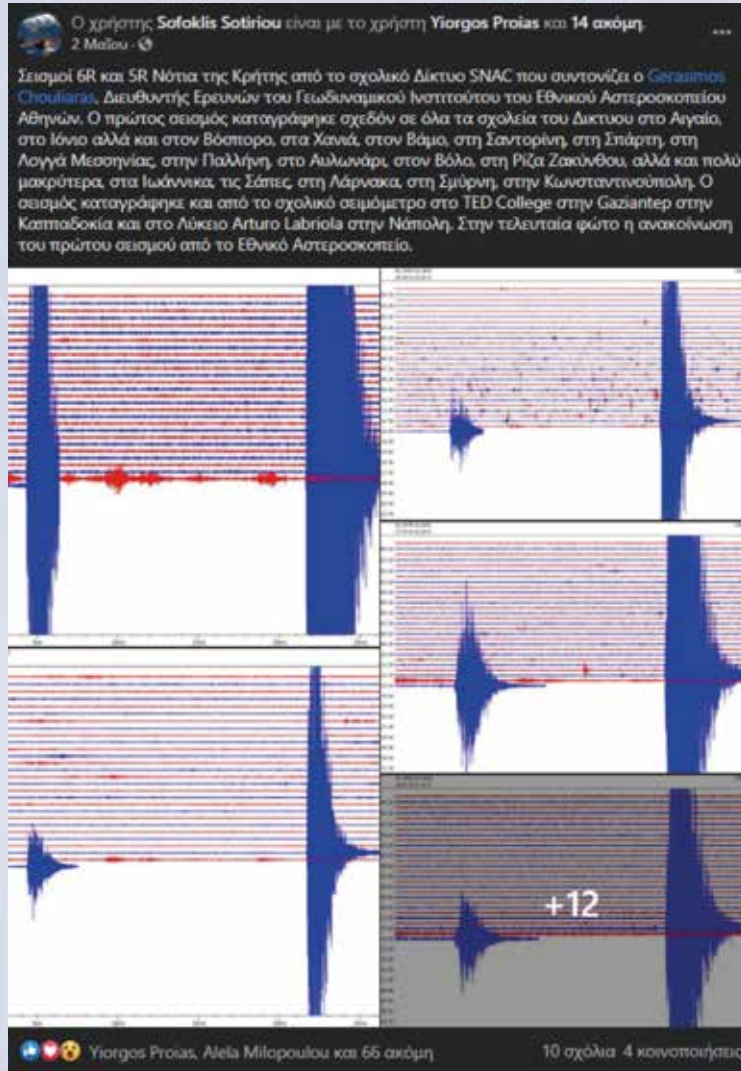


### 4.10.2. SNAC Facebook Page

Another important dissemination and communication channel of SNAC’s news and results in its page on Facebook which included hundreds of posts and is being followed by 515 people (most of them teachers). It is located at: <https://www.facebook.com/Schools-Study-Earthquakes-School-Networks-Alert-Citizens-367612884076599/>. All project news are shared here along with the seismic waveforms recorded from the SNAC Network of School Seismometers

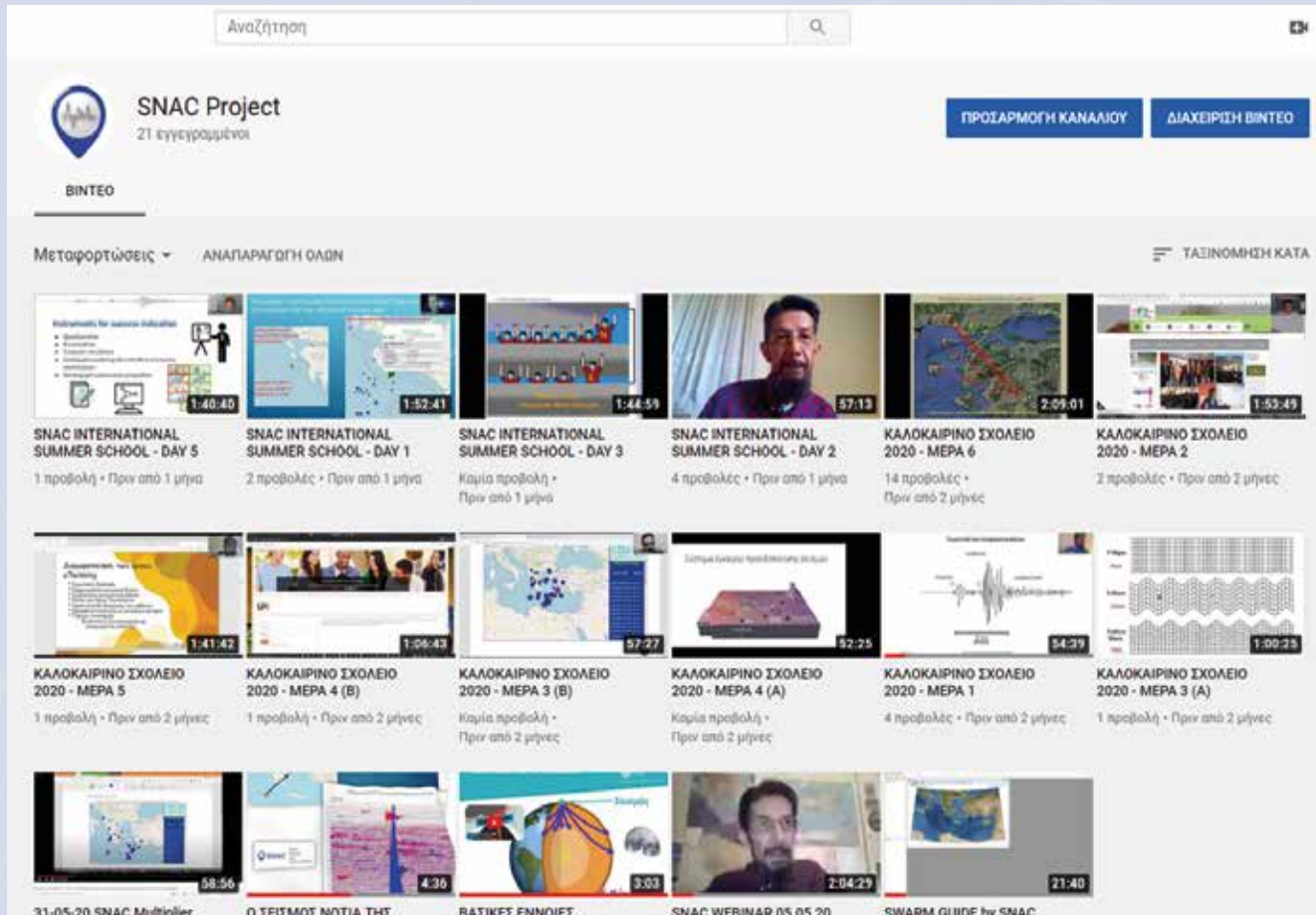


Furthermore, each time an significant earthquake occurred inside the Network of School Seismographs of SNAC, partners and teachers created Facebook posts about the event, using data from the closest (to the epicenter) seismographs.



### 4.10.3. SNAC Youtube Channel

SNAC partners have created a Channel in Youtube where they upload all videos related to the project, including the recording from the performed webinars. It is a very useful resource for both students and teachers that is available 24/7 and ready to be used for distance learning, if necessary.



### 4.10.4. Other Communication Channels

#### Greek Local Press

The activities in

- Vrilissia (<https://vrilissianews.gr/paideia/vrilissia-to-1o-gymnasio-meleta-toys-se/>),
- Sapes (<https://www.paratiritis-news.gr/article/221787/Se-seismografiko-diktuo-7-xoron-summetexei-pleon-to-Gumnasio-Sapon>) and
- Patras <https://bit.ly/2xhc3m0>

where covered extensively by local newspapers, websites, radio and tv stations.

#### Greek National Press

Articles about the SNAC project were published by Dr. Chouliaras (NOA) and Dr. Sotiriou (EA) in two nationwide newspapers with very high circulation:

- <https://www.kathimerini.gr/1057060/article/epikairothta/ellada/ta-sxoleia-meletoy-n-toys-seismoys>
- <https://www.kathimerini.gr/politics/961325/paylopoylos-i-pliroforia-prepei-na-metatrepetai-se-gnosi-kai-epistimi/>

- <https://www.iefimerida.gr/news/412516/mathites-eftixan-seismografo-kai-ton-paroysiasan-ston-paylopoylo-eikones>
- <https://www.minedu.gov.gr/dimofili/34203-25-04-18-ftiakse-to-diko-sou-seismografo-apo-to-20o-gymnasio-athinas-sto-festival-epistimis-kai-kainotomias-athens-science-festival>
- <https://www.protothema.gr/greece/article/972863/oi-mathites-meletoun-kai-katagrafoun-seismous-me-tous-sholikous-seismografous/>

### **Greek National TV**

Dr Chouliaras (NOA) and Dr Sotiriou (EA) were invited to the news show “Apo tis eksi” (<https://webtv.ert.gr/shows/apo-tis-exi/>) of the Greek National TV (ERT – [www.ert.gr](http://www.ert.gr)) to talk about SNAC and the network of installed school seismometers in Greek schools.

### **Greek National Radio**

Dr Chouliaras (NOA) discussed about SNAC in the nation-wide radio station SKAI ([www.skairadio.gr](http://www.skairadio.gr)) with the famous journalist Christina Vidou (13/12/2019)

- **SNAC Project Website:** <http://snac-project.ea.gr/>
- **SNAC Educational Platform:** <https://snac.gein.noa.gr/>
- **SNAC Portal - Community Schools Study Earthquake at OSOS:**
- <https://portal.opendiscoveryspace.eu/en/community/schools-study-earthquakes-849203>
- **School Projects:** <https://portal.opendiscoveryspace.eu/en/search-projects-in-community/849203>
- **Sources / Tools:** <https://portal.opendiscoveryspace.eu/en/search-resources-in-community/849203>
- **SNAC Facebook page:** <https://www.facebook.com/Schools-Study-Earthquakes-School-Networks-Alert-Citizens-3676128840765599>
- **SNAC Youtube Channel:** <https://www.youtube.com/channel/UCp8GBi4U20klop-L2gKyRbQ?reload=9>

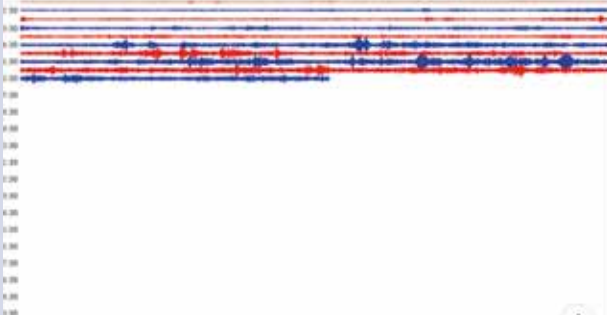
### **Dissemination in Cyprus**

Newsletters regarding the project (e.g. installation of a seismometer to a school, supporting materials suggested to teachers, information regarding seismic activity in the area) were frequently disseminated through emails to the network of teachers and schools participating in the project or have participated in other projects.

Also, related material and announcements were posted in the facebook page of the ReSciTEG research group (<https://www.facebook.com/ReSciTEG/>) which has approximately 550 members (teachers, parents etc.). Teachers were more than welcome to share this information to their peers and students.

**ReSciTEG**  
 Δημοσιεύτηκε από Yvoni Pavlou (7) · 21 Φεβρουαρίου · 🌐

Το Γυμνάσιο Αποστόλου Παύλου αποτελεί πλέον μέρος του δικτύου εκπαιδευτικών σεισμογράφων του προγράμματος SNAC! Μπορείτε να παρακολουθήσετε τις σχετικές καταγραφές εδώ: <https://snac.gein.noa.gr/plotfiles/RF201.php>



SEISMOCRAFOS.EA.GR

**Real Time Plotting of ERASMUS SNAC "Gymnasio Apostolou Pavlou, Pafos, Cyprus" station using SeisComp**

**ReSciTEG**  
 Δημοσιεύτηκε από Marios Papaevripidou (7) · 6 Φεβρουαρίου · 🌐

Ενδιαφέρει τα σχολεία που συμμετέχουν στο ερευνητικό πρόγραμμα SNAC και όχι μόνο!



ΚΑΛΩΣ ΗΡΘΑΤΕ ΣΤΟΝ ΔΙΑΓΩΝΙΣΜΟ  
**ΦΤΙΑΞΕ ΤΟΝ ΔΙΚΟ ΣΟΥ ΣΕΙΣΜΟΓΡΑΦΟ**

SEISMOCRAFOS.EA.GR

**Ο Διαγωνισμός ~ Πληροφορίες για τον Διαγωνισμό και Εκδήλωση Ενδιαφέροντος**

**ReSciTEG**  
 Δημοσιεύτηκε από Yvoni Pavlou (7) · 29 Ιανουαρίου · 🌐

Το δίκτυο εκπαιδευτικών σεισμογράφων του Erasmus+ προγράμματος SNAC επεκτάθηκε ακόμη περισσότερο με νέους σεισμογράφους στο Περιφερειακό Σχολείο Γόλου και στο Β Δημοτικό Σχολείο Λισπετρίου! Μπορείτε να παρακολουθήσετε τις σεισμικές καταγραφές όλων των σεισμογράφων του δικτύου στην πλατφόρμα του προγράμματος: <https://snac.gein.noa.gr/project-network/>

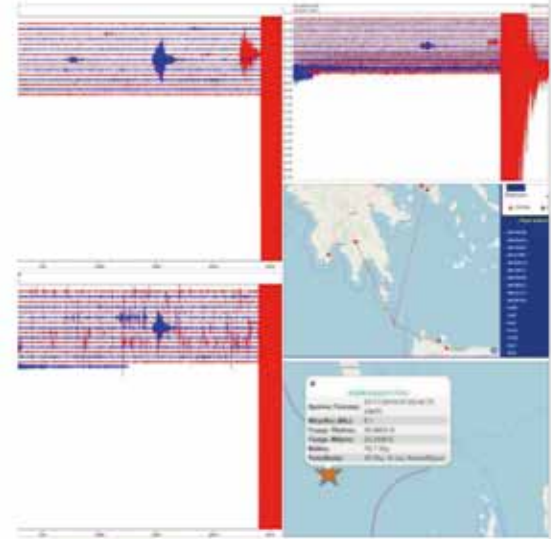


744 Απήχηση 133 Αλληλεπιδράσεις

Εσείς και 10 ακόμη 5 σχόλια 2 κοινοποιήσεις

Πρώιθηση δημοσίευσης

**ReSciTEG**  
 Δημοσιεύτηκε από Marios Papaevripidou (7) · 27 Νοεμβρίου 2019 · 🌐



© Sofoklis Sotiriou είναι με τον Gregory Mikroulakis και 4 ακόμη 27 Νοεμβρίου 2019

Χορεύει η γη Gerassimos Choularas! Σεισμός Νήσια των Κυθέρων, Δυτικά της Κρήτης (στις 9.23, μέγεθος 8.1) πριν λίγο όμοιες καταγραφές στη Σπόρτη (2ο Λύκειο), στον... Δείτε περισσότερα

143 Απήχηση 15 Αλληλεπιδράσεις

Η πρώιθηση δεν είναι δυνατή

Teacher’s post regarding an earthquake event on a digital platform for teachers and parents of the school (Makedonitissas Gymnasium)

## 4.11. Bringing innovation in schools with fewer opportunities

The consortium involved schools with fewer opportunities for participation in innovative projects (approximately 10% of the schools involved in the core SNAC network).

Also, an effort was made to select schools from various cities of each country to create hubs of innovation and awareness in those areas.

### 4.11.1. Sapes Intercultural High School

On Friday, January 31, 2020, the High School for Intercultural Education of Sapes invited Dr. Gerasimos Chouliaras from NOA and Dr. Sofoklis Sotiriou from EA to install the new Raspberry-Shake seismometer, meet and train the schools educational staff and discuss with local stakeholders.

The purpose of the visit was to install a Raspberry Shake-type school seismograph, which with direct internet access would be connected to the SNAC school seismograph network. After completing the installation of the school seismograph Mr. Chatziagapiou Andreas (Professor of Computer Science High School) and Mr. Kostas Boukouras (NOA-Athinon) initiated the public presentation about the SNAC projects to the local guests.



A one-hour speech was given by Dr Chouliara on the topic “Earthquakes in Greece”, with approximately 260 pupils of the Sape Gymnasium and about 30 pupils of the Sape High School in the school’s event hall. Subsequently, Dr Chouliaras and Dr Sotiriou met with local municipal authorities, during which earthquake issues and the importance of earthquake protection as a social self-management policy were discussed.

### 4.11.2. Cypriot School at Paphos

Sschools in Paphos (Cyprus) due to their location have limited opportunities for participation in such projects. Hence, two schools from different districts of Paphos (i.e. Gymnasium Apostolou Pavlou is in the city center and Regional Primary School of Giolou is in a village) were approached for installing a seismometer in their premises and becoming a hub for the rest of the schools and citizens in that area.



## 5. Recommendations for Uptake & Strategies for scale-up

This chapter would provide the readers with some recommendations useful for the better exploitation of the SNAC's experience in order to develop in autonomy similar actions in open schooling related to seismology or, more in general, other significant scientific in and/or cultural topics. These recommendations are aimed to both teachers and school heads of schools of all levels, and to project managers of organizations that would promote such kinds of experience with the schools themselves. In particular, for these organizations it is fundamental the relationship of mutual trust that should be established with teachers and school managers, a trust based on the scientific and technical skills of the organization, on offering continuous support at all levels during the development of the experiences, as well as on the possible offer of innovative and original technical tools.

SNAC's Platform, Data and Resources are now openly available to all European Teachers. The proposed five steps to exploit SNAC's legacy are presented in the following figure. Keep in mind that this is not the only path. There are various potential paths, depending on the interests, the imagination and the willingness of the European school heads, teachers and students to experiment with new ideas!

### 5.1. Seismology as a catalyst for the connection of schools with the local society

Since the dawn of its history, humanity has wondered about the origin of earthquakes, fascinated and intimidated at the same time by this portentous phenomenon. In conjunction with the birth of Greek philosophy, the phenomenon of earthquakes began to be observed and theorized, in an attempt to give a rational explanation to what for centuries had been considered as a disaster sent by the gods to punish men. However, such an interpretation of the phenomenon never completely died out, but came back into vogue after the first attempts at scientific interpretation, and continued to circulate until the late nineteenth century. "Independent researchers" are still proliferating who with personal methods, both obscure and rambling, would claim to be able to predict the occurrence of strong earthquakes and then be promptly denied by the reality of the facts.

