

# Live data education experience with the “Earthquake Suitcase” and “Raspberry Shake and Boom”

V. Kouskouna<sup>1</sup>, H. Ridge<sup>2</sup>, V. Kapetanidis<sup>1</sup>, N. Galanos<sup>1</sup>, G. Sakkas<sup>1,3</sup>, N. Sakellariou<sup>4</sup>

<sup>1</sup>National and Kapodistrian University of Athens, Greece, <sup>2</sup>Boulder Valley School District, Boulder Colorado, USA, <sup>3</sup>Center for Security Studies, Athens, Greece, <sup>4</sup>Museo Nacional de Ciencias Naturales, Madrid, Spain

### ABSTRACT

Using live data in secondary school science lessons adds relevancy and real-world experience to classrooms. It also demonstrates how a global network of scientists may collaborate and share observations to increase our understanding of natural phenomena. In this project, supported through Fulbright’s alumni network and part of their Global Teacher Grant, secondary school students in Kefalonia and Ithaca, Greece, used Raspberry Shake and Boom devices to look at real-time data of plate tectonic movement and earthquake activity, and explored the contents of the traveling Earthquake Suitcase by simulating an earthquake on a shake table and recording it on an accelerometer.

Prior to school visitations, teachers participated in virtual trainings to learn about how the Raspberry Shake and Boom device can be used to both simulate earthquake data as well as record actual seismic activity and upload it to a global network of live data. Teachers and students can access the real-time data from all over the world, including from stations in their area, and use this data for classroom instruction.

During classroom lessons, students learned how to interpret seismograms, including using P-wave and S-wave intervals to triangulate an epicenter and relate concepts like amplitude and duration to a seismogram.

As part of the classroom lesson, the earthquake suitcase contains a shake table with an accelerometer. Two model buildings of different vulnerability are mounted on top of the moving platform and various earthquakes are simulated. Students discuss the response of buildings to different levels of shaking and relate this to antisismic construction. Finally, the contents of the “Earthquake Emergency Bag” are presented, which review a family earthquake emergency plan to fill in at home, as well as essential items that should be assembled for use during and after an earthquake emergency.

### Layout

#### IN SITU VISITS

#### INCLUSIVENESS

the quality of including many different types of people and educating them all fairly and equally

**Dual objective:**  
 ✓ Train the trainers  
 ✓ Train the students

#### Step 1: Pre-visit

- Pre-visit communication with educators
- Pre-visit train the trainers

#### Step 2: Visit

- Introduction to earthquakes basics
- Live data experience
- The earthquake suitcase

#### Step 3: Post-visit

- Additional material to students
- Additional material to educators
- Students evaluation and suggestions
- Educators evaluation and suggestions

## Part I: Live data education: the real time data experience

Prior to school visitations, teachers participated in virtual trainings to:  
 - define the level of their students knowledge on earthquakes  
 - get access to teaching material  
 - learn about how the Raspberry Shake & Boom device can be used to both simulate earthquake data, as well as record actual seismic activity and upload it to a global network of live data.

**Σεισμοί – βασικές γνώσεις**  
 Τι είναι οι σεισμοί;  
 Πώς γίνονται οι σεισμοί;  
 Γιατί έχουμε σεισμούς;  
 Πώς μετράμε τους σεισμούς;  
 Ποια είναι τα μέτρα προστασίας μας;

**Σεισμοί – ανώτερες γνώσεις**  
 Ποιες είναι οι βασικές έννοιες της σεισμολογίας;  
 Ποιες είναι οι βασικές έννοιες της γεωλογίας;  
 Ποιες είναι οι βασικές έννοιες της γεωφυσικής;  
 Ποιες είναι οι βασικές έννοιες της γεωτεχνικής;

#### LAB ACTIVITY

**Παρακολούθηση κυματοφόρου**

Διάρκεια: 15 λεπτά

Ερωτήσεις: 1. Ποια είναι η μορφή του σεισμογράφου; 2. Ποιες είναι οι βασικές έννοιες της σεισμολογίας; 3. Ποιες είναι οι βασικές έννοιες της γεωλογίας; 4. Ποιες είναι οι βασικές έννοιες της γεωφυσικής; 5. Ποιες είναι οι βασικές έννοιες της γεωτεχνικής;

**Watching Waveforms**

How is the size and shape of spikes on the seismogram affected by ground motion from jumping with more people (greater mass)?

