

Geoscience practical activities on natural hazards in a rapidly changing world

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EGU - GEFO

Geoscience Information for Teachers | Vienna 25th April 2023



Meetings | Publications | Outreach | www.egu.eu

EGU and the birth of GEFO Programme

- Among the different STEM subjects, **geosciences are probably the most neglected**, both in school curricula and in the teaching practices of many countries.
- 2019 - **EGU** launched a programme with the objective to promote geoscience education in Europe and beyond, creating a first group of teacher trainers, the **Geoscience Education Field Officers (GEFO)** in 6 countries (France, India, Italy, Morocco, Portugal, and Spain) with the support of the International Union of Geological Sciences (**IUGS**) and the International Geoscience Education Organisation (**IGEO**).



1st GEFOs' trainee (Vienna, 2019)



- 2020/2022 - Due to its success, a second call was open and **13 new GEFO** were appointed to represent Albania, Burkina Faso, Chile, Colombia, Estonia, Germany, Greece, India, Malaysia, Romania, Togo, Turkey, and the United Kingdom.

New GEFOs' trainee (Barcelona, 2022)

21 Geoscience Education Field Officers in the world EGU + IUGS-COGE

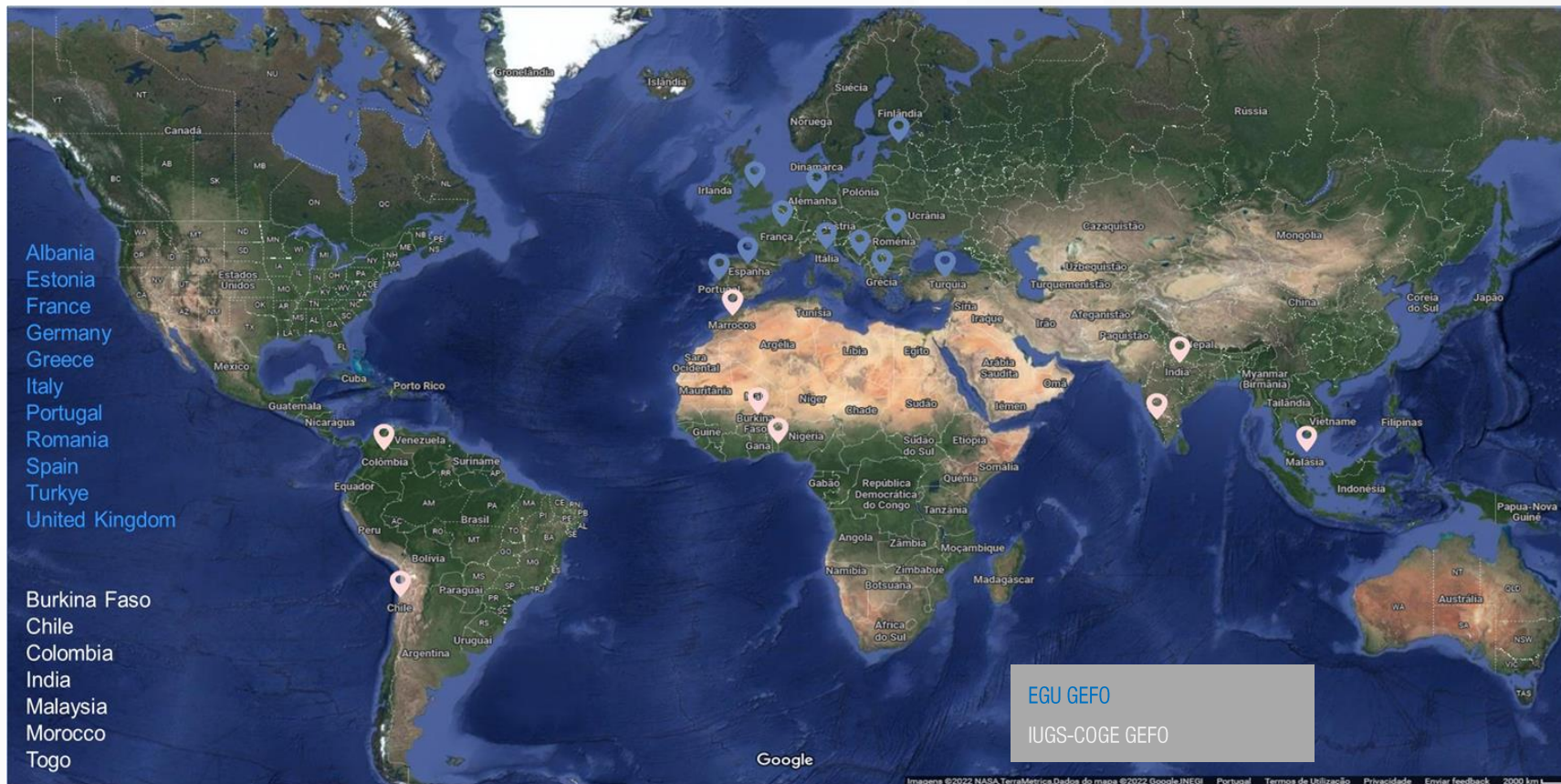


Image: Google Earth, Gina P. Correia



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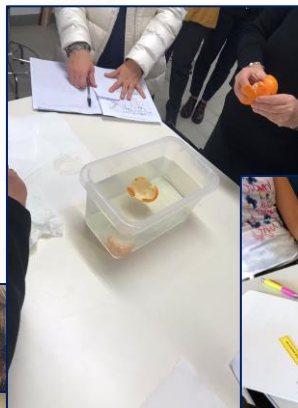
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Goal:

providing professional development for school teachers and future teachers, from primary to secondary schools, in teaching the elements of geoscience appropriate for their teaching curriculum, through interactive workshops.