These considerations testify to the disturbing charm that seismic phenomena have always exercised and still exert on the general public, and not only on professionals, regardless of the real scientific value of a discipline such as seismology. And it is from this perspective that we can start to highlight the role of catalyst that seismology can play in promoting the connection between educational institutions and society as a whole. As we will see in the following chapters, within SNAC a seismic network has been created whose sensors are located in a clear prevalence at the offices of numerous schools in the countries of the partner organizations of the project, and the scientific data collected by this network can be acquired as much by school users as well as by all citizens, whether they are operators or not of public institutions.

In its general lines, SNAC has promised to promote the development of research projects independently by the schools involved, having provided them with both conceptual tools, introductory intellectual outputs to the practice of open schooling as well as to the non-formal teaching of seismology, both practical, represented by the seismic network and scientific data that can be acquired in open source by the beneficiaries of the project itself. Hence, the subject of non-formal education in seismology can be exploited by schools in order to involve local society in these experiences in several different ways. Below are listed just some possible examples:

- Involvement in public events in the schools of researchers in geophysics and/or manager-expert in civil protection. In such contexts, students and teachers can compare the experiences acquired independently with what is proposed by this kind of expert, so as to have feedback on the work of the world of research as well as that of public technical offices in the interest of the community;
- Through the interaction of students with their families, so that the report of the educational experiences carried out can be reflected and disseminated in an audience not directly involved but strongly interested in the cultural education of their children or family members in general. It should be remembered that these are experiences relating to a topic of great social relevance that meets the interest of the public both in conjunction with specific events and from a more exquisitely cognitive-cultural point of view.

- In schools of all levels and in the countries of the SNAC partner organizations it is also customary to organize open days that generally involve students' family members as well as members of local communities. These are the contexts par excellence in which the presentation of educational experiences, also and above all extracurricular, are presented to an audience other than school users and strongly interested in a socially relevant topic such as seismic risk in their territory of residence;

## 5.2. How schools can cooperate with research organisations and science centres

To the present day, in addition to teaching and research, the activities of university departments and/or research organizations in general also include the so-called "third mission", that is, communication to the citizens of the work done and the results achieved. Hence the opportunity to collaborate with schools in projects of open schooling could represent for these kind of organizations a huge opportunity to present to the widespread audience of citizenry their work and carry out the "third mission" entrusted to them by public institutions.

The main task of science centres is to communicate to the world of the school and to the citizenry in general socially relevant scientific issues. Usually these organizations represent a kind of bridge between research and the widespread audience, promoting exhibitions and programmes in non-formal education about science and technology. Hence, where there is a science centre, schools can find a reference interlocutor who supports them in the development of open schooling projects that involve research centres for content development. Similarly, even in the absence of a science centre, schools will be able to get in touch with research bodies ready to provide their expertise for the development of significant training experiences on issues of great social relevance.

## 5.3. How students can design projects related to community needs and challenges

Both students and teachers have been very enthusiastic about seismographs in their schools. Students become familiar with seismology and the data resulting from the operation of the seismograph. The students themselves act as multipliers and transfer all this valuable information to their families and so the network acquires another meaning, that of its contribution to society. Students learn how to be better protected in the event of an earthquake and this in turn communicates beyond the school environment

In many cases, the schools open and invite either other schools in the city or members of the community to visit the seismograph, outside of school hours and organize very interesting events. It is extremely important to point out that this is an action that methodically and systematically simulates scientific methodology in school reality. The students understand that the scientific instrument they have under their supervision must always be in operation, to provide correct data as the correct estimation of the magnitude and location of each earthquake also depends on their own seismograph.

The activity (as is done in the real study of earthquakes by scientists) requires cooperation between schools that exchange data and results. Many students plan additional activities with their teachers e.g. converting earthquake data into notes and composing melodies giving a more artistic and creative approach to the study of the earthquake phenomenon. It is trivial to say that the contemporary world is a global village, and yet it is from this obvious consideration that we can start by stating that the availability of in-depth and reliable news in real time can represent the trigger for open schooling initiatives in schools of every order and grade.

In addition to promoting the learning of curricular subjects, schools also provide informed and responsible citizens among their goals. In this perspective schools, on the initiative of teachers and principals, have the opportunity to act as mediators between researchers, political institutions, citizenship, and with numerous other social actors. The experience of monitoring seismic activity enhances the teachers' and students' awareness of the real earthquakes' activity in their territory of residence, as well as the opportunity to have knowledge of the real local seismic risk. This awareness could be indirectly transferred to the people in touch with them (parents, relatives, friends, etc.).

A more informed citizenry will ask for more responsible public decision-makers regarding potential risks to the community regardless of whether or not these risks have caused disasters in the more or less recent past. Once

the citizenry will have expressed its requests for more security – for instance, in the framework of public events held –, decision-makers will be addressed to take in account these instances and provide adequate responses.

For example, an Alert system, which analyses the P waves and provides a warning of a few seconds before the arrival of the deadly S waves, can provide enough time for citizens and safety systems to:

- take cover under a desk
- prevent people to use an elevator or enter buildings
- move away from dangerous machines or chemicals in work environments
- slow down trains
- give directions to airplanes
- prevent cars from entering bridges and tunnels
- automatically shut down and isolate industrial systems.

This kind of actions and many more not listed above are able to directly reduce damage and casualties during an earthquake. Indirectly, they can also prevent unforeseen failures during an earthquake such as the number of fire initiations.

#### **5.4. How the SNAC methodology and processes can be replicated by other disciplines and subjects**

SNAC offered schools in all countries the opportunity to expand their horizons and perspectives of collaboration with other schools in their own country or other countries, to apply, implement and adopt non-traditional educational methods and activities in STEM education, to increase their awareness of cutting-edge trends and developments in science, technology and education that all have greater impact to society as a whole. SNAC schools connected with their local society through on site and online multiplier events, workshops and webinars.

During the implementation of the SNAC project we have seen that each school has followed a different approach, depending on their respective School Development Plan and the results of the Self-Reflection Tool. Through the participation in the unique School Network of Seismographs, teachers, students and even citizens can be engaged and inspired to implement transversal educational projects that involve not seismology but also physics, geology, geography, technology and even social sciences like history and psychology. Seismometers can be used to study the pendulum, electromagnetism, elastic waves or frequency analyses. The network can also be a motivation to develop technological projects with the objective of designing homemade seismometers based in simple and low cost elements and to develop programming exercises for processing the recorded data. Furthermore, aspects of seismic risk or the historical interest can also be addressed.

SNAC students developed abilities to read and interpret graphs, propose hypotheses to explain the data and seek additional information to validate or not the hypothesis. Students also investigated aspects directly related to Earth sciences, as the distribution and rate of occurrence of earthquakes, their relationship with plate tectonics, the concepts of intensity and magnitude and the aspects related to seismic hazards, all of them elements included in the official curricula in the participating countries.

Students can play a very important role in the promotion of a safety culture, leading to catastrophe prevention and risk cuts. Therefore, educating them through projects that will follow and replicate the SNAC methodology, is a successful approach to communicate safety guidelines to the entire community and serves to spread vital information to most of the population via the knowledge, skills and passionate enthusiasm of young students. These students become the perfect messengers throughout society, starting with their parents. Therefore, using unique and engaging methods in teaching about earthquakes and other natural disasters can accelerate the process of learning and sharing the information and experience with others.

Moreover, in our experience to provide both teachers and students with technical skills aimed to better exploit in an educational way the scientific data acquirable from such a kind of tool, represents a powerful incentive to encourage schools to develop their experiences in open schooling. In this perspective, it results crucial to offer to the school staff training opportunity focused the better educational exploitation of the

scientific data made available for them into a path of open schooling. ICTs offer countless resources with huge educational potentialities and referred to numerous significant subjects - like astronomy, meteorology, geology etc., independently if these resources have been exclusively developed for educational tasks.

The web offers several examples of user-friendly Geographic Information Systems (e.g.: Google Earth Pro; Microsoft MapPoint; etc.) providing teachers and students with further effective tools to promote autonomously their educational projects.

Furthermore, the existing network of SNAC Seismometers and the vast database of seismograms that are openly available to SNAC’s Network of School can be utilised in different ways. Many citizen activities produce vibrations that can be recorded seismically, including traffic, subway systems, music concerts or football games. The identification of the vibrations generated by this kind of sources is useful to correctly interpret ambient noise data, but also to attract the attention of mass media (journals, radio, TV) and social networks and be used as a valuable tool for spreading news related to seismology and, in general, Earth sciences to the main public<sup>9</sup>. SNAC has created communities of student/amateur seismologists. This is unprecedented opportunity to create citizen seismological networks whose results could be used for scientific purposes, besides of attracting the interest of the youngest generation toward seismological research. Overall, the SNAC project succeeded at a great extent to impact positively on schools, teachers, students and the wider community by creating a rich context to actively participate in innovative, interdisciplinary activities which focused on civic responsibility and citizen seismology. It seems there are no limits to teachers, students and schools in general to express their resourcefulness and creativity. It’s up to them to implement the SNAC pilot experience model with their own ideas and proposals. These promising findings indicate the sustainability of the projects’ impact for all the participation levels and the continuation of the implementation of innovative practices in schools.

### 5.5. SNAC forever!

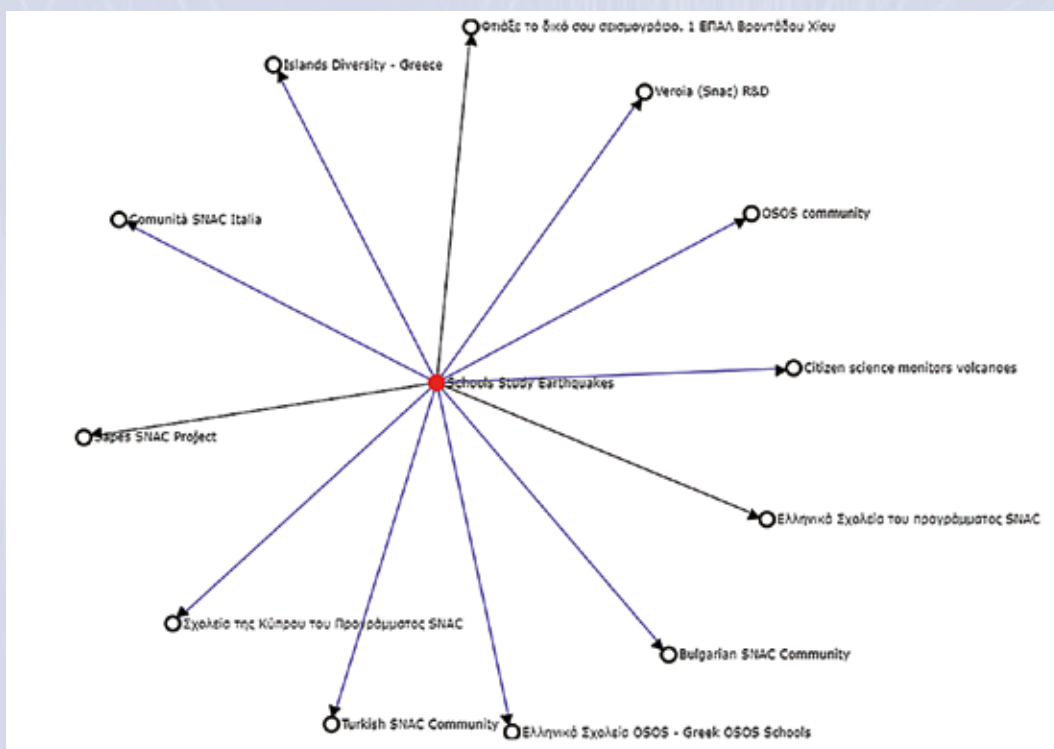
SNAC represents an emblematic case, having been realized in its framework the seismic network and the web platform whose data are available to all schools interested in developing educational experience in open schooling on the topic of seismology and seismic risk. The Geodynamic Institute of the National Observatory of the Athens, as the organization that is coordinating the project, ensures that SNAC’s network of school seismographs, the SNAC Technical Platform and all the tools that are available today, will continue to operate even after the end of the project, as well as the scientific data will be still available on the server of NOA.



<sup>9</sup> Seismometers Within Cities: A Tool to Connect Earth Sciences and Society Jordi Diaz, Martin Schimmel, Mario Ruiz and Ramon Carbonell Institute of Earth Sciences Jaume Almera, ICTJA-CSIC, Barcelona, Spain

Moreover, the organizations that joined the SNAC consortium have gathered strong and various skills both on non-formal education in seismology and on open schooling, and they could support the schools in the development of similar experiences instance at national level but also internationally through cooperations among schools, teachers and students of different countries.

Furthermore, Ellinogermaniki Agogi ensures that schools involved in SNAC will continue to be supported by the OSOS portal and its vast network **consisting of 1167 schools, 2309 teachers and 118 communities from 11 European Countries and Israel and hosts 1221 projects and 69 best practices** (accelerators). Through the SNAC communities in OSOS schools found the opportunity to be in mutual touch to better develop their ideas, teachers had the ability to use and/or upload lessons plans, best practices and other resources and students had the option to create, upload and share their projects with their local society and with other students all over Europe. The OSOS H2020 CSA project has been successfully completed in March 2020 but its legacy will continue forever since it is already acknowledged as a flagship project in the area of Open Schooling.



According to the Final Review report **“The OSOS project has very successfully achieved all its objectives and more, delivering impressive results with both immediate and longer-term impact for schools, teachers and students across the EU and beyond. The Open Schooling ‘proof of concept’ and the resulting OSOS Roadmap.** The latter sets out what being an Open School means, defines the idea and describes the process”. And it continues as follows: “This knowledge and guidance is exploitable by individual schools or clusters of schools, regional and national education bodies and European-level policy makers.

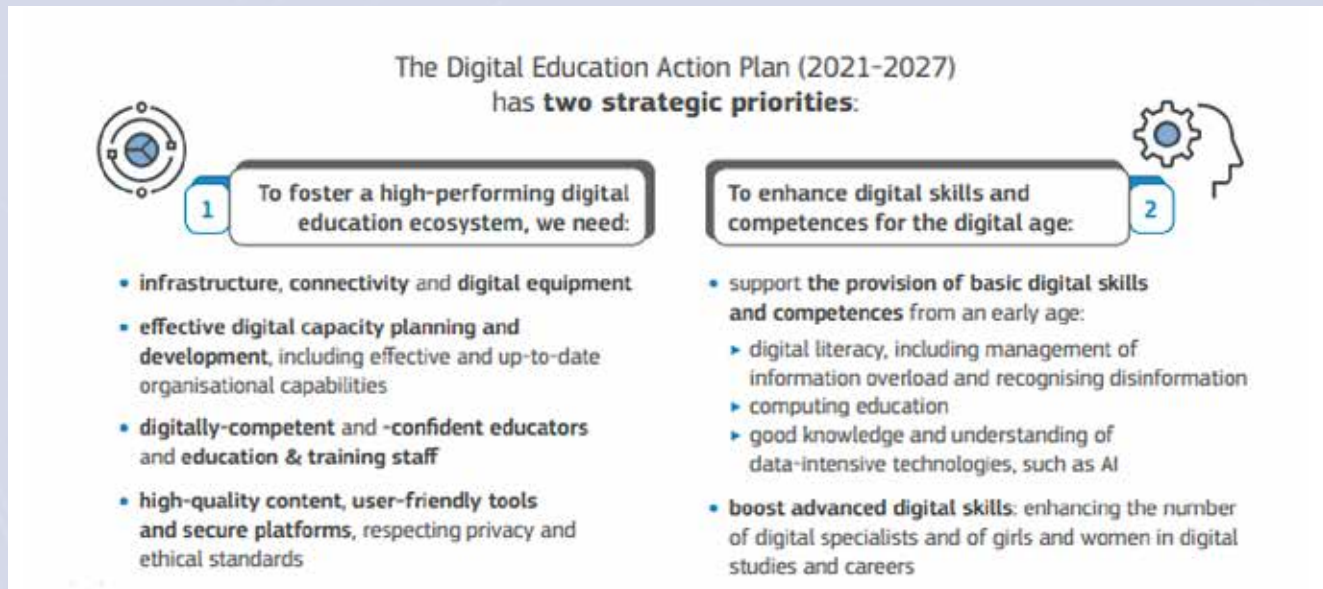
It is being disseminated online through:

- the OSOS Platform and other educational websites;
- via articles in appropriate publications and journals;
- at national, European & international events and conferences; and
- by engagement with policy makers through relevant organisations such as the European Education Policy Network.

Additionally, the learning and outcomes from the project have been shared with a number of new EU-funded Open Schooling projects which have recently commenced.”

Furthermore, the project has developed very strong links with established initiatives and communities of schools and teachers, acknowledged and supported by the European Commission such as the EU Codeweek (section 4.5.2), eTwinning (section 4.6), Scientix (section 4.7) and OpenAire (section 4.8).

Finally, SNAC is completely in line with the new Digital Education Action Plan (2021-2027) which has two strategic priorities:



SNAC's vision is to develop a European network of school heads and teachers, whose common goal is to enhance science education through the study of seismology. To this end SNAC promotes installation and effective use of school-based seismographs and seismic data and envisions the development of a robust network of educational seismographs together with pedagogical resources, that will allow teachers to utilize past and real-time seismological data, tools and software and experiment beyond the curriculum while teaching Physics, Math, Geography, Geology, Arts and Environmental Science in classrooms across Europe.

## 6. Appendices

### 6.1. Exemplary use-cases per country

#### 6.1.1. Greece

**(i) Name of the school:** 1<sup>st</sup> Technical High School of Karditsa

**Number of teachers and their disciplines:** 3 Physics, Mathematics, Engineering

**Grade:** 10<sup>th</sup> Grade

**Collaborations:**

The Karditsa Earthquake Project - Schools in Action, with the Terraemotus Team, aims to inform and raise awareness of students and society about proper prevention measures in the event of an earthquake. The educational seismograph has been used to inform and raise awareness of all students and teachers of our school, as well as the wider school community and the local community of Karditsa. This has been achieved with the presentation of the construction in the school unit of the 1st EPAL Karditsa, where the students of the Group also study, with presentations that we made in the primary and kindergartens of the city, with our presence at the 3rd Student Conference of the Secondary Education Department of Karditsa title "What unites us....", with our participation in the annual exhibition of the Laboratory Center of Karditsa and in the exhibition of Natural Sciences of the city's schools. At the same time, our actions have been announced in the printed and electronic press of Thessaly, such as <https://www.pezodromio.gr/karditsaeearthq/>. In addition, the relevant material will be posted on the program's Facebook page and the school. ([https://www.facebook.com/KarditsaEarthquakeProject/?ref=page\\_internal](https://www.facebook.com/KarditsaEarthquakeProject/?ref=page_internal))

Video: <https://www.youtube.com/watch?v=B0I6Cbs2A4Q>

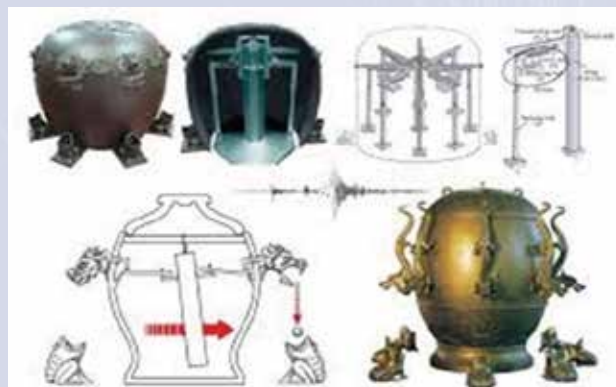
**Approx. time spent for the completion of the project:** 72 Hours

**Description of the project**



After the successful presence of the last two seismographs in 2018 and 2019 competitions, we wanted to make a seismograph that would be better than the previous two.