At the same distance from the seismograph, a greater mass of jumpers creates a larger spike.

### RaspberryShake station view

<https://stationview.raspberrypi.org/#?lat=37.96690&lon=28.78470&zoom=19.834&sta=R620E>

Click the link next to “Live Streaming” for real-time waveforms/spectrograms view

You can select station (e.g. R620E) and channel (e.g. EHZ) to plot the respective waveforms and spectrograms

### Raspberry Shake in Kefalonia



### Part II: The Earthquake Suitcase

The Earthquake Suitcase, an educational system for information about - and familiarization with - earthquakes, was designed and integrated in the Laboratory of Seismology, Department of Geology and Geoenvironment, National and Kapodistrian University of Athens.

The Suitcase contains educational material, such as interactive educational toys, an experiential shake table for earthquake simulation with a model accelerometer recording in real time, the simulation and model structures of different vulnerability, books, leaflets, the Family Emergency Plan, and an earthquake emergency bag.

During classroom lessons, students learn how to interpret seismograms, including using P-wave and S-wave intervals to triangulate an epicenter and relate concepts such as amplitude and duration to a seismogram.

The training is conducted by the specialized staff of the project’s scientific team. During the training and, in collaboration with the educators in charge, the effectiveness of the earthquake suitcase is evaluated, with the students drafting their own individual emergency plan.

Educational applications to schools in Greece and the US (Boulder, CO), the Researcher’s Night and the Athens Science Festival are presented.

The Earthquake Suitcase project was sponsored by the Hellenic Petroleum Group and the US Department of State.

<https://www.youtube.com/watch?v=VW28L1B1TQ>

### The “Earthquake suitcase” is a travelling laboratory especially designed for educational purposes.

The tool aims in educating youth at remote localities, unable to reach a museum or an institute.

Prepare for the earthquake!  
 The earthquake suitcase

Developed in 2019

### The earthquake simulator

manual rotation

Moving surface

fixed surface

model buildings of different vulnerability

3D accelerometer

Accelerogram

Spectrum

An updated version of the earthquake simulator is equipped with a motor to produce the shaking.

### Reading Material

The suitcase also includes a presentation and videos of the earthquake basics (why, how and where a large earthquake occurs, its effects on people, objects and buildings/infrastructure), reading material, hands-on exercises and instructions on how to build a family emergency plan, interactive educational toys and leaflets and the earthquake emergency kit.

Earthquake Emergency kit

## EARTHQUAKE INTERRUPTION: A LIVE DATA LESSON WITH THE RASPBERRY SHAKE AND BOOM

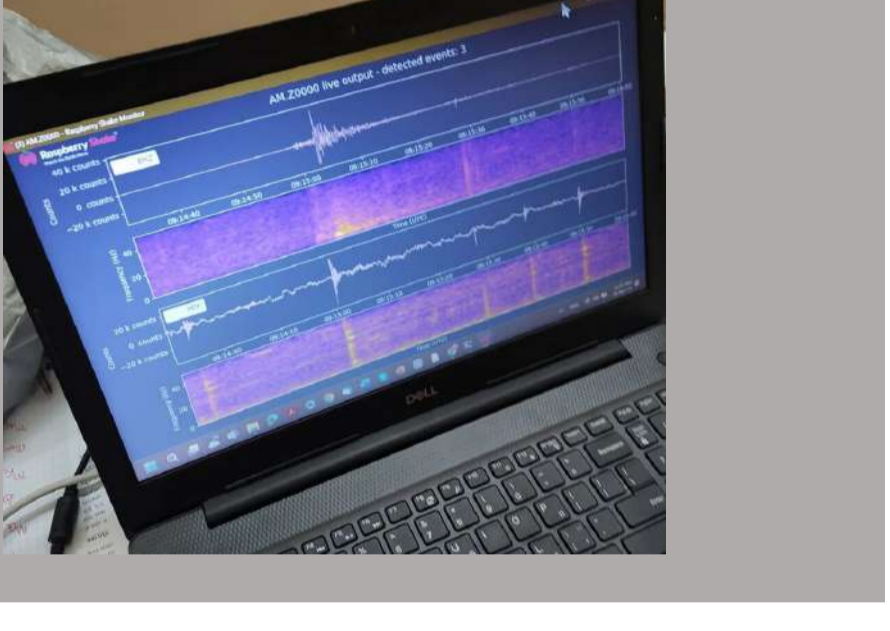
<https://raspberrypi.org/earthquake-interruption-data-lesson-with-raspberry-shake/>