At the urging of our professor, we decided that the new seismograph should also have an educational character, be original and be understood by young students. Our extensive internet research yielded, and our idea came from the OASP fairy tale "The earth dances". So we decided to build the first seismograph, which was created in 132 AD. by Zhang Heng in China.

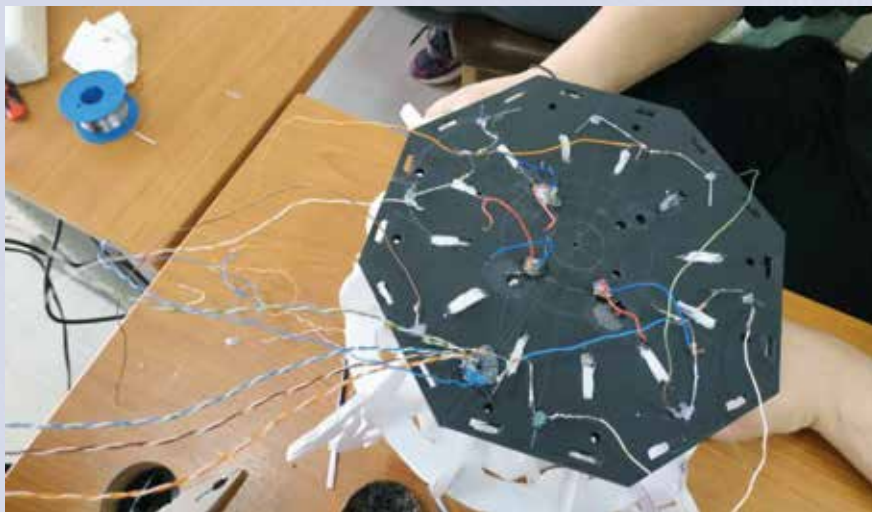


The first seismograph was made in China by Chang Heng in 132 AD. It was a system with bronze dragons and frogs, around a large container. When an earthquake struck, an internal pendulum activated a switch, a ball fell out of the dragon's mouth and fell into the frog, causing a loud sound. Depending on the direction of the ball, people understood the direction of the epicenter.

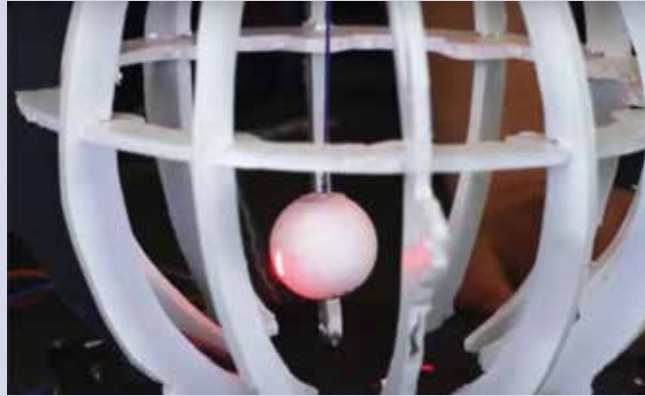
**Construction process:** We searched many sites for the designs of this seismograph, but what we found was impossible to build. We decided to redesign its parts from scratch. The main body would be in the form of a cage, which would have eight railings, four for the points on the horizon N, S, E, W and four for the points between them. For the mechanism we turned to some pendulum form, which would hit some mechanical switches. We designed its parts on paper, thus making the patterns of the pieces. Then, we placed them on a piece of parchment paper, drew them, cut them out and assembled them.



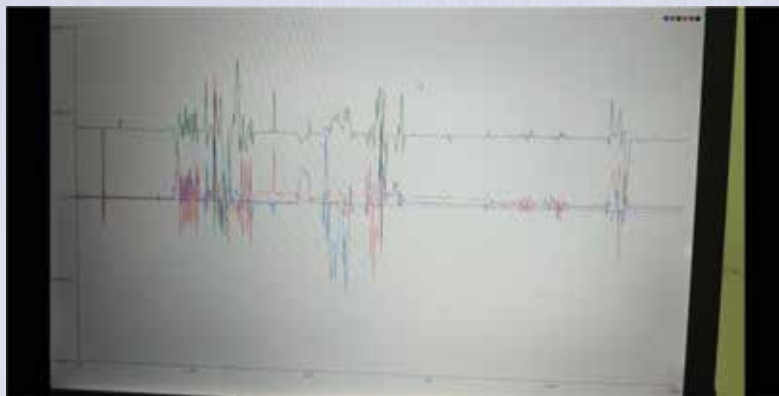
Studying our model, we realized that the solution of mechanical switches would not work. We also thought about magnetic switches, but we also rejected them. So we came up with the solution of Lasers and photoresistors. For the pendulum, we chose a ping pong ball that we filled with thermo-silicone to gain weight. We installed the lasers and sensors, connected the circuit together with the Arduino Uno which we programmed.



We symbolized the four points of the horizon N, S, E, W with dragons and in the North, we made it black, and at the eight points we placed a LED of a different color. Each time the system is disturbed (by an earthquake), the bullet “cuts” one or two bundles at a time, the bomber produces sound and turns on the corresponding LED.



We used a second Arduino Uno and an accelerometer that we stuck on the seismic bank. So, our system records the earthquake and shows us the direction of its epicenter.



After completing the model, we collaborated with the University of Thessaly. We gave them the original patterns, and with the help of AutoCad they turned them into a digital design.

Video of the whole process: <https://youtu.be/EKw-fn8zjs4>

**(ii) Name of the school:** 5th Primary School of City of Rhodes

**Number of teachers and their disciplines:** 4 Mathematics, Science, ICT, Engineering

**Grade:** 3<sup>rd</sup>

**Collaborations:**

1. Visit from the Independent Civil Protection Office of the Municipality of Rhodes - program "Readiness and safety in the school environment" <https://emathisi.weebly.com/blog-2019-20/4486397>
2. Earthquake Exercise II - in the school unit complex - Organized by the OASP. the Municipality of Rhodes (through the school committee and the President of Mrs. Vyrini Athanassiou) and the Directorates of Primary and Secondary Education of Dodecanese.

1st Session: <https://emathisi.weebly.com/blog-2019-20/the-tipping-point>

2nd Session: <https://emathisi.weebly.com/blog-2019-20/the-tipping-point6690792>

3. Protection measures - Information from Specialists

[https://www.youtube.com/watch?v=pc-Y1YyHQ\\_0](https://www.youtube.com/watch?v=pc-Y1YyHQ_0)

<https://www.youtube.com/watch?v=dqxqmsL2JeQ>

<https://www.youtube.com/watch?v=OT68BVoxdHE>

4. The program was shared within the school and with the local community through the following actions:

- Creation of a “STEM corner” in the classroom:



- Publication of the program’s actions on the school’s website: <https://blogs.sch.gr/5dimrodou/>
- Post the program on the class page: <https://emathisi.weebly.com/earthquake.html>
- Publication of articles in the local electronic press (eg publication in the online newspaper i12: <https://i12.gr/?p=21367>)
- The creation of a YouTube channel: <https://www.youtube.com/channel/UCczGS34iU1A7gkks3m2AJA>
- The creation of a Pinterest page: <https://gr.pinterest.com/irinipapaz/osos-earthquake/>

**Approx. time spent for the completion of the project:** 40 hours

### **Description of the project:**

The project was named: “Earthquakes & Volcanoes: I’m not afraid of earthquakes, I’m seismologist”. The program was implemented by the students of the C1 and C2 classes of the 5th Primary School of the City of Rhodes. The main purpose of the program was to raise awareness, inform and prepare students about the case of an earthquake and to acquaint them with the precautionary measures before, during and after an earthquake.

The impetus for the implementation of the program was given by the lesson of the History of the 3rd Primary School regarding the Battle of Titans and the myth of Egelados. The students were also troubled by the recent 6.1 magnitude earthquake in Albania, as several children at our school are from Albania.

### **Activity 1: Kids watching seismology related videos from YouTube**

Thinking and discussing the following questions:

- What is this? Has it ever happened to you? How did you feel? What did you do;

Example video: Kos: Deaths, panic and disaster from the strong earthquake:

[https://www.youtube.com/watch?time\\_continue=4&v=dOSNzsYyYPY&feature=emb\\_title](https://www.youtube.com/watch?time_continue=4&v=dOSNzsYyYPY&feature=emb_title)

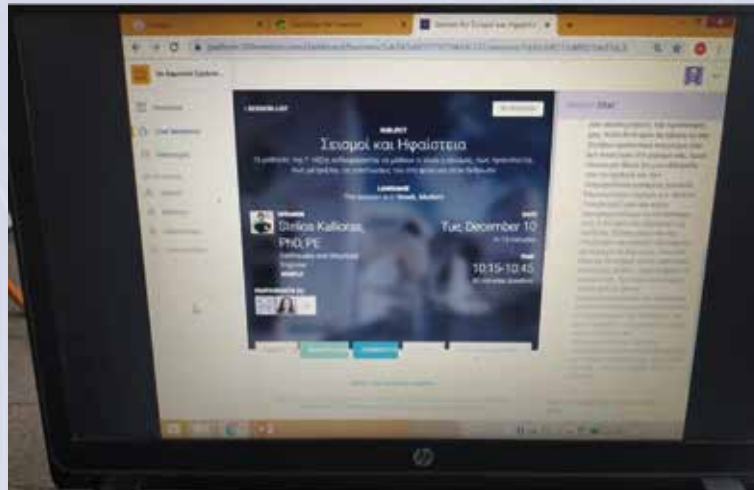
Objectives: a) To identify the phenomenon of the earthquake, b) to describe it and c) to recall the personal experiences of the earthquake. Assess the level of interest of children to strengthen it, if necessary, with appropriate actions.

### **Activity 2: Distance learning from the experts**

On Tuesday, December 10, 2019, the students of C1 and C2 of the 5th Board of Directors of Rhodes Town attended a session - distance learning by Mr. Stelios Kallioras, member of 100mentors (online platform

community of mentors) of the Non-Governmental Organization ‘The Tipping Point’. Our young students were given the opportunity to be informed by an expert on earthquakes and volcanoes in the classroom and to ask their own questions. Mr. Kallioras clearly answered all the questions of the students, simplifying the terminology of his science so that it could be understood by the students of the third grade of primary school.

Session link: <https://platform.100mentors.com/dashboard/business/5dc043a6f5f72927f4d36733/sessions/5dd3cbf6213df80219e97ddc3>



### Activity 3: Cut the orange!

We present the children with an orange and make a horizontal cut on it. We ask the children to guess what they will see if they cut the orange in half.

Objective: To help children understand how the earth can be mentally divided into two equal parts.

### Activity 4: Study of the Earth model.

Children make the model of the earth from plasticine and we draw on paper.

<https://thecraftyclassroom.com/crafts/geology-crafts-for-kids/layers-of-the-earth-craft/>



Objectives:

- To make children understand how the earth can be mentally divided into two equal parts
- To get to know the main strata that make up the interior of the earth and to understand their basic composition and condition.

Children understood the concepts: “I stand on the nucleus, inner, outer nucleus, mantle, cortex”, etc.

**Activity 5: Presentation of the earth structure** (nucleus, inner, outer nucleus, mantle, cortex) by students with a boiled egg.

Video uploaded to YouTube: <https://www.youtube.com/watch?v=sYIRuCdOswc>

#### **Activity 6: Movement of the Lithospheric Tiles**

Just as the orange peel does not allow the juices to leak, so the earth’s crust does not allow the lava to “burn the earth.” Children understand that the hot lava of the mantle can find its way to the surface of the earth.

#### **Experiment 1: What are tectonic plates - Fractures**

Materials: 1-2 boiled eggs, Color (tempera), Water

Implementation: Break the egg shell and place it in a container with water and paint. Leave it for 5 minutes and then take it out. We notice that at the point where the egg shell has “broken” the color is more intense. It becomes even more noticeable if we remove the egg shell. The children understood the cracks on the surface of the earth.

Video: [https://www.youtube.com/watch?v=iaHqPxfGyhw&feature=emb\\_title](https://www.youtube.com/watch?v=iaHqPxfGyhw&feature=emb_title)

**(iii) Name of the school:** American Agricultural School of Thessaloniki  
**Number of teachers and their disciplines:** 1 Physicist  
**Grade:** 8<sup>th</sup>  
**Collaborations:**

Our goal is through the promotion of our construction to inform the general public about the earthquakes and the ways in which they can be protected from them. That is why we have created a poster that includes basic information and is addressed to our fellow citizens and we are trying to inform the school community. Basic information on seismometry and earthquakes and protection rules as provided by the Earthquake Design and Protection Agency (OASP) are provided.



**Approx. time spent for the completion of the project:** 60 hours

**Description of the project:**

Students of Robotics High School Team of the American School of Agriculture in Thessaloniki published their research study with the title: “Study and understanding of earthquakes and creation of seismograph for educational use” which was created under the supervision of Mr. Pegiopoulos Nikolaos, Professor of Secondary School Physics, American School of Agriculture.

Earthquakes are a common occurrence in our lives. Our research aims to fully understand the science of seismology through the construction of an improvised seismograph, to measure earthquakes that can be easily used in the laboratory and citizen awareness. Keywords: Seismology, seismograph, types of earthquakes, seismometry, seismic waves.

The study had the following chapters, describing in detail all related seismologic terms:

- Part A: Theoretical Background

Introduction, Useful terms, Philosophy, Mythology and Tradition, Earthquake waves, Earthquake Types, Earthquake recording instruments, Seismometry, Earthquake measuring scales

- Part B: Construction of a Seismograph using Lego Mindstorms

Problem / Phase 1: We feel, Proposal and mode of operation, Phase 2: We imagine, Description and analysis of the provision, Construction of the device, Phase 3: We create, Public information, Phase 4: We share

- Part C: Sources of information

Taking into account the principles of operation of a seismograph but also the way of measuring earthquakes as mentioned in Theoretical Part listed above, our team ended up creating a seismograph using a weight, twine, marker and lego bricks that we mentioned I found next to us.

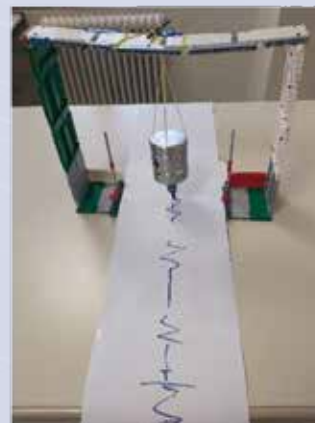
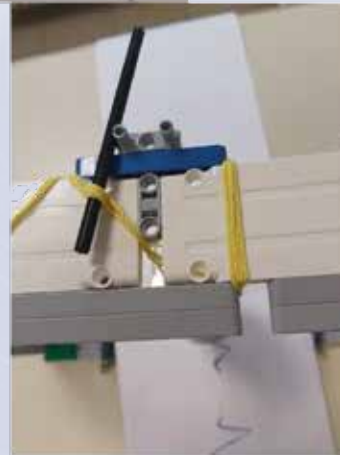
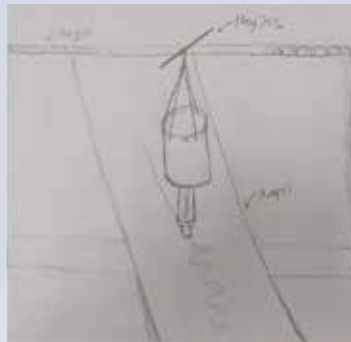
We thought of creating a seismograph that would consist of accessible and simple materials. That’s why we made a supportive arrangement of LEGO bricks and not a metal one. In this device we placed a weight at a predetermined distance which hung and at one end was attached a marker, ie a pendulum device, which when it starts to go zigzag means that an earthquake is created. When it is deleted, it means that everything is fine.

We also put a lever on the top with which we adjust the length of the string so that it works in all situations. At the base of the layout is a continuous paper that moves in a direction with a certain constant speed. On this paper the marker records the earthquake. With the creation of seismographs, an study of the earthquake can be made as described above in Theoretical Part A. It is pointed out that we do not study the vertical component of the movement because we do not know the direction of the seismic waves.

When creating our seismograph, we first designed the device with a pencil and paper to have a plan for its construction. Then, we built a support base for the thread, with lego bricks that we had in the robotics club and determined how to support them with the weight. For weight we found a cylindrical metal that was the cylinder of a car piston (heavy and easily adjusted to both the threads and the marker). To ensure the smooth oscillation of the pendulum, we tied the cylinder with four threads to hover.

To ensure that the marker rests on the paper and leaves a line, We put a lever on top of which we wrapped and unrolled the string to move the marker vertically until it rests on the paper and leaves traces. The paper can be assembled at a constant speed that we can control in a cylinder that will be driven by a Lego Mindstorms engine.

Below is a drawing as well as photos from the process of making and taking measurements.



### 6.1.2. Turkey

**(i) Name of the school:** Izmir Istek Private High School

**Number of teachers and their disciplines:** 3 teachers (Physics, Art, Geography)

**Grade:** 10th grade

**Collaborations:**

**GEA (National Save and Rescue Team)**

**AFAD (Ministry of Interior Disaster & Emergency Management Presidency)**

**Approx. time spent for the completion of the project:** 3 months

Description of the project: Turkey being in the cross-section of a group of very active tectonic plates is a country where earthquakes are periodic occurrences. Besides the recorded very destructive earthquakes in the history of the country, many milder disturbances occur almost every day. As the citizens of such a country we believe it is important to be prepared beforehand, not to be sorry later. With such a perspective our students were excited to take part in SNAC project. The students developed many ideas and activities with the guidance of their teachers and some professionals in the area to raise awareness in their peers and community.

In true SNAC spirit, their first step was to prepare a poster and a brochure to give information about the SNAC project to their peers, families and community. The brochure was about what type of activities they planned and it was a call of action to the families and everyone from the community who could participate and help. The poster was hung in the school and the vicinity. The poster was also highlighted in the school magazine so the younger students were also informed and could become interested.





Then, with the help of their teachers, they invited a national save and rescue team of volunteers (GEA) to give a talk about the realities of an earthquake and the impact it has on our lives.



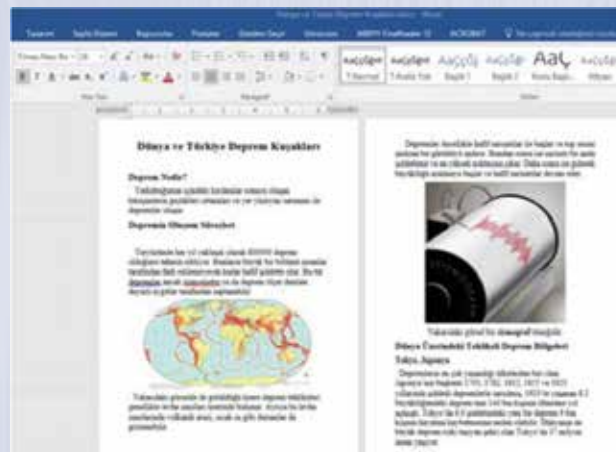
As the students and the school staff got more interested and involved, our students invited AFAD to educate the students and the school staff about earthquake readiness.



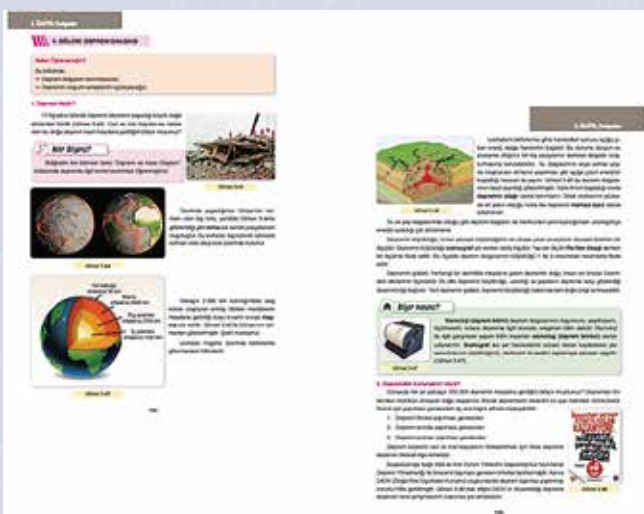
In art classes many students prepared posters about Earthquake bags and what to do before, during and after an earthquake.



In geography an interested student prepared a special report called “Dünya ve Türkiye Deprem Kuşakları” about earthquake belts and seismic zones in Turkey and around the world.



In physics students learnt about earthquake waves in their properties.



As a next step, we analyze the waves using Swarm software and put our knowledge to test.

**(ii) Name of the school:** Istanbul ALKEV School

**Number of teachers and their disciplines:** 4 teachers (Chemists, Physicists, Music and Science)

**Grade:** 9<sup>th</sup> grade

**Collaborations:** SNAC Partner, Ellinogermaniki Agogi, Researchers, Other Schools.

**Approx. time spent for the completion of the project:** 3 months

**Description of the project:**

In this project, the similarities and differences of earthquake waves with sound waves were investigated. In this way, it is planned to conduct a study on the sound of the earthquake. In this context, EA, one of the SNAC project partners, was contacted. EA staff held a teacher workshop on how to analyze earthquake waves to our school. Approximately 10 teachers participated in this workshop, which was carried out through distance education due to pandemic. In this workshop, how to analyze earthquake waves and how these waves can be converted to sound waves is explained in detail. Examples of earthquake sounds prepared by EA students were shared with both teachers and students. After this workshop, our teachers carried out distance education with their students and shared the information they gained. Examples and pictures of the works carried out under this project are presented below. We think that useful information and experiences have been acquired within the scope of this project where Turkish and Greek students and teachers share via distance education.



*SNAC Workshop among Greek and Turkish Teachers.*



*Turkish teachers plan interactive training for their students.*



*Turkish – Greek Students Workshop in terms of SNAC Project.*



*Turkish Students' Sound Examples:*

Date	Earthquake Place	Squencer link	Name of the Student
11.01.2020	Silivri	<a href="http://onlinesequencer.net/1506097">http://onlinesequencer.net/1506097</a>	Murat
02.02.2020	Akhisar/Manisa	<a href="http://onlinesequencer.net/1504629">http://onlinesequencer.net/1504629</a>	Merve
02.02.2020	Akhisar/Manisa	<a href="https://onlinesequencer.net/1506576">https://onlinesequencer.net/1506576</a>	Semin
02.02.2020	Akhisar/Manisa	<a href="https://onlinesequencer.net/1506632">https://onlinesequencer.net/1506632</a>	Irmak
02.02.2020	Akhisar/Manisa	<a href="https://onlinesequencer.net/1506393">https://onlinesequencer.net/1506393</a>	Zeynep
02.02.2020	Akhisar/Manisa	<a href="http://onlinesequencer.net/1507794">http://onlinesequencer.net/1507794</a>	Zeynep K.
24.01.2019	Elazığ	<a href="https://onlinesequencer.net/1506679">https://onlinesequencer.net/1506679</a>	Ozan

**(iii) Name of the school:** DEUZEM-75.Yil

**Number of teachers and their disciplines:** 3 teachers (Science Teacher and Computer Teacher)

**Grade:** 6-7<sup>th</sup> Grades

**Collaborations:** Dokuz Eylül University Departments (Distance Education Center and Statistics – to get scientific information and support), seismology institutions (to check collected earthquake data), researcher (presentation and support during the implementation of the study and the data analysis)

**Approx. time spent for the completion of the project:** 3 months

**Description of the project:**

**The summary:**

The project provides an emergency aid to the buildings that demonstrate the amount of demolition and analyze the differences resulting from the comparison of the bird-eye images collected with the drones before the earthquake and the images to be taken immediately after the earthquake. In this system design, important technologies such as artificial intelligence, internet of things technologies, the seismometer and the drone are used to make instant decisions about the disaster.

**The problem:**

Earthquakes in our country caused loss of life and property. In this project, the problem of how early intervention systems can be developed after the earthquake using industry 4.0 technologies (artificial intelligence, internet of things, drone etc.) has been studied.

**The Solution:**

The system that is developed is based on providing assistance and support to the necessary places by informing the current status of the locations determined at the time of any earthquake. The model allows the local seismometer device and drone to work interactively. The local seismometer consists of a sensor (Geophone) placed on a mini computer Raspberry Pi that can be used to detect earth movements (raspberryShake). In this context, when the raspberrryShake device, which first measures the vibration, detects earthquake mobility that exceeds the specified threshold value, it sends a signal, enabling the drone to perform the pre-determined route (height, etc.) and tasks (taking pictures, etc.). In this way, by making a comparison with the other photograph taken in the same location, instant pictures will be reached to the authorized units. Figure 1 shows the local time 20.55 January 24, 2020 Date occurring in Turkey's Elazığ province, the epicenter of which is sharp, and shows the data of the earthquake lasted about 40 seconds.

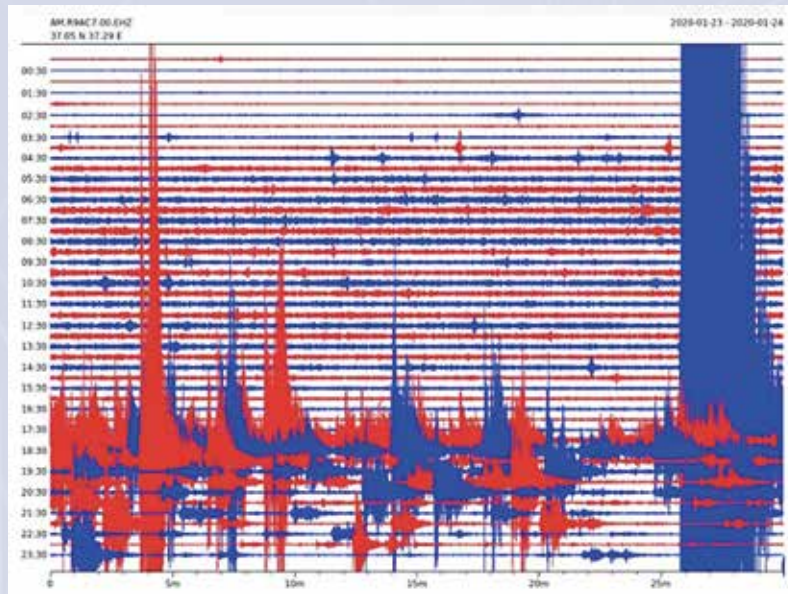
The system design consists of 1 earthquake device (RaspberrryShake), 1 drone and 1 mobile device in different regions. 2 different structures are designed as the interface. It is a web interface design that shows instant earthquake data of the region, photographs taken at normal time and photos at the moment of danger. The other is the interface of the system that takes photos and then compares 2 different photos. HTML5, PHP, Javascript, Python programming languages will be used in system development.

**The Innovation:**

When the studies on this field are examined, we realized that a similar high-level technological design has not been considered and implemented yet. Our project is a system that has emerged with the use of devices and technologies that are completely compatible with the industry 4.0 era. The innovative dimension of our project is that the seismometer named RasperryShake connects to the drone with the technologies of the objects and analyzes the system by taking a photograph of the earthquake location in sudden situations and provides instant information to local administrators.



One of the big earthquakes that was happened in Elazığ City on 24 January 2020. The data was collected by Gaziantep Station.



This project was sent to one of the big students competition called TEKNOFEST. The project was accepted by the scientific committee for the next step. SNAC project was presented at following student scientific events. The TEKNOFEST Aerospace and Technology Festival is organized under the leadership of the Republic of Turkey Ministry of Industry and Technology and the Turkish Technology Team Foundation (T3), which aims at making a Move of National Technology and transforming Turkey into a technology producing society, with the support of Turkey’s major institutions and companies.

More information about the event can be found at the <https://www.teknofest.org/en/>

### 6.1.3. Cyprus

**(i) Name of the school:** American Academy, Larnaca, Cyprus

**Number of teachers and their disciplines:**

2 teachers- Mrs Christiana Mavri-Kyriakidou (Geography)

And Mr Panagiotis Demetriou (Humanities/History)

**Grade:** Junior School students (12-14)

**Collaborations:** The teachers collaborated with education researchers of the University of Cyprus (i.e. SNAC’s partners) in different aspects of the project (presentation at the beginning of the project, participation in teachers’ meetings to develop the activities etc.) to facilitate the implementations and to provide support during the installation of the seismometer

**Approx. time spent for the completion of the project:** Six Months (September 2019- February 2020)

**Description of the project:**

During the school’s implementations, students carried out investigations to discover how to make buildings earthquake resistant and a research study was conducted to recognize how Cyprus is a danger zone for Earthquakes. Thus, the students were able to decide whether buildings in the school premises were earthquake resistant or if improvements were needed (upgrades in the school old buildings were done during the previous years). Once the seismometer was installed at the school, the students were shown its basic functions and how it can record earthquakes, as well as how the deriving waveforms can be analyzed further to locate the epicenter and estimate the magnitude of an earthquake. Students were checking the seismic activity of the area via the SNAC platform every week either during school hours or in their spare time at home (based on the instructions given by the participating teachers).

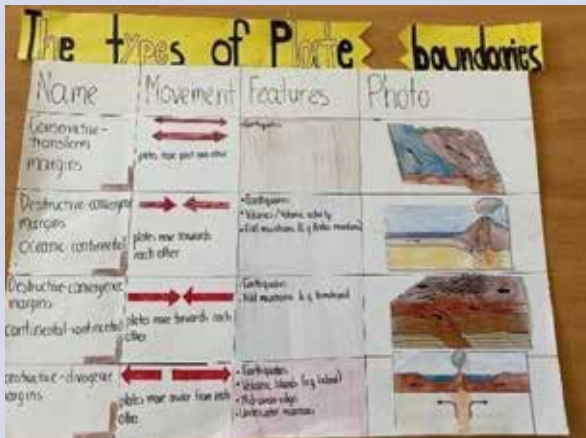
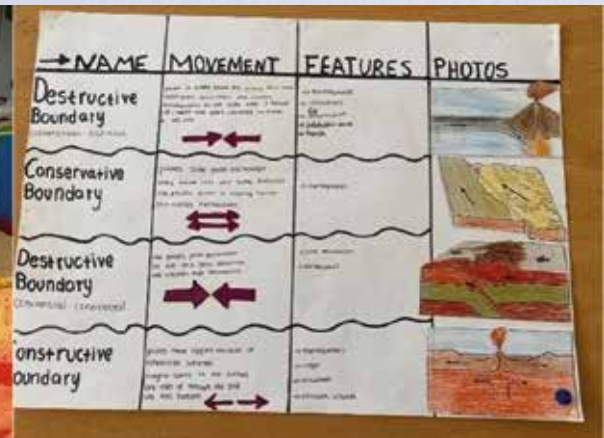
This added another dimension to the lesson- adding to the reality of earthquakes in their daily lives. To inform and raise awareness mainly about tectonic plates movement among students, teachers and parents

of the school the participating students and teachers developed different posters and models for display in various areas of the school (see examples below).

During their overall project and as part of their curriculum, students learned about:

- Plate tectonic Theory
- The different layers Earth is made from Igneous rocks, basalt, granite and the differences between oceanic and continental crust.
- Causes of plates' movement.
- Danger areas of volcanic and earthquake activity around the world.
- Case studies to show how different countries at different levels of development are able to plan, predict and manage these hazards.

Also, students of the Geography club of the school planned to conduct an Earthquake Risk Assessment survey (with the use of a questionnaire) among the school's students but due to the conditions of the closure of the school this activity was not completed. It is planned however to conduct this study during the next school year.



**(ii) Name of the school:** Makedonitissa Gymnasium

**Number of teachers and their disciplines:** 2 teachers (Physicists)

**Grade:** 9<sup>th</sup> grade

**Collaborations:** Civil protection organization (provision of materials), seismologist (presentation and support for the development of the questionnaire), researcher (presentation and support during the implementation of the study and the data analysis)

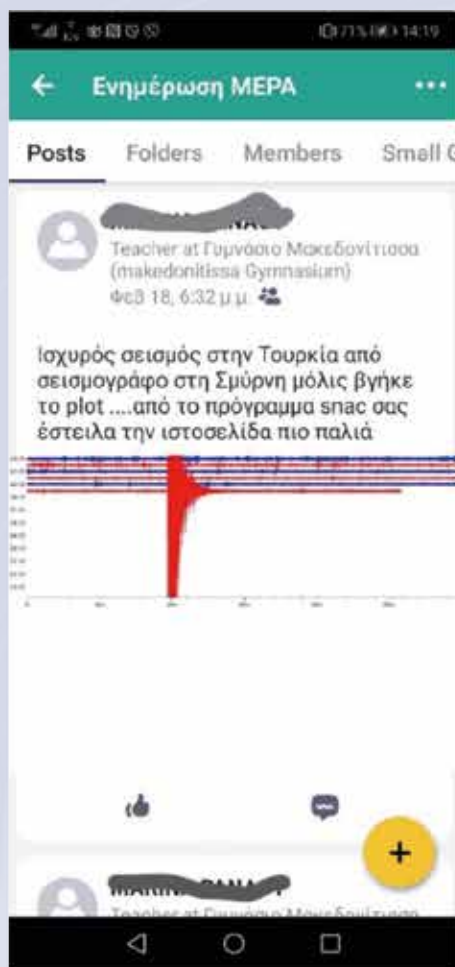
**Approx. time spent for the completion of the project:** 3 months

**Description of the project:** The students and teachers developed a project to identify the knowledge and awareness of students and parents of their school regarding earthquakes. In order to do so, they developed and administrated a questionnaire (with the help of a researcher and the seismologist) to the participants. After they analyzed the data using Excel, they developed various actions within the school in order to increase awareness and knowledge regarding earthquakes.

Some of their actions was the creation of games for the students of the school to participate in (for example, see picture 1), sending earthquake alerts and civil protection information to parents and students using the Edmondo digital platform (see picture 2) and doing presentations to their peers regarding information gathered during the project (see picture 3). Students utilized the SNAC digital platform throughout their project to identify and present any earthquakes occurring in the region.

After the finalization of their actions, the students, with the support of their two teachers, re-administrated the same questionnaire to parents and students to identify any enhancement of their knowledge and awareness. Their main results showcased an increase of both knowledge and awareness to both groups (students and parents) as a result of their actions with the students having a higher increase of knowledge in relation to their parents. Their study and related results were presented in the form of a report to the school, to a contest of the Ministry of Education (MERA) and to their school's newspaper.





(iii) **Name of the school:** Polemidia High School

**Number of teachers and their disciplines:** 4 teachers (Physicists)

**Grade:** 11<sup>th</sup> grade

**Collaborations:** Civil protection organization (provision of materials) and researcher of the University of Cyprus (presentation of main concepts regarding seismology and support with the installation and maintenance of the Raspberry Shake)

**Approx. time spent for the completion of the project:** 2 months

**Description of the project:** After an initial presentation of the researcher of the University of Cyprus to teachers and students, the teachers of the school participating in the project, decided to involve groups of students in various activities based on questions they posed during the presentation.

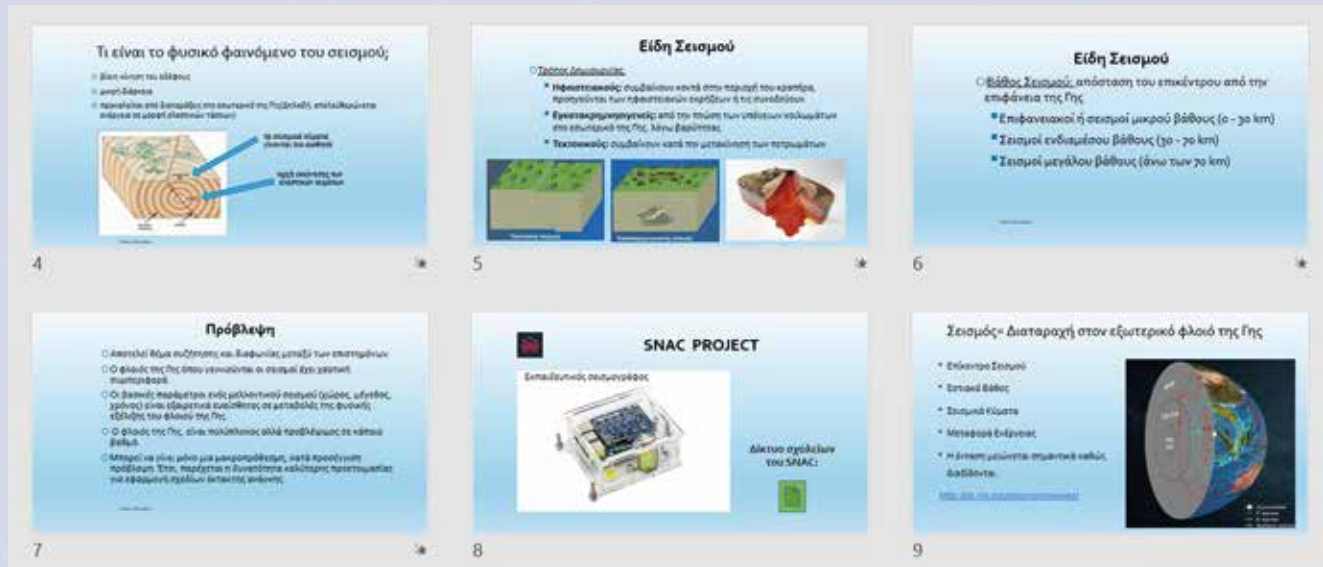
The main questions the different students' groups decided to investigate further in order to learn more and communicate their findings to others were:

- What is an earthquake, how it is created and propagated in the inner layers of the Earth? What dangers does an earthquake entail?
- How does a seismometer work? What information does it provide and how can we process this information?
- How can we protect ourselves during an earthquake?