Students at Argostoli 1<sup>st</sup> Junior High School on the island of Cephalonia, Greece are experts on earthquakes. Living in one of Europe’s most seismically active spots, they know how earthquakes occur and how to stay safe during and after a quake.

On April 16<sup>th</sup>, they were learning how to read seismograms and were excited to use the live data on seismic activity thanks to the RSB device visiting their school that day. Little did they know how “live” that data would be!

In the middle of the lesson, a 2.4 magnitude earthquake shook the island, and gave students and the instructors a seismogram they could use and share with researchers all around the world.

“If it would have been in a Hollywood movie I would have said: “Too incredulous!”  
 J. Mijderwijk



Manual solution for event: rca20240416

Location: 8.17m WSW from Rassa Kefalonia  
 Magnitude: 2.4 Mw  
 Origin Time: 16/04/2024 08:36:49.52 (GMT)  
 Latitude: 38.25279  
 Longitude: 20.4552 E  
 Focal Depth: 0.0 km  
 Type: Normal

Map: Solution Details

After getting the chance to create their own waves, students were returning to their seats when a doorbell noise from the Raspberry Shake and Boom alerted them to a surprising guest. An earthquake!

The students’ eyes widened, and they looked at each other in confusion.

It was a real earthquake, right in the middle of their lesson about earthquakes! Everyone watched the screen. The seismogram showed the dramatic spikes, capturing the moment the Earth had moved beneath their feet. As the earthquake was a small magnitude offshore event, they had not felt it, but it was recorded by the Raspberry Shake and Boom.

The real-life demonstration left a lasting impression on the students.



### Feedback

What additional materials or resources would be valuable to you in the future? Ποια από τα παρακάτω επιπρόσθετα στοιχεία θα σας ήταν πολύτιμότερα στο μέλλον; Ποια από τα 3 απαντήσεις

66.7%

33.3%

- Presentations about earthquakes / Παρουσιάσεις για τους σεισμούς
- Links to live data of seismograms from seismological centers / Σύνδεσμοι με δεδομένα σεισμογραφημάτων σε πραγματικό χρόνο από σεισμολογικά...
- Additional lessons and activities you can do in your classroom with students / Πρόσθετα μαθήματα και δραστηριότητες...
- Nothing / Τίποτα

### Remarks-Conclusions

- The multiple goals achieved with such activities are to educate students on what an earthquake is, where, how and why earthquakes occur, and the preventive measures to be taken.
- The students gain experience through earthquake simulation by creating their own earthquake, familiarize themselves with the feeling of an earthquake, and learn the necessary self-protection measures.
- The earthquake lesson can act as a unified paradigm for both individuals and groups that provide direct educational or humanitarian services to youth, and for the youth themselves
- Specific benefit of the workshop/training that could be turned into a sustainable one for long-term benefit - building resiliency
- Open-up to community: bringing together educators, students, parents and scientific community
- Train the trainers
- Involving citizens of all ages in science

### Grants Competition!

2022 - 2023

55 PROJECTS  
 29 COUNTRIES

Heather Ridge  
 Vicki Kouskouna

GLOBAL TEACHER GRANTS

FULBRIGHT

Fulbright Alumni Network project supported through the Global Teacher Grant of the US Department of State