To investigate the first and third question, students used different internet sources (e.g. USGS, EMSC, IRIS) and the presentation of the researcher to answer each one and then filtered all this information to be able to create a comprehensive text to include in a presentation and a poster. For the second question, a raspberry shake was installed in their school and it was used (along with other real-time data from the SNAC platform and the SWARM software) to identify different seismic parameters of local events. The real-time data of their seismometer are accessible here: <https://snac.gein.noa.gr/plotfiles/AM.RF7FF.php>. In order to present their work and their findings, students created a poster (see below) which was posted in various areas of the school and presented to parents and teachers along with an earthquake drill during which they presented ways to protect from an earthquake.



Students also posted some information about the project on their schools' website (<http://lyk-polemidiadem.schools.ac.cy/index.php?id=photos-robot-seminar>) and created a presentation (some slides of which are showcased below) to be presented in a national students' conference regarding natural sciences.



#### 6.1.4. Bulgaria

**(i) Name of the school:** High School of Mathematics “Paisiy Hilendarski”

**Number of teachers and their disciplines:** 2 teachers (Physicist and IT Teacher)

**Grade:** 10<sup>th</sup> grade

**Collaborations:** NRN Association (providing data, information and support) researcher/physicist from Sofia University (making a presentation and providing support on the case study)

**Approx. time spent for the completion of the project:** 1 month

**Description of the project:** The students, supported by the teacher made a project on finding the the epicentre of an earthquake by using modern technologies and the data collected by the SNAC network. The teacher explained students what seismic waves are, what seismogram is and how we could make the difference between S and P waves using knowledge and lesson plans created during other seismology related projects (specifically the SNAC Project main website and Platform.

A researcher from Sofia University, that participated in the project further explained the students the nature and characteristics of S-waves and P-waves during earthquake and their effect on the environment and population and the methodology for calculating the epicentre of an earthquake.

The students also developed a plan on how to raise the awareness on earthquakes among students and parents by making a webpage on their school intranet website regarding earthquakes and their possible impact on the area and the community. The webpage also suggested steps and actions for the community in an earthquake occurs in the area.

#### 6.1.5. Italy

**(i) Name of the school:** Istituto Statale di Istruzione Secondaria Superiore Guglielmo Marconi

**Number of teachers and their disciplines:** two teachers respectively in physics and computer science

**Grade:** 10<sup>th</sup>

**Collaborations:** local authorities (municipality; city councilors) and families

**Approx. time spent for the completion of the project:** 3 months

**Description of the project:**

After several collaborations in educational experiences between Città della Scienza and one of the involved teachers, the school has been chosen to host one of the seismometers of the networks. Therefore, the

involved teachers were trained by the referring person of Città della Scienza to install of the seismometer and how have access to the data acquired by the device on the SNAC platform.

By the end of January 2020, the same expert trained the pupils of the involved classes in the seismic monitoring and in the use of the Swarm software to locate the epicenters of the earthquakes recorded by the seismometers of the SNAC network.

Students presented their experience in the course of a couple of open days in the school attended by local stakeholders like citizens (mainly parents and other relatives).

At the beginning of March 2020, the lockdown imposed by of the Covid-19 emergency entailed the enclosure of all the schools in Italy, therefore no further scheduled actions in physical presence were carried out.

Thanks to the installed SNAC seismometer, the lockdown did not prevent the students to continue seismic monitoring from their homes. Using the SWARM platform, they even managed to produce various reports on occurred earthquakes, with the guidance of their teachers.



**(ii) Name of the school:** Istituto Superiore G. Minutoli – Liceo S. Quasimodo di Messina

**Number of teachers and their disciplines:** two teachers respectively in math and physics, and in computer science

**Grade:** 12<sup>th</sup>

**Collaborations:** University of Messina, Associazione Italiana Insegnanti di Fisica (AIF), parents and families.

Training meetings with the teachers and the pupils in remote, and multiplier event in presence involving the other stakeholders.

**Approx. time spent for the completion of the project:** 3 months

it's quite difficult to quantify the time spent by both the teachers and the pupils in this experience because we have first to consider the meeting between the teachers and the referring person from Città della Scienza who instructed directly them on the installation procedure of the seismometer and in remote on seismic monitoring by this device.

We also have to consider the meeting with seismology experts where students learned how to monitor the seismic activity by the SNAC platform and how to use the SWARM software to locate the epicenters. After the training, students started to monitor the seismic activity and they showed this experience to the local community in the course of the open days organized in the first months of 2020.

**Description of the project:**

The Istituto Minutoli of Messina hosts from summer 2018 a seismometer provided in the framework of the previous project SSE, so it has been one of the firsts schools involved in the activities of SNAC in Italy. One of the referring teachers has a long experience in non-formal teaching in physics as well as his pupils who started to practise seismic monitoring.

During December 2019 and January 2020 the two involved teachers have been in touch with Città della Scienza to fine-tune the connection of their seismometer to the SNAC project network. On January 30<sup>th</sup> a public event was carried out in the headquarter of the school where a representative of Città della

Scienza showed to the attending participants the educational and technical opportunities allowed by the SNAC seismic network and platform while a researcher in physics of the University of Messina presented some research experiences in the use of refined investigation techniques several different issues.

The audience was composed by teachers of local schools (so the meeting acted also as a multiplier events), researchers of the University of Messina, representatives of the AIF (Italian Association of Teachers in physics), pupils and representatives of their families.

A researcher took inspiration from the meeting to undertake the artisanal realization of a broadband seismometer with the classes of an educational project of which he is leader.

The imagines below show some moments of the meeting held on January 31st in Istituto Minutoli of Messina:



**(iii) Name of the school:** Liceo Scientifico Statale Arturo Labriola di Napoli

**Number of teachers and their disciplines:** two teachers in science

**Grade:** 13<sup>th</sup>

**Collaborations:** families of the pupils

**Approx. time spent for the completion of the project:** 4 months

**Description of the project:**

The Liceo Scientifico Labriola is usual to be involved in educational projects and other activities with Città della Scienza having both the organizations their headquarters in the same neighborhood.

Therefore, the school was available to be involved in the project and to host a seismometer of the network in its place. The device was installed and become operational on February 12<sup>th</sup> 2020.

Already in the course of an open day on December 14<sup>th</sup> 2019, students of the school presented to their families and other citizens the scheduled future activities and the SNAC platform.

A training meeting on the use of the seismic data acquirable from the SNAC platform involving two teachers in science of the school was held on March 30<sup>th</sup> 2020.

The meeting was recorded and the related clips are available to the link below:

<https://www.youtube.com/watch?v=UhdXYNvdZIE&t=189s>

<https://www.youtube.com/watch?v=y9MAW38TD-o>



## 6.2. SNAC Resources – eTwinning Toolkit

### 6.2.1. SNAC Resources (created by the project partners and communities)

Title	Description	Link
Schools Study Earthquakes - 14 Lesson Plans	This Guide for Teachers contains 14 lesson plans related to earthquakes. These are the following: 1. What is the relation between tectonic plates and earthquakes? (Primary school), 2. Εύρεση επίκεντρου με τη χρήση του SeisGram2K (in Greek) (High school), 3. Σεισμικά κύματα (in Greek) (High school), 4. Εύρεση επίκεντρου του σεισμού (in Greek) (High school), 5. Measuring an earthquake (High school), 6. Pangea Puzzle (Primary school), 7. Proper behavior in an earthquake situation (Primary school), 8. How to find the epicenter of an earthquake using modern information technology (High school), 9. How to locate the epicenter of an earthquake (High school), 10. How to estimate the Magnitude of an earthquake (in Italian) (High school), 11. Study of earthquakes (High school), 12. Earthquakes and tectonic plates (High school), 13. Σεισμοί - Χρόνος και Επίκεντρο (in Greek)(High school), 14. Σεισμοί - Δραστηριότητα Χρονομέτρησης (in Greek)(High school)	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/schools-study-earthquakes-lesson-plans-851827">https://portal.opendiscoveryspace.eu/en/edu-object/schools-study-earthquakes-lesson-plans-851827</a>
Schools Study Earthquakes - Seismology Handbook	The main purpose of this guide is to step by step direct teachers in organizing a training route which would ultimately lead to the active students' participation in seismograph handling process, recording and studying seismograms, calculating seismic parameters and exchanging results and experience within their cooperation with other student groups participating in the project. Seismology is fundamental for understanding our dynamic planet, as it plays a vital role in monitoring both human-made and natural seismogenic events.	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/schools-study-earthquakes-seismology-handbook-851826">https://portal.opendiscoveryspace.eu/en/edu-object/schools-study-earthquakes-seismology-handbook-851826</a>
Earthquakes - Time and Focus	An online guide for Greek Students on how to locate the epicentre of an earthquake: <a href="https://graasp.eu/ils/575fab3cc3ddb608c844d2e0/?lang=el">https://graasp.eu/ils/575fab3cc3ddb608c844d2e0/?lang=el</a>	<a href="https://portal.opendiscoveryspace.eu/en/node/855407">https://portal.opendiscoveryspace.eu/en/node/855407</a>
Earthquakes In Greece - Course Scenario	Study of seismic activity in Greece. Students are connected to a scientific laboratory for recording seismic data. They observe, record, analyze and come to conclusions. This course is autonomous, but also part of the 'Anxious Earth' accelerator. Note: This activity is hosted on the Go-Lab platform. To use it, first create your personal account in the Go-Lab course editing tool: <a href="http://graasp.eu">http://graasp.eu</a> and then click on 'Duplicate Space' on the course page. For more information on how to use the course, see here.	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/seismoi-stin-ellada-senario-mathimatos-854192">https://portal.opendiscoveryspace.eu/en/edu-object/seismoi-stin-ellada-senario-mathimatos-854192</a>

Schools Study Earthquakes - Pedagogical Framework	A guide in assisting teachers in planning and implementing inquiry lessons and activities within their science classrooms. The framework is built around three components, which are as follows: a) Project-mapping with the school curricula of the national educational systems of the participating countries b) Determining the educational and pedagogical role of the teachers leading the students' teams involved c) Further sound concepts and tools for the development of additional inquiry based learning scenarios in order to enhance the learning experience of students in the school teams participating The Pedagogical Framework of the SSE project that is presented is flexible, widely applied and offers teachers the main structure for designing learning and evaluation processes for their students.	<a href="https://portal.opendiscovery.space.eu/en/edu-object/schools-study-earthquakes-pedagogical-framework-851824">https://portal.opendiscovery.space.eu/en/edu-object/schools-study-earthquakes-pedagogical-framework-851824</a>
How to locate the epicenter of an earthquake	The lesson plan was developed according to the Italian national curriculum for high school students. It explains how geophysicists individuate the location of the epicenter of an earthquake. Interpret data gathered from the analysis of a seismogram and carry out a true scientific experiment using real data by mean of ICTs	<a href="https://portal.opendiscovery.space.eu/en/edu-object/how-locate-epicenter-earthquake-855397">https://portal.opendiscovery.space.eu/en/edu-object/how-locate-epicenter-earthquake-855397</a>
Restless Earth Accelerator	Students reflect on the impact of natural phenomena, such as earthquakes, volcanic eruptions and tsunamis, on people and their societies. They are also called upon to design a public awareness program in order to raise the awareness of the local community and to help their Municipality prepare the citizens for such events. Note: To use this accelerator, select the English version here and create student projects on it. When creating Project you can replace the English texts with the corresponding Greek ones from this file.	<a href="https://portal.opendiscovery.space.eu/en/edu-object/anisyhi-gi-epitahyntis-854191">https://portal.opendiscovery.space.eu/en/edu-object/anisyhi-gi-epitahyntis-854191</a>
Study of Earthquakes	School-project plan, resources and classroom activities for high-school students (ages 15-18) in accordance with the Greek Science Curriculum	<a href="https://portal.opendiscovery.space.eu/en/edu-object/study-earthquakes-855405">https://portal.opendiscovery.space.eu/en/edu-object/study-earthquakes-855405</a>
Measuring Earthquakes in Turkey	The lesson plan was developed according to Turkey's national curriculum for 8th grade, 13-14 years old	<a href="https://portal.opendiscovery.space.eu/en/edu-object/measuring-earthquakes-turkey-855398">https://portal.opendiscovery.space.eu/en/edu-object/measuring-earthquakes-turkey-855398</a>
"Restless Earth" Accelerator	Our beautiful planet is constantly under transformation. Sometimes, changes occur over a very long period of time and we barely note them. Some other times however, transformations are the result of massive and devastating events. In this activity we explore some of Earth's most intense and overwhelming events; volcanic eruptions, earthquakes and tsunamis. We will reflect on the impact of these natural phenomena on humans and their societies. You will also be challenged to design a citizens' alert programme in order to raise awareness in the local community and help your municipality in preparing citizens for such events.	<a href="https://portal.opendiscovery.space.eu/en/edu-object/restless-earth-accelerator-854148">https://portal.opendiscovery.space.eu/en/edu-object/restless-earth-accelerator-854148</a>
Learning About Volcanoes - Lesson Scenario	In this activity students learn about volcanoes. They will learn about their basic characteristics, their creation as well as the effects of volcanic eruptions on humans.	<a href="https://portal.opendiscovery.space.eu/en/edu-object/mathainontas-gia-ta-ifaisteia-senario-mathimatos-854189">https://portal.opendiscovery.space.eu/en/edu-object/mathainontas-gia-ta-ifaisteia-senario-mathimatos-854189</a>

Learning About Volcanoes - School activity	This is an introductory activity about volcanoes. Students learn about their main features, their creation and the effects of volcanic eruptions to humans. This activity is also part of the 'Restless Earth' OSOS accelerator. Note: This activity is hosted on the Go-Lab platform. To use it, you will first need to make a personal account in the Go-Lab authoring tool: <a href="http://graasp.eu/">http://graasp.eu/</a> and then click on 'Duplicate Space' in the preview page of the activity. For more information about how to use this activity, see here.	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/learning-about-volcanoes-school-activity-854153">https://portal.opendiscoveryspace.eu/en/edu-object/learning-about-volcanoes-school-activity-854153</a>
Earthquakes - Timing Activity	In this activity we will better understand the relationship between distance and arrival time difference: <a href="http://graasp.eu/ils/575fab50c3ddb608c844d2e1/?lang=en">http://graasp.eu/ils/575fab50c3ddb608c844d2e1/?lang=en</a>	<a href="https://portal.opendiscoveryspace.eu/en/node/855408">https://portal.opendiscoveryspace.eu/en/node/855408</a>
Our Restless Earth - Collaborative Inquiry activity	This activity is about designing a citizen's alert program to help your municipality raise awareness among the locals on natural hazards and how to be protected from them. Students can carry out their inquiry simultaneously with schools from other countries, share their results and data and exchange experiences.	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/our-restless-earth-collaborative-inquiry-activity-854160">https://portal.opendiscoveryspace.eu/en/edu-object/our-restless-earth-collaborative-inquiry-activity-854160</a>
Quick Guide to Downloading and Displaying Data from the SSE and SNAC Database	Quick Guide for Downloading and Displaying Data from the SSE and SNAC Database for Students and Teachers	<a href="https://portal.opendiscoveryspace.eu/en/node/854228">https://portal.opendiscoveryspace.eu/en/node/854228</a>
What is the relation between tectonic plates and earthquakes	What is the relation between tectonic plates and earthquakes.	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/what-relation-between-tectonic-plates-and-earthquakes-855406">https://portal.opendiscoveryspace.eu/en/edu-object/what-relation-between-tectonic-plates-and-earthquakes-855406</a>
Earthquakes for Junior High School Students	The "Earthquakes for Junior High School Students" Inquiry Learning Space introduces students to aspects of earthquakes. Students learn about the science behind earthquake generation and detection and investigate the Tectonic Plate Theory, by correlating its outcomes with the worldwide distribution of earthquakes in real time. To use this inquiry learning space, you will need to click on the link to the activity and enter with a username of your choice.	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/earthquakes-junior-high-school-students-854243">https://portal.opendiscoveryspace.eu/en/edu-object/earthquakes-junior-high-school-students-854243</a>
Tsunami - Lesson Scenario	Lesson plan for teaching Tsunamis in class	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/tsoynami-senario-mathimatos-854190">https://portal.opendiscoveryspace.eu/en/edu-object/tsoynami-senario-mathimatos-854190</a>
How to estimate the Magnitude of an earthquake_ in English	Lesson plan for teaching students of high school how to estimate the magnitude of an earthquake	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/how-estimate-magnitude-earthquakeenglish-855395">https://portal.opendiscoveryspace.eu/en/edu-object/how-estimate-magnitude-earthquakeenglish-855395</a>
Exploring seismicity and identifying patterns - School activity	In this lesson you will investigate the relation between the different types of tectonic plates boundaries and the occurrence of earthquakes. This activity is a standalone activity, but it is also part of the 'Restless Earth' accelerator. Note: This activity is hosted on the Go-Lab platform.	<a href="https://portal.opendiscoveryspace.eu/en/edu-object/exploring-seismicity-and-identifying-patterns-school-activity-854155">https://portal.opendiscoveryspace.eu/en/edu-object/exploring-seismicity-and-identifying-patterns-school-activity-854155</a>
LastQuake's Quick User Guide	LastQuake's Quick User Guide	<a href="https://portal.opendiscoveryspace.eu/en/node/854225">https://portal.opendiscoveryspace.eu/en/node/854225</a>

Proper behaviour in an earthquake situation	Guidelines for students and citizens on how to react while an earthquake	<a href="https://portal.opendiscovery.space/en/edu-object/proper-behaviour-earthquake-situation-855404">https://portal.opendiscovery.space/en/edu-object/proper-behaviour-earthquake-situation-855404</a>
SWARM Installation and Use Guide from SNAC (Printed Guide)	An analytic step by step on how to use the SWARM software	<a href="https://portal.opendiscovery.space/en/edu-object/swarm-odigos-egkatastasis-kai-hrisis-apo-snac-entypos-odigos-859719">https://portal.opendiscovery.space/en/edu-object/swarm-odigos-egkatastasis-kai-hrisis-apo-snac-entypos-odigos-859719</a>
Earthquakes and tectonic plates		<a href="https://portal.opendiscovery.space/en/edu-object/earthquakes-and-tectonic-plates-855394">https://portal.opendiscovery.space/en/edu-object/earthquakes-and-tectonic-plates-855394</a>
Tsunamis - School Activity	This is an introductory activity about tsunamis. Students learn about the mechanism behind the generation of these giant waves and how they can be protected by them. This activity is a standalone activity, but it is also part of the 'Restless Earth' accelerator. Note: This activity is hosted on the Go-Lab platform.	<a href="https://portal.opendiscovery.space/en/edu-object/tsunamis-school-activity-854154">https://portal.opendiscovery.space/en/edu-object/tsunamis-school-activity-854154</a>
SWARM SNAC Installation and Use Guide (Video)	An analytic step by step on how to use the SWARM software.	<a href="https://portal.opendiscovery.space/en/edu-object/swarm-odigos-egkatastasis-kai-hrisis-apo-snac-entypos-odigos-859719">https://portal.opendiscovery.space/en/edu-object/swarm-odigos-egkatastasis-kai-hrisis-apo-snac-entypos-odigos-859719</a>
The Sound of the Earth: Application Guide	A guide to sonificate seismic waves and listen to the Melody of the Earth	<a href="https://portal.opendiscovery.space/en/edu-object/i-melodia-tis-gis-odigos-efarmogis-854241">https://portal.opendiscovery.space/en/edu-object/i-melodia-tis-gis-odigos-efarmogis-854241</a>
How to estimate the Magnitude of an earthquake_italian	Lesson plan for teaching Italian students of high school how to estimate the magnitude of an earthquake	<a href="https://portal.opendiscovery.space/en/node/855396">https://portal.opendiscovery.space/en/node/855396</a>
SNAC CASE STUDY: 5.9R EARTHQUAKE SOUTH OF THE GATE ON 21/5/2020	A video, showing the various recordings and data received about a specific earthquakes from various installed seismometers of the SNAC network in Greece	<a href="https://portal.opendiscovery.space/en/node/860184">https://portal.opendiscovery.space/en/node/860184</a>
Students Study Volcanoes Accelerator	The "Students Study Volcanoes" accelerator aims to shed light in the mechanisms of volcano eruption, provide students and schools with educational scenarios employing state of the art simulations and remote labs which can be used to help forecast the possibility of a volcanic eruption and finally provide students with the means and methodology to raise awareness regarding volcanic dangers. This way, the students are trained to become sensitive and informed citizens, responsive to the needs of their local community, who will be able to understand and in the future manage crises in a consistent and minimum-risk fashion.	<a href="https://portal.opendiscovery.space/en/edu-object/students-study-volcanoes-accelerator-854233">https://portal.opendiscovery.space/en/edu-object/students-study-volcanoes-accelerator-854233</a>

Seismology in simple words for high school students (Source: Geological Society)	A presentation of basic seismological theories for Greek high school students	<a href="https://portal.opendiscovery.space.eu/en/node/860183">https://portal.opendiscovery.space.eu/en/node/860183</a>
Students Study Volcanoes Inquiry Learning Space	The “Students Study Volcanoes” inquiry learning space aims to shed light in the mechanisms of volcano eruption, provide students with a unique educational experience employing state of the art simulations which can be used to help forecast the possibility of a volcanic eruption and finally provide students with food for thought concerning how to raise awareness regarding volcanic dangers.	<a href="https://portal.opendiscovery.space.eu/en/edu-object/students-study-volcanoes-inquiry-learning-space-854240">https://portal.opendiscovery.space.eu/en/edu-object/students-study-volcanoes-inquiry-learning-space-854240</a>
Study of P and S wave velocities with waveforms from the SNAC network	A step by step for Greek students on how to find the speed of P and S waves	<a href="https://portal.opendiscovery.space.eu/en/node/861102">https://portal.opendiscovery.space.eu/en/node/861102</a>
SNAC Projesi Hakkında	SWARM Handbook	<a href="https://portal.opendiscovery.space.eu/en/node/856800">https://portal.opendiscovery.space.eu/en/node/856800</a>
EARTHQUAKE ACTIVITY	SNAC Lesson plan	<a href="https://portal.opendiscovery.space.eu/en/node/857717">https://portal.opendiscovery.space.eu/en/node/857717</a>
SWARM INSTALLATION AND USE	Educational video teaching how to determine the location and magnitude of earthquakes.	<a href="https://portal.opendiscovery.space.eu/en/node/857129">https://portal.opendiscovery.space.eu/en/node/857129</a>
SNAC Project Presentation	Power point presentation introducing the SNAC Project.	<a href="https://portal.opendiscovery.space.eu/en/node/857094">https://portal.opendiscovery.space.eu/en/node/857094</a>
Seismic Wave Types	Seismology Handbook	<a href="https://portal.opendiscovery.space.eu/en/edu-object/sismik-dalga-cesitleri-857139">https://portal.opendiscovery.space.eu/en/edu-object/sismik-dalga-cesitleri-857139</a>

### 6.2.2. SNAC Projects (in OSOS)

#	Title	Link
1	Southern Cretan Sea. A Sea with a long and unstable Geomorphological and Geological history	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/southern-cretan-sea-sea-long-and-unstable-geomorphological-and-geological-history">https://portal.opendiscoveryspace.eu/en/osos-project/southern-cretan-sea-sea-long-and-unstable-geomorphological-and-geological-history</a>
2	Become an amateur seismologist for a while...	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/gine-gia-ligo-erasitehnis-seismologos-860982">https://portal.opendiscoveryspace.eu/en/osos-project/gine-gia-ligo-erasitehnis-seismologos-860982</a>
3	Coding and Analysis of seismic phenomena: << Studying earthquakes and seismographs >>	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/kodikopoiisi-kai-analysi-ton-seismikon-fainomenon-860855">https://portal.opendiscoveryspace.eu/en/osos-project/kodikopoiisi-kai-analysi-ton-seismikon-fainomenon-860855</a>
4	Earthquakes and Fractures	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/seismoi-kai-rigmata-860848">https://portal.opendiscoveryspace.eu/en/osos-project/seismoi-kai-rigmata-860848</a>
5	Earthquakes	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/oi-seismoi-859973">https://portal.opendiscoveryspace.eu/en/osos-project/oi-seismoi-859973</a>
6	Little Seismologists in action 2019	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/mikroi-seismologoi-en-drasei-859857">https://portal.opendiscoveryspace.eu/en/osos-project/mikroi-seismologoi-en-drasei-859857</a>
7	Construction of an experimental seismograph	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/construction-experimental-seismograph-859849">https://portal.opendiscoveryspace.eu/en/osos-project/construction-experimental-seismograph-859849</a>
8	Make your own seismograph_ TALOS_SEISMO	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/ftiaxe-diko-soy-seismografo-talosseismo-859817">https://portal.opendiscoveryspace.eu/en/osos-project/ftiaxe-diko-soy-seismografo-talosseismo-859817</a>
9	Earthquakes and Volcanoes: "I am not afraid of earthquakes, I am a seismologist 2019	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/seismoi-kai-ifaisteia-de-fovamai-seismo-eimai-seismoeidikos-859814">https://portal.opendiscoveryspace.eu/en/osos-project/seismoi-kai-ifaisteia-de-fovamai-seismo-eimai-seismoeidikos-859814</a>
10	Schools in Action - Terraemotus - Chang Heng Seismograph!	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/sholeia-en-drasei-terraemotus-o-seismografos-toy-tsangk-hengk-859813">https://portal.opendiscoveryspace.eu/en/osos-project/sholeia-en-drasei-terraemotus-o-seismografos-toy-tsangk-hengk-859813</a>
11	Build your own seismograph TALOS_Wedo2.0	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/ftiaxe-diko-soy-seismografo-talowsedo20-859811">https://portal.opendiscoveryspace.eu/en/osos-project/ftiaxe-diko-soy-seismografo-talowsedo20-859811</a>
12	Earthquakes and Volcanoes: "I am not afraid of earthquakes, I am a seismologist" 2020	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/seismoi-ifaisteia-de-fovamai-seismo-eimai-seismoeidikos-859804">https://portal.opendiscoveryspace.eu/en/osos-project/seismoi-ifaisteia-de-fovamai-seismo-eimai-seismoeidikos-859804</a>
13	Study and understanding of earthquakes and creation of a seismograph for educational use	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/meleti-kai-katanoisi-ton-seismon-kai-dimioyrgia-seismografoy-gia-ekpaideytiki-hrisi">https://portal.opendiscoveryspace.eu/en/osos-project/meleti-kai-katanoisi-ton-seismon-kai-dimioyrgia-seismografoy-gia-ekpaideytiki-hrisi</a>
14	Digital Seismograph	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/psifiakos-seismografos-859766">https://portal.opendiscoveryspace.eu/en/osos-project/psifiakos-seismografos-859766</a>
15	1st Educational program: Earthquake, construction of a seismograph	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/1o-ekpaideytiko-programma-seimos-kataskeyi-seismografoy-moyseio-fe-859730">https://portal.opendiscoveryspace.eu/en/osos-project/1o-ekpaideytiko-programma-seimos-kataskeyi-seismografoy-moyseio-fe-859730</a>
16	Seismograph from old materials!	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/seismografos-apo-palia-ylika-859706">https://portal.opendiscoveryspace.eu/en/osos-project/seismografos-apo-palia-ylika-859706</a>
17	I know the earthquake, I dispel the fear - A study on earthquakes and volcanoes	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/ton-seismo-gnorizo-ton-fovo-exanemizo-mia-meleti-gia-toys-seismoys-kai-ta-ifaisteia">https://portal.opendiscoveryspace.eu/en/osos-project/ton-seismo-gnorizo-ton-fovo-exanemizo-mia-meleti-gia-toys-seismoys-kai-ta-ifaisteia</a>
18	Let's start with the myth...	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/xekinisoyme-apo-mytho-855725">https://portal.opendiscoveryspace.eu/en/osos-project/xekinisoyme-apo-mytho-855725</a>
19	Little Seismologists in action 2020	<a href="https://portal.opendiscoveryspace.eu/en/osos-project/mikroi-seismologoi-en-drasei-855180">https://portal.opendiscoveryspace.eu/en/osos-project/mikroi-seismologoi-en-drasei-855180</a>

20	Our first seismograph	<a href="https://portal.opendiscovery.space.eu/en/osos-project/o-protos-mas-seismografos-855098">https://portal.opendiscovery.space.eu/en/osos-project/o-protos-mas-seismografos-855098</a>
21	Schools in Action - Educational Seismograph	<a href="https://portal.opendiscovery.space.eu/en/osos-project/sholeia-en-drasei-ekpaideytikos-seismografos-853655">https://portal.opendiscovery.space.eu/en/osos-project/sholeia-en-drasei-ekpaideytikos-seismografos-853655</a>
22	Construction of a seismograph model	<a href="https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-maketas-seismografoy-853625">https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-maketas-seismografoy-853625</a>
23	The Chinese Seismograph	<a href="https://portal.opendiscovery.space.eu/en/osos-project/o-kinezikos-seismografos-853620">https://portal.opendiscovery.space.eu/en/osos-project/o-kinezikos-seismografos-853620</a>
24	Recording vibrations with a smartphone	<a href="https://portal.opendiscovery.space.eu/en/osos-project/katagrafontas-doniseis-me-ena-smartphone-853599">https://portal.opendiscovery.space.eu/en/osos-project/katagrafontas-doniseis-me-ena-smartphone-853599</a>
25	Recording Vibrations!	<a href="https://portal.opendiscovery.space.eu/en/osos-project/katagrafontas-doniseis-me-ena-smartphone-853599">https://portal.opendiscovery.space.eu/en/osos-project/katagrafontas-doniseis-me-ena-smartphone-853599</a>
26	The rupture of Parnitha ... let's prepare!	<a href="https://portal.opendiscovery.space.eu/en/osos-project/rigma-tis-parnithas-proetoimastoyme-853588">https://portal.opendiscovery.space.eu/en/osos-project/rigma-tis-parnithas-proetoimastoyme-853588</a>
27	Seismograph with LEGO EV3 and MIT App Inventor	<a href="https://portal.opendiscovery.space.eu/en/osos-project/seismografos-me-lego-ev3-kai-mit-app-inventor-853587">https://portal.opendiscovery.space.eu/en/osos-project/seismografos-me-lego-ev3-kai-mit-app-inventor-853587</a>
28	Creating a Seismograph	<a href="https://portal.opendiscovery.space.eu/en/osos-project/dimioyrgia-seismografoy-853575">https://portal.opendiscovery.space.eu/en/osos-project/dimioyrgia-seismografoy-853575</a>
29	Construction of a seismograph by the Earthquake Busters team of the 7th High School of Trikala	<a href="https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-seismografoy-apo-tin-omada-earthquake-busters-toy-7oy-gymnasioy-trikalon-0">https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-seismografoy-apo-tin-omada-earthquake-busters-toy-7oy-gymnasioy-trikalon-0</a>
30	SCHOOL SEISMOGRAPHER OF PANOU	<a href="https://portal.opendiscovery.space.eu/en/osos-project/sholikos-seismografos-ekpaideytirion-panoy-853565">https://portal.opendiscovery.space.eu/en/osos-project/sholikos-seismografos-ekpaideytirion-panoy-853565</a>
31	Make your own seismograph " 1 EPAL Vrontadou Chios	<a href="https://portal.opendiscovery.space.eu/en/osos-project/ftiaxe-diko-sas-seismografo-1-epal-vrontadoy-hioy-853559">https://portal.opendiscovery.space.eu/en/osos-project/ftiaxe-diko-sas-seismografo-1-epal-vrontadoy-hioy-853559</a>
32	Construction of a seismograph	<a href="https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-seismografoy-853553">https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-seismografoy-853553</a>
33	Student seismograph	<a href="https://portal.opendiscovery.space.eu/en/osos-project/mathitikos-seismografos-853541">https://portal.opendiscovery.space.eu/en/osos-project/mathitikos-seismografos-853541</a>
34	The students of the Structural Works Sector of the 1st Vocational Lyceum of Kos participate in the Build your own seismograph contest	<a href="https://portal.opendiscovery.space.eu/en/osos-project/students-structural-works-sector-1st-vocational-lyceum-kos-participate-build-your-own">https://portal.opendiscovery.space.eu/en/osos-project/students-structural-works-sector-1st-vocational-lyceum-kos-participate-build-your-own</a>
35	Seismograph - SeismoTrop	<a href="https://portal.opendiscovery.space.eu/en/osos-project/seismografos-seismotrop-853532">https://portal.opendiscovery.space.eu/en/osos-project/seismografos-seismotrop-853532</a>
36	Build your own seismograph: an interdisciplinary approach to the section Earthquakes in the course of Geography and STEM teaching methodology	<a href="https://portal.opendiscovery.space.eu/en/osos-project/ftiaxe-ton-diko-soy-seismografo-mia-diathematiki-proseggisi-tis-enotitas-seismoisto">https://portal.opendiscovery.space.eu/en/osos-project/ftiaxe-ton-diko-soy-seismografo-mia-diathematiki-proseggisi-tis-enotitas-seismoisto</a>
37	Build your own seismograph with a RaspberryPi!	<a href="https://portal.opendiscovery.space.eu/en/osos-project/ftiaxe-ton-diko-soy-seismografo-me-ena-raspberrypi-853526">https://portal.opendiscovery.space.eu/en/osos-project/ftiaxe-ton-diko-soy-seismografo-me-ena-raspberrypi-853526</a>
38	I create a robotic seismograph with STEM (LEGO WEDO 2)	<a href="https://portal.opendiscovery.space.eu/en/osos-project/dimioyrgo-ena-rompotiko-seismografo-me-stem-lego-wedo-2-853518">https://portal.opendiscovery.space.eu/en/osos-project/dimioyrgo-ena-rompotiko-seismografo-me-stem-lego-wedo-2-853518</a>
39	Microphone on Earth	<a href="https://portal.opendiscovery.space.eu/en/osos-project/mikrofono-stigi-853489">https://portal.opendiscovery.space.eu/en/osos-project/mikrofono-stigi-853489</a>
40	CONSTRUCTION OF A SEISMOGRAPH USING THE ARDUINO UNO MICROCONTROLLER	<a href="https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-seismografoy-me-hrisi-toy-mikroelekkti-arduino-uno-853487">https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-seismografoy-me-hrisi-toy-mikroelekkti-arduino-uno-853487</a>

41	Internet of Things (IoT) Earthquake Detector based on Ground Acceleration Waves	<a href="https://portal.opendiscovery.space.eu/en/osos-project/internet-things-iot-earthquake-detector-based-ground-acceleration-waves-853448">https://portal.opendiscovery.space.eu/en/osos-project/internet-things-iot-earthquake-detector-based-ground-acceleration-waves-853448</a>
42	Construction of an experimental seismograph	<a href="https://portal.opendiscovery.space.eu/en/osos-project/construction-experimental-seismograph-853420">https://portal.opendiscovery.space.eu/en/osos-project/construction-experimental-seismograph-853420</a>
43	Volcanoes and earthquakes in Greece	<a href="https://portal.opendiscovery.space.eu/en/osos-project/ifaisteia-kai-seismoi-stin-ellada-853012">https://portal.opendiscovery.space.eu/en/osos-project/ifaisteia-kai-seismoi-stin-ellada-853012</a>
44	Seismoving	<a href="https://portal.opendiscovery.space.eu/en/osos-project/seismoving-849887">https://portal.opendiscovery.space.eu/en/osos-project/seismoving-849887</a>
45	Earthquake - Evangeliki School of Smyrna	<a href="https://portal.opendiscovery.space.eu/en/osos-project/earthquake-evangeliki-school-smyrna-849878">https://portal.opendiscovery.space.eu/en/osos-project/earthquake-evangeliki-school-smyrna-849878</a>
46	We feel - we study - we understand the Earthquake using SEISMOBOX	<a href="https://portal.opendiscovery.space.eu/en/osos-project/we-feel-we-study-we-understand-earthquake-using-seismobox-855112">https://portal.opendiscovery.space.eu/en/osos-project/we-feel-we-study-we-understand-earthquake-using-seismobox-855112</a>
47	The 8th records Earthquakes, warns students and expects to inform the Athens Observatory.	<a href="https://portal.opendiscovery.space.eu/en/osos-project/8o-katagrafei-seismoy-s-proeidopoei-toys-mathitestries-kai-prosdoka-na-enimeronei-kai">https://portal.opendiscovery.space.eu/en/osos-project/8o-katagrafei-seismoy-s-proeidopoei-toys-mathitestries-kai-prosdoka-na-enimeronei-kai</a>
48	Let's get Digital studying Earthquakes	<a href="https://portal.opendiscovery.space.eu/en/osos-project/lets-get-digital-studying-earthquakes-861318">https://portal.opendiscovery.space.eu/en/osos-project/lets-get-digital-studying-earthquakes-861318</a>
49	Earthquakes and Fractures 2020	<a href="https://portal.opendiscovery.space.eu/en/osos-project/seismoi-kai-rigmata-860848">https://portal.opendiscovery.space.eu/en/osos-project/seismoi-kai-rigmata-860848</a>
50	Liceo Scientifico S.Quasimodo di Messina: analisi di rilevamenti sismologici per individuare epicentro sisma in calabria	<a href="https://portal.opendiscovery.space.eu/en/osos-project/liceo-scientifico-quasimodo-di-messina-analisi-di-rilevamenti-sismologici-individuare">https://portal.opendiscovery.space.eu/en/osos-project/liceo-scientifico-quasimodo-di-messina-analisi-di-rilevamenti-sismologici-individuare</a>
51	Worksheets SNAC program	<a href="https://portal.opendiscovery.space.eu/en/edu-object/fylla-ergasias-programma-snac-859279">https://portal.opendiscovery.space.eu/en/edu-object/fylla-ergasias-programma-snac-859279</a>
52	Measuring Egelados' anger	<a href="https://portal.opendiscovery.space.eu/en/osos-project/metrontas-thymotoy-egkeladoy-859772">https://portal.opendiscovery.space.eu/en/osos-project/metrontas-thymotoy-egkeladoy-859772</a>
53	I make my own seismograph	<a href="https://portal.opendiscovery.space.eu/en/osos-project/ftiahno-ton-dikomoy-seismografo-859739">https://portal.opendiscovery.space.eu/en/osos-project/ftiahno-ton-dikomoy-seismografo-859739</a>
54	MANUFACTURE AND ASSEMBLY OF A SEISMOGRAPH USING THE ARDUINO UNO MICROCONTROLLER	<a href="https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-kai-synarmologisi-seismografoy-me-hrisi-toy-mikrolegkti-arduino-uno-859765">https://portal.opendiscovery.space.eu/en/osos-project/kataskeyi-kai-synarmologisi-seismografoy-me-hrisi-toy-mikrolegkti-arduino-uno-859765</a>
55	Make your own seismograph with LabVIEW- 1st EPAL Livadia	<a href="https://portal.opendiscovery.space.eu/en/osos-project/ftiaxe-diko-soy-seismografo-me-labview-1o-epal-livadeias-850416">https://portal.opendiscovery.space.eu/en/osos-project/ftiaxe-diko-soy-seismografo-me-labview-1o-epal-livadeias-850416</a>

### 6.2.3. SNAC Communities (in OSOS)

#	Title	Members	Link
1	Schools Study Earthquakes*	118	<a href="https://portal.opendiscoveryspace.eu/en/community/schools-study-earthquakes-849203">https://portal.opendiscoveryspace.eu/en/community/schools-study-earthquakes-849203</a>
2	Turkish SNAC Community	63	<a href="https://portal.opendiscoveryspace.eu/en/community/turkish-snac-community-856796">https://portal.opendiscoveryspace.eu/en/community/turkish-snac-community-856796</a>
3	Greek Schools of SNAC Project	43	<a href="https://portal.opendiscoveryspace.eu/en/community/ellinika-sholeia-toy-programmatos-snac-857512">https://portal.opendiscoveryspace.eu/en/community/ellinika-sholeia-toy-programmatos-snac-857512</a>
4	Cypriot Schools of SNAC Project	11	<a href="https://portal.opendiscoveryspace.eu/en/community/sholeia-tis-kyproy-toy-programmatos-snac-856691">https://portal.opendiscoveryspace.eu/en/community/sholeia-tis-kyproy-toy-programmatos-snac-856691</a>
5	Comunità SNAC Italia	3	<a href="https://portal.opendiscoveryspace.eu/en/community/comunita-snac-italia-857636">https://portal.opendiscoveryspace.eu/en/community/comunita-snac-italia-857636</a>
6	Bulgarian SNAC Community	2	<a href="https://portal.opendiscoveryspace.eu/en/community/bulgarian-snac-community-857046">https://portal.opendiscoveryspace.eu/en/community/bulgarian-snac-community-857046</a>
7	Büyükçekmece SNAC Community	2	<a href="https://portal.opendiscoveryspace.eu/en/community/buyukcekmece-snac-community-857547">https://portal.opendiscoveryspace.eu/en/community/buyukcekmece-snac-community-857547</a>
8	Sapes SNAC Project	2	<a href="https://portal.opendiscoveryspace.eu/en/community/sapes-snac-project-859036">https://portal.opendiscoveryspace.eu/en/community/sapes-snac-project-859036</a>
9	Veroia (Snac) R&D	1	<a href="https://portal.opendiscoveryspace.eu/en/community/veroia-snac-rd-859524">https://portal.opendiscoveryspace.eu/en/community/veroia-snac-rd-859524</a>
10	School Study Earthquakes (SSE)	7	<a href="https://portal.opendiscoveryspace.eu/en/community/school-study-earthquakes-sse-849969">https://portal.opendiscoveryspace.eu/en/community/school-study-earthquakes-sse-849969</a>
11	Make your own Seismograph (Chios)	1	<a href="https://portal.opendiscoveryspace.eu/node/853557">https://portal.opendiscoveryspace.eu/node/853557</a>
		<b>253</b>	-

\*The Schools Study Earthquakes community is the main community of the SNAC project. The other communities have been developed independently from the initiatives of SNAC teachers and other schools.

RELATED to SNAC COMMUNITIES				
#	Title	Members	Link	Projects
1	Islands Diversity - Greece	29	<a href="https://portal.opendiscoveryspace.eu/en/community/islands-diversity-greece-852299">https://portal.opendiscoveryspace.eu/en/community/islands-diversity-greece-852299</a>	6
2	Ελληνικά Σχολεία OSOS - Greek OSOS Schools	118	<a href="https://portal.opendiscoveryspace.eu/en/community/ellinika-sholeia-osos-greek-osos-schools-848856">https://portal.opendiscoveryspace.eu/en/community/ellinika-sholeia-osos-greek-osos-schools-848856</a>	32
3	OSOS Community	925	<a href="https://portal.opendiscoveryspace.eu/en/community/osos-community-848423">https://portal.opendiscoveryspace.eu/en/community/osos-community-848423</a>	88
4	Citizen science monitors volcanoes	9	<a href="https://portal.opendiscoveryspace.eu/en/search-projects-in-community/850043">https://portal.opendiscoveryspace.eu/en/search-projects-in-community/850043</a>	3

### 6.2.4. SNAC Educational & Implementation Videos

TITLE	LINK
<b>SNAC Guides</b>	
SWARM Guide	<a href="https://www.youtube.com/watch?v=Z3Nc9tM9S80&amp;list=PLgYrtynYFbn59FPRKvcd1DGnxwGnc6j4x&amp;index=2&amp;t=70s">https://www.youtube.com/watch?v=Z3Nc9tM9S80&amp;list=PLgYrtynYFbn59FPRKvcd1DGnxwGnc6j4x&amp;index=2&amp;t=70s</a>
Pylos Earthquake Example	<a href="https://www.youtube.com/watch?v=eVWa6rWmIlo&amp;list=PLgYrtynYFbn59FPRKvcd1DGnxwGnc6j4x&amp;index=3&amp;t=140s">https://www.youtube.com/watch?v=eVWa6rWmIlo&amp;list=PLgYrtynYFbn59FPRKvcd1DGnxwGnc6j4x&amp;index=3&amp;t=140s</a>
Basic Seismology	<a href="https://www.youtube.com/watch?v=EgumhERycFU&amp;list=PLgYrtynYFbn59FPRKvcd1DGnxwGnc6j4x&amp;index=4&amp;t=0s">https://www.youtube.com/watch?v=EgumhERycFU&amp;list=PLgYrtynYFbn59FPRKvcd1DGnxwGnc6j4x&amp;index=4&amp;t=0s</a>
<b>Webinar</b>	
Webinar to Greek Teachers supported by the Ministry of Education	<a href="https://www.youtube.com/watch?v=PsoFH2YMRJI&amp;list=PLgYrtynYFbn7t84ZeZ8QiFFzWXtm7gYer&amp;index=3&amp;t=4s">https://www.youtube.com/watch?v=PsoFH2YMRJI&amp;list=PLgYrtynYFbn7t84ZeZ8QiFFzWXtm7gYer&amp;index=3&amp;t=4s</a>
EELLAK/Scientix Conference	<a href="https://www.youtube.com/watch?v=nX-C35v1UOY&amp;list=PLgYrtynYFbn7t84ZeZ8QiFFzWXtm7gYer&amp;index=2&amp;t=0s">https://www.youtube.com/watch?v=nX-C35v1UOY&amp;list=PLgYrtynYFbn7t84ZeZ8QiFFzWXtm7gYer&amp;index=2&amp;t=0s</a>
<b>Summer School 2020 Greek</b>	
DAY 1	<a href="https://www.youtube.com/watch?v=dyMFOXrZ8UI&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=2&amp;t=11s">https://www.youtube.com/watch?v=dyMFOXrZ8UI&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=2&amp;t=11s</a>
DAY 2	<a href="https://www.youtube.com/watch?v=nsemEYAXCJ8&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=3&amp;t=0s">https://www.youtube.com/watch?v=nsemEYAXCJ8&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=3&amp;t=0s</a>
DAY 3	<a href="https://www.youtube.com/watch?v=VacFd2_eAZ8&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=4&amp;t=0s">https://www.youtube.com/watch?v=VacFd2_eAZ8&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=4&amp;t=0s</a> <a href="https://www.youtube.com/watch?v=oNqcQcMASfw&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=5&amp;t=0s">https://www.youtube.com/watch?v=oNqcQcMASfw&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=5&amp;t=0s</a>
DAY 4	<a href="https://www.youtube.com/watch?v=NIgrB0DgzX8&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=6&amp;t=0s">https://www.youtube.com/watch?v=NIgrB0DgzX8&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=6&amp;t=0s</a> <a href="https://www.youtube.com/watch?v=hQLJYrxb44&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=7&amp;t=0s">https://www.youtube.com/watch?v=hQLJYrxb44&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=7&amp;t=0s</a>
DAY 5	<a href="https://www.youtube.com/watch?v=vS0Nwvec96c&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=8&amp;t=0s">https://www.youtube.com/watch?v=vS0Nwvec96c&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=8&amp;t=0s</a>
DAY 6	<a href="https://www.youtube.com/watch?v=BYQWJPYrqHg&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=9&amp;t=0s">https://www.youtube.com/watch?v=BYQWJPYrqHg&amp;list=PLgYrtynYFbn6f64OBPHG6VUUbEVNyyJ3E&amp;index=9&amp;t=0s</a>
<b>Summer School 2020 International</b>	
DAY 1	<a href="https://www.youtube.com/watch?v=5cvvIN8uNkM&amp;list=PLgYrtynYFbn5gXBllr-vDeatMabsFHfuE&amp;index=2&amp;t=0s">https://www.youtube.com/watch?v=5cvvIN8uNkM&amp;list=PLgYrtynYFbn5gXBllr-vDeatMabsFHfuE&amp;index=2&amp;t=0s</a>
DAY 2	<a href="https://www.youtube.com/watch?v=Z7SJHX2IJ0&amp;list=PLgYrtynYFbn5gXBllr-vDeatMabsFHfuE&amp;index=3&amp;t=0s">https://www.youtube.com/watch?v=Z7SJHX2IJ0&amp;list=PLgYrtynYFbn5gXBllr-vDeatMabsFHfuE&amp;index=3&amp;t=0s</a>
DAY 3	<a href="https://www.youtube.com/watch?v=xIWxuHmYpTs&amp;list=PLgYrtynYFbn5gXBllr-vDeatMabsFHfuE&amp;index=4&amp;t=0s">https://www.youtube.com/watch?v=xIWxuHmYpTs&amp;list=PLgYrtynYFbn5gXBllr-vDeatMabsFHfuE&amp;index=4&amp;t=0s</a>
DAY 4	Free day where teachers had the time to prepare their projects

DAY 5	<a href="https://www.youtube.com/watch?v=A0ZUornUBZQ&amp;list=PLgYrtynYFbn5gXBllr-vDeatMabsFHfuE&amp;index=5&amp;t=0s">https://www.youtube.com/watch?v=A0ZUornUBZQ&amp;list=PLgYrtynYFbn5gXBllr-vDeatMabsFHfuE&amp;index=5&amp;t=0s</a>
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Various Implementation Videos from SNAC Schools	
Collaborative Workshop between Turkish and Greek School (teachers only) on the Sound of Earth	<a href="https://youtu.be/BBVfz6J1bTE">https://youtu.be/BBVfz6J1bTE</a> , <a href="https://youtu.be/zaBu2IRTH_Q">https://youtu.be/zaBu2IRTH_Q</a>
Collaborative Workshop between Turkish with Greek School on the major Earthquakes in Greece & Turkey	<a href="https://youtu.be/gwJlg0QhSBk">https://youtu.be/gwJlg0QhSBk</a>
Collaborative Workshop between Turkish and Greek School students on the Sound of Earth	<a href="https://youtu.be/fl8zA6oQC2l">https://youtu.be/fl8zA6oQC2l</a>
Collaborative Workshop between Turkish School and University regarding seismology	<a href="https://youtu.be/Hq1nEDs1IIE">https://youtu.be/Hq1nEDs1IIE</a>
SNAC PROJECT in TURKISH	<a href="https://www.youtube.com/watch?v=doM6VMlskfE">https://www.youtube.com/watch?v=doM6VMlskfE</a>
SNAC PROJECT in TURKISH II	<a href="https://www.youtube.com/watch?v=HRdm8h4-8fE">https://www.youtube.com/watch?v=HRdm8h4-8fE</a>
SNAC PROJECT in TURKISH II	<a href="https://www.facebook.com/istekizmirokullari/videos/583266232530913/UzpfSTEyNzU2OTQyNDQ6MTAyMjE4NTk1OTk3MDA1ODA/">https://www.facebook.com/istekizmirokullari/videos/583266232530913/UzpfSTEyNzU2OTQyNDQ6MTAyMjE4NTk1OTk3MDA1ODA/</a>
Karditsa Earthquake Project 1 - Event	<a href="https://www.youtube.com/watch?v=B0I6Cbs2A4Q">https://www.youtube.com/watch?v=B0I6Cbs2A4Q</a>
Karditsa Earthquake Project 1 - Project Presentation	<a href="https://youtu.be/EKw-fn8zjs4">https://youtu.be/EKw-fn8zjs4</a>
5th Primary School of City of Rhodes Event at school	<a href="https://www.youtube.com/watch?v=dqxqmsL2JeQ">https://www.youtube.com/watch?v=dqxqmsL2JeQ</a>
5th Primary School of City of Rhodes Event at school	<a href="https://www.youtube.com/watch?v=OT68BVoxdHE">https://www.youtube.com/watch?v=OT68BVoxdHE</a>
5th Primary School of City of Rhodes Youtube Channel	<a href="https://www.youtube.com/channel/UCczGS34iU1A7gkks3m2AJA">https://www.youtube.com/channel/UCczGS34iU1A7gkks3m2AJA</a>
Kos Earhquake Example	<a href="https://www.youtube.com/watch?time_continue=4&amp;v=dOSNzsYyYPY&amp;feature=emb_title">https://www.youtube.com/watch?time_continue=4&amp;v=dOSNzsYyYPY&amp;feature=emb_title</a>
5th Primary School of City of Rhodes Activities	<a href="https://www.youtube.com/watch?v=sYIRuCdOswc">https://www.youtube.com/watch?v=sYIRuCdOswc</a>
5th Primary School of City of Rhodes Activities	<a href="https://www.youtube.com/watch?v=iaHqPxfGyhw&amp;feature=emb_title">https://www.youtube.com/watch?v=iaHqPxfGyhw&amp;feature=emb_title</a>
Liceo Scientifico Labriola di Napoli: Meeting with experts	<a href="https://www.youtube.com/watch?v=UhdXYNvdZIE&amp;t=189s">https://www.youtube.com/watch?v=UhdXYNvdZIE&amp;t=189s</a>
Liceo Scientifico Labriola di Napoli: Meeting with experts	<a href="https://www.youtube.com/watch?v=y9MAW38TD-o">https://www.youtube.com/watch?v=y9MAW38TD-o</a>

## 6.3 S.W.A.R.M User Guide



# SNAC

**School Networks Alert Citizens protection**

### **S.W.A.R.M USER GUIDE** **Seismic Wave Analysis and Real-time Monitoring**

#### **Prologue**

Since 2015, the Geodynamic Institute of the National Observatory of Athens in collaboration with the Department of Research and Development of Greek-German Education, have developed and coordinated a European collaboration through which school seismographs operate in educational networks. Today the network includes 61 school seismographs covering the entire extremely seismogenic region of the Eastern Mediterranean and operates in a total of 5 countries (Greece, Cyprus, Italy, Turkey, Bulgaria).

The actions of the School Seismograph Network are supported by the European project Erasmus + School Networks Alert Citizens-SNAC and the Horizon 2020 OpenAIRE-Advance project, through which the data resulting from the school seismograph network are hosted with open access and in editable format. HELIX (Hellenic Data Service) platform, thus enabling teachers to include them in the student process. In addition, students have the opportunity to publish their research papers in the Open Schools Journal for Open Science (OSJ) describing the scientific methodology they have followed.

SWARM (Seismic Wave Analysis and Real-time Monitoring) is an Open Source Java application designed to make the simplest tools used in seismology easily accessible to amateur seismologists and students. Developed in 2004 and 2005 at the Alaska Volcano Observatory by Dan Cervelli, Peter Cervelli, Thomas Parker and Thomas Murray.

The SWARM Installation and Use Guide, presents in simple and understandable steps all the procedures that must be followed in order for the application to be installed correctly and for teachers and students to be able to study waveforms from earthquakes that have occurred in the past, to watch real-time seismograph recordings of the school network and learn to locate the epicenter and magnitude of each earthquake in different ways.

## SWARM in 60 steps



1. There are two ways to find the SNAC page:
  - a. Via OSOS, in the SCHOOLS STUDY EARTHQUAKES community:  
<https://portal.opendiscoveryspace.eu/en/community/schools-study-earthquakes-849203>.  
 Here you can see the latest news of the network, the registered members, the activities that have taken place, as well as submitted projects.  
 Going down to the same page, you will find the map with all the seismographs of the Network, which extends from the Azores in the Atlantic Ocean to the depths of Eastern Turkey and is constantly expanding with new stations.  
 By clicking on a station you can see the exact location of the seismograph, as well as its recording in real time!  
 It is important to visit the Community, as there you will find instructions, lesson plans and other resources, which you can freely use and enrich.  
 Additionally, if you subscribe, you can create your own sub-community.
  - b. Once registered in the Community, you can then access the SNAC page from the following link:  
<https://snac.gein.noa.gr/>
2. We go to the SOFTWARE menu and we download the two files we find there:
  - a. SWARM SOFTWARE (**swarm-2.8.10-SNAPSHOT-bin.zip**)
  - b. SWARM MANUAL (swarm\_v2.pdf)

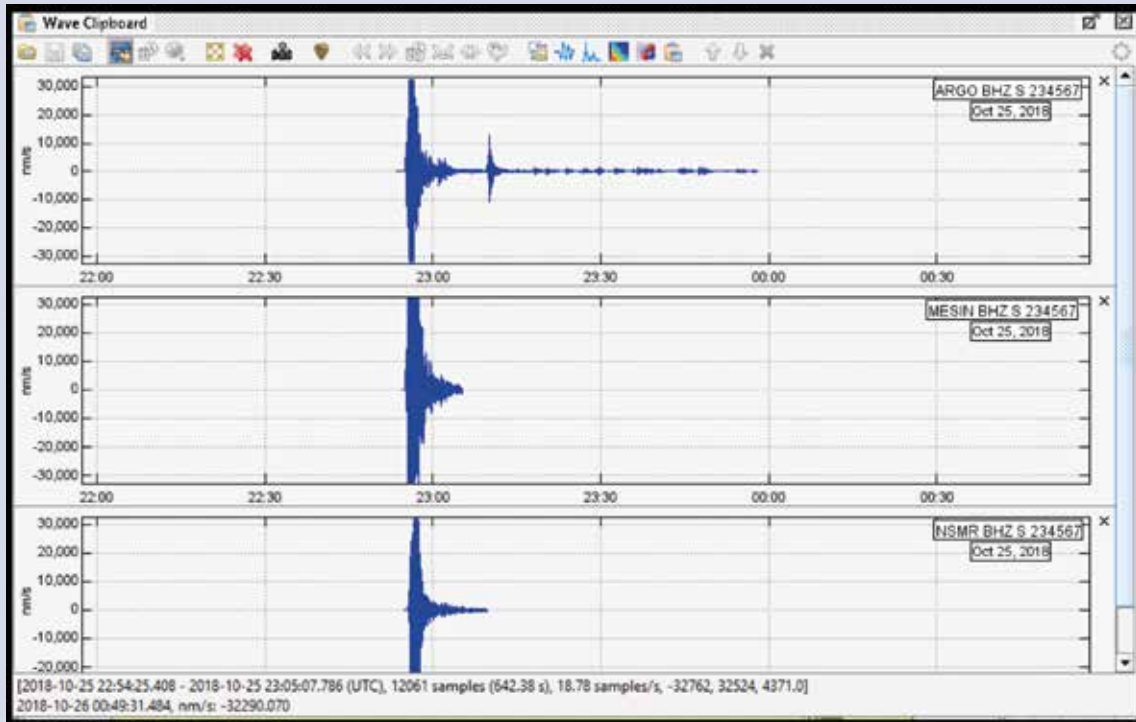
We recommend that you create a folder on the desktop called SWARM, so that you can save there all the files you will need for the proper operation of the program.
3. From the same SOFTWARE menu, go to JAVA Download, download the file and proceed to the installation of JAVA by “running” this file that will be downloaded. The procedure described in step 3 does not need to be repeated next time.
4. Now we have to connect to the internal network of the National Observatory, through a special software.
5. Inside the folder we will find the subfolder swarm-2.8.10-SNAPSHOT-bin and inside there the subfolder swarm-2.8.10-SNAPSHOT. There is the file SNAC PLATFORM VPN SETUP.pdf. Follow the detailed instructions found in this file:
  - a. We download **SoftEther VPN Client** from the following link: <https://www.softether.org/5-download>.
  - b. We choose “Download SoftEther VPN”.
  - c. In “Select Component” we choose **SoftEther VPN Client**
  - d. In Select Platform we select **Windows**
  - e. A link is created with bold blue characters. Click on the link and the software downloads.
  - f. We proceed with the installation, running the file and constantly selecting “next”.
6. We run **SoftEther VPN Client**
  - a. We choose **Add VPN Connection** (with double click) and then “Yes”
  - b. It asks us for a name for the virtual network. We leave the “VPN”
  - c. The **VPN Client Adapter is created**. We double click on it
  - d. In the following screen we use:
    - i. Setting Name: **SNAC**
    - ii. Host Name: **194.177.194.46**
    - iii. Port Number: **5555**
    - iv. Virtual Hub Name: **VPN**


- v. User Name: **SNACERASMUS** (one word)
- vi. Password: **You will get it by email.**
- e. Choose “OK”
- f. The **connection SNAC** has been created
- g. We right click on it and select “**Connect**”
- h. We get the message «**Welcome to GEIN**».
- i. We choose **OK** and we are ready.

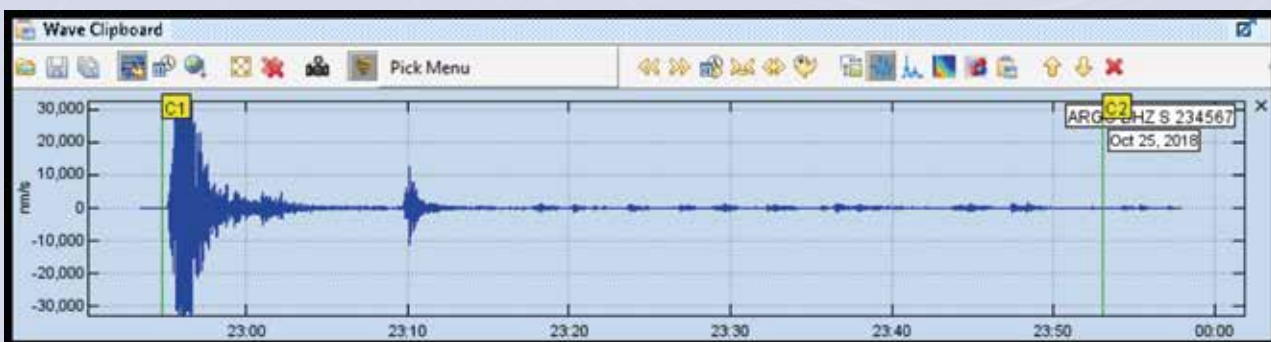
*The procedure described in steps 6 and 7 does not need to be repeated next time. Just before running SWARM, check if we are connected to the VPN (step 7g): we need to run the SoftEther VPN Client and the indicator is “connected”.Επιστρέφουμε στον φάκελο **swarm-2.8.10-SNAPSHOT***

- 7. We are running the swarm\_console.bat file. If we want we can make a shortcut from this file on our desktop. In case there is a firewall, we give access by pressing “OK”.
- 8. The maximize the screen to see the map better.
- 9. We can, with the icons on the window, enlarge and reduce the map.
- 10. If we want to see the data from the seismographs of the SNAC network, in the left part of the screen we make two clicks on the HL.
- 11. We see all the installed seismographs of the SNAC network!
- 12. By clicking on the “+” and double clicking on the link that appears, we see in real time the recordings of any seismograph we want.
- 13. Let us now learn how to find the magnitude and epicenter of an earthquake through the use of three waveforms. For this purpose we have created an example. Detailed instructions can be found in the file SNAC\_SWARM\_PLATFORM\_EXERCISE.pdf, which is located in the swarm-2.8.10-SNAPSHOT folder
- 14. Go to the File menu, select Open File.
- 15. Through the search engine, find the **swarm-2.8.10-SNAPSHOT** folder (created on the desktop) and select the **Example - SAC Data** subfolder. It contains three (3) .sac files (is the special type of waveform files). Open all 3 files, one by one (by selecting it and pressing OK) or all together (holding down the Ctrl key).
- 16. Now, on the left side of the screen, below “ALL” we see the three waveforms we previously loaded. (**ARGO, MESIN and NSMR**).
- 17. We select (with double click) the first **SNSM BHZ HL 01**. A new window opens.
- 18. In this new window, there is a “bar” of options at the top. By placing the cursor over each one, the name of each option is displayed.
- 19. Select the second icon “**Helicorder View Settings**”. In the **Zoom option**, seconds put the value “5400” and press “OK”
- 20. We repeat steps 20 and 21 for the other two waveforms (If the window that opens appears empty, follow step 21 again and the waveform will appear.
- 21. We now have three windows open, with three waveforms, one for each file.
- 22. Let’s use the first window
- 23. Right click on the waveform and a new window will appear. From the options bar of the window we select the yellow icon  “**Copy Inset to clipboard**”.
- 24. A new “**Wave Clipboard**” window opens.
- 25. Repeat step 23 for the other two waveforms.
- 26. We choose the icon Pick Menu  and we enable the pick mode  **Pick Menu**  
This icon turns Pick Mode on and off.
- 27. From the **Pick Menu**, select “**Settings**”, and set the value “10” in all fields (if different).

- 28. When **Pick Mode** is off, with the icons  “**Open or close**” the graphs to see in more detail the evolution of the phenomenon over time. We center them with the icons . We can also use the “**arrows**” on the keyboard. This will help us in the next step to select specific points of the graph.
- 29. Now, the **Wave Clipboard** should look like this:

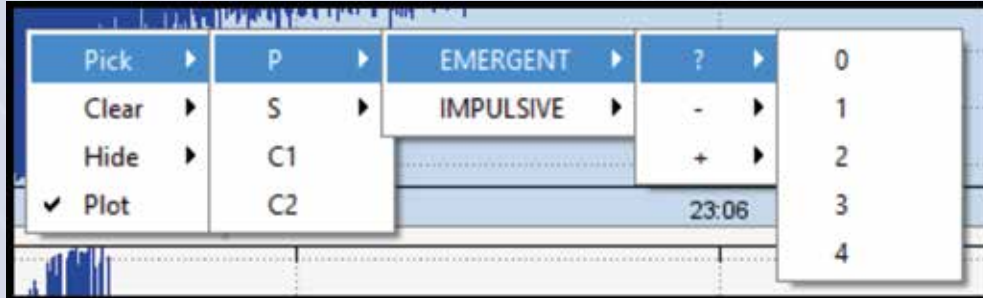


- 30. Another useful tool is that of synchronizing the three waveforms on the clock icon: . At any time we can copy the format of the waveform we are working on and ask the program to present the other two waveforms with time and format in sync. In this way, the difference of a few seconds of the arrival of the seismic waves in each seismograph is obvious. This time can be valuable for receiving alerts shortly before an earthquake strikes an area and for activating security systems.
- 31. The next step is to place the cursor on the graph. For our example we start from the graph “ARGO”. A thin red line appears. With a simple click, we start editing the graph we want.
- 32. We place the line at the point where the wave starts. (i.e. where it is no longer a simple straight line). Right click and select in order: **Pick** → **C1**.

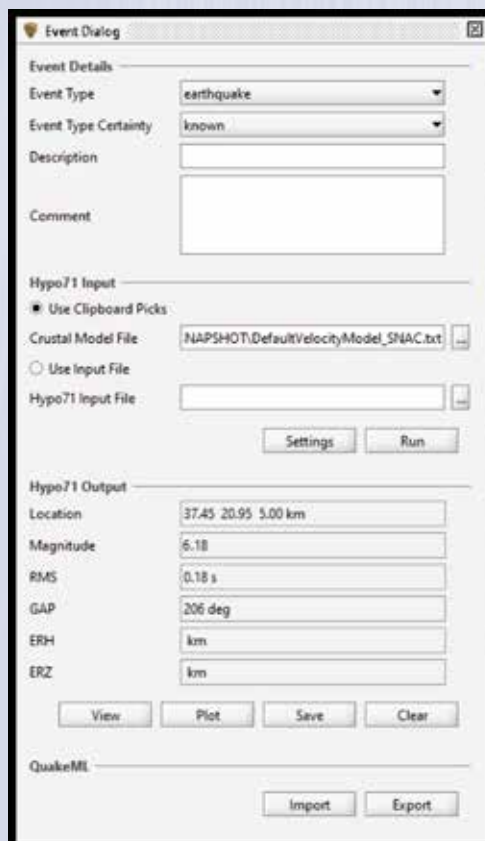


- 33. We place the line at the point where the wave ends (including the aftershock). Right click and select in order: **Pick** → **C2**.
- 34. Here we can use the tools described in step 21 to magnify the wave and easily locate the beginning (**C1**) and end (**C2**) of the wave.

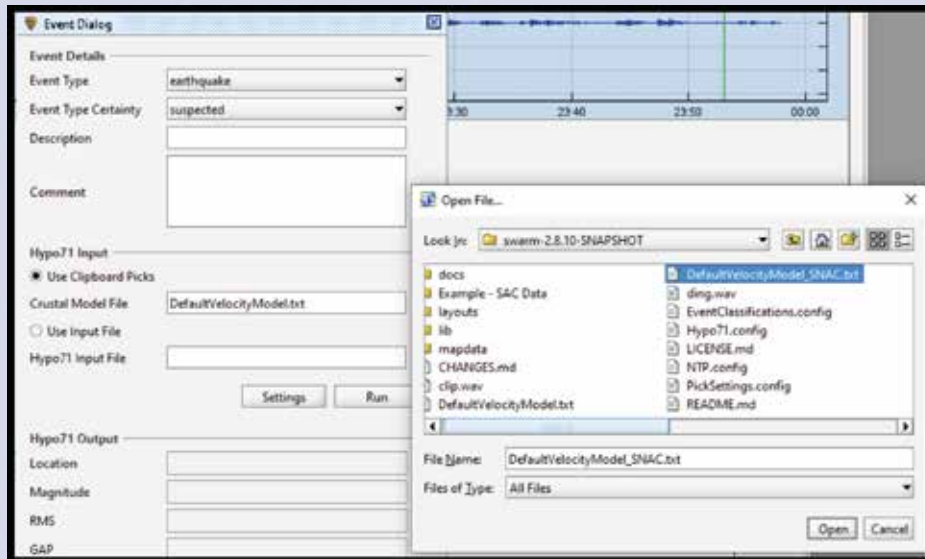
35. Now we have to locate the **P waves** in each graph.
36. We select with a simple click the waveform in which we want to work.
37. We go to the beginning of the wave (where the line stops being straight) and right click and follow the steps. **Pick→P→EMERGENT→? → 0**.



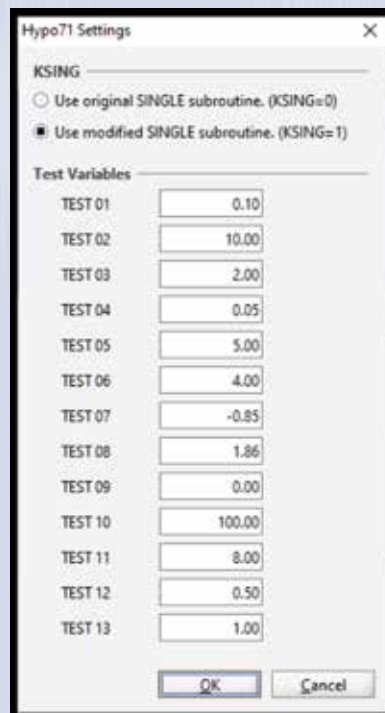
38. Repeat the process for the other two waveforms.
39. We return to the Pick Menu and choose “**Open Event Dialog**”.
40. In **Event Type** we choose “**Earthquake**”. In **Event Type Certainty** we choose “**Known**”.



41. In **Hypo71** we should import the file **DefaultVelocityModel\_SNAC.txt** that we will find in the folder **swarm-2.8.10-SNAPSHOT**. To do this, click on the icon with the three dots and find the file in question.



42. We check again **Settings** and examine if we see the following numbers:







49. On the SNAC page we have included a database of old earthquakes, which can be found in the menu “**Data Download**” and in particular in the option **SSE Data**. There you will find historical .sac files that you can import into SWARM the way we showed you.
50. Finally, very important is the possibility given to us by the builder, which we can visit through the same menu “**Data Download**”, selecting “**School Network Data**”.
51. Here we need to enter the initial and final period for which we want to get data from any seismograph in the network.
52. If we know exactly when the earthquake we want to study happened, we can ask the **Builder** to bring us the data a few seconds before and a few minutes after, in order to limit the size of the file and the graph to be edited.
53. The Geodynamic Institute of the National Observatory offers us a list of all earthquakes that take place in Greece. You can find him here: <http://www.gein.noa.gr/el/seismikotita/katalogoi-seismwn>. Always remember to be connected to the **Observatory’s VPN**.
54. Let’s say for example that we want to study the earthquake that occurred on **4/2/2020 at 17:55** with a magnitude of **4.8**. Our school seismographs must have recorded it.
55. To find the network and the code of our seismograph, go to the SNAC page and select “**SCHOOLS LIST**”. We see for example that in the **1st High School of Vrilissia**, in the Station column, the code is **AM.R4F38**.
56. We return to the **Builder** and we import:
  - a. **Start Time:** Select the date and then manually enter the time. Let’s put **17:54:00**
  - b. **End Time:** Select the date and then manually enter the time. Let’s put **18:30:00**
  - c. **Network: AM**
  - d. **Station: R4F38**

**SeisComP3 FDSNWS DataSelect - URL Builder**

**Time constraints**

Start Time

End Time

**Channel constraints**

Network

Station

Location

Channel

**Service specific constraints**

Quality

Minimum Length (s)

Longest Only

Authentication

**Output control**

Format

No Data 404

**URL**

<http://10.0.0.235:8080/fdsnws/dataselect/1/query?nodata=404>

57. Automatically, a link is created at the bottom of the screen, which we select and download a file named **fdsnwa.mseed**. We can rename the file to something more descriptive. Eg **vrilissia4feb.mseed**
58. We repeat the steps and “**download**” two more waveforms, entering the same time period and using different seismographs.
59. We import, as we have learned the three waveforms in **SWARM** and calculate the Magnitude and the Epicenter!
60. You can also use the [SNAC Automatic Alerts System](#) to find .sac files and import them to S.W.A.R.M!