- GEFOs offer face to face and online workshops at national and international level.



Workshops:

- Interactive
- Hands-on
- Activities: practical, simple, requiring max. one teaching time
- Materials: inexpensive, easy to obtain/build and/or readily available in normal school classrooms and science labs.

Topics:

Plate tectonics | Rock cycle | Seismology | Time Scale and history of Earth | Volcanology | Hydrology and oceanography | Earth in space | Natural hazards | Geopark training courses



Images: examples of workshop materials, Chris King, ESEU

- GEFOs promote geosciences teaching by presenting GEFO programme in National and international Conferences and magazines.

Conferences

Publications

EGU CoE Webinar, 2020

My experience as a Geoscience Education Field Officer

VIII ENEC / III ISSE, 2020. Porto, Portugal

EGU Geoscience Education Field Officers

Nuova opportunità per la formazione in servizio dei docenti : Il programma EGU Geoscience Field Officers

Le Geoscienze a Scuola, 2019. Parma, Italy

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¹Università di Camerino-Sezione di Geologia, Gruppo di lavoro UNICAMearth
²Università G. Marconi, Roma

Networking for More Geoscience in School Education
 The Geoscience Education Field Officer Initiative

GeoMinköln, 2022. Germany

İlk Ve Ortaokul Öğretmenlerinin Yerbilimleri Eğitimi

74th Geological Congress of Turkey. 2022, Ankara, Turkey

Candan Kafalı
 Fen Bilimleri Öğretmeni
 EGU Türkiye Saha Görevlisi

Abstract
 The geoscience plays a critical role in society and its sustainable development, it is a cross-cutting discipline that provides a comprehensive understanding of the Earth system and its evolution. Geoscience education is essential for the development of a sustainable society and for the promotion of geoscience literacy. This paper presents the results of a survey conducted in 2020 among geoscience teachers in Portugal, Italy and Spain. The survey aimed to assess the current state of geoscience education in these countries and to identify the challenges and opportunities for its improvement. The results show that geoscience education is still limited in most countries, with a focus on basic concepts and a lack of practical and interdisciplinary approaches. The authors discuss the need for a more integrated and multidisciplinary approach to geoscience education, involving teachers, researchers and the public. The paper also presents some recommendations for the improvement of geoscience education, such as the development of teacher training programmes, the use of innovative teaching methods and the promotion of geoscience education in the media and in the public sphere.

Science in School
 The European journal for science teachers
 ISSUE 54 | 01/09/2021
 Topics Chemistry | Earth science | Science and society

EGU (European Geosciences Union) Geoscience Education Field Officer program appreciation, perceptions and impact
 Giulia Realdon¹, Guillempe Coscocheva², Gini P. Cornejo³, Xavier Jauss³ and Chris King³

Abstract
 The geoscience plays a critical role in society and its sustainable development, it is a cross-cutting discipline that provides a comprehensive understanding of the Earth system and its evolution. Geoscience education is essential for the development of a sustainable society and for the promotion of geoscience literacy. This paper presents the results of a survey conducted in 2020 among geoscience teachers in Portugal, Italy and Spain. The survey aimed to assess the current state of geoscience education in these countries and to identify the challenges and opportunities for its improvement. The results show that geoscience education is still limited in most countries, with a focus on basic concepts and a lack of practical and interdisciplinary approaches. The authors discuss the need for a more integrated and multidisciplinary approach to geoscience education, involving teachers, researchers and the public. The paper also presents some recommendations for the improvement of geoscience education, such as the development of teacher training programmes, the use of innovative teaching methods and the promotion of geoscience education in the media and in the public sphere.

Geoscience Education Field Officer

EGU GEOSCIENCE EDUCATION FIELD OFFICERS
 Gini P. Cornejo¹ & Chris King²
¹EGU Geoscience Education Field Officer, CITEUC - Centre for Earth and Space Research of the University of Coimbra (PORTUGAL)
²EGU Committee on Education (COE), Emeritus Professor of Earth Science Education, Keele University (UNITED KINGDOM)

Abstract
 As a strategy to support geoscience education across Europe and beyond, the European Geosciences Union (EGU) Committee on Education has developed a new project involving Geoscience Education Field Officers (GEFOs). In the first pilot year, four FOs have been appointed and trained: in Portugal, France, Italy and Spain. They will represent EGU in their countries with the main purpose of providing professional development to school teachers and their teaching practices. This project is also supported by the International Union of Geological Sciences (IUGS) and the International Geoscience Education Organization (IGEO). Meeting two FOs from Italy and Morocco to be included in the team. The Earth science education workshops (EduE) by FOs are based on the experience of the Earth Science Education Unit (ESEU) (<https://www.euseuonline.com/>) in the United Kingdom and have been presented to nearly 45,000 teachers and trainee teachers across that country (King, 2007; Thomas & King, 2012). Participants provided consistently excellent evaluation feedback, with the post-training skills obtained allowing a real change in classroom teaching (Lisboa & King, 2020). The EduE workshops are based on practical, hands-on, interactive teaching materials and are structured designed to generate critical thinking skills, knowledge and understanding. The activities and materials also do not require any additional resources and are readily available in normal school classrooms and science labs. FOs present the workshops at conferences of school teachers and science classes across their countries in order to promote it in their national language. The two-hour interactive workshops to conference participants and to pre-service teachers. The workshop topics include the geoscience curriculum contents such as Plate Tectonics, Rock cycle, Seawater, Time scale and history of Earth and Volcanology, but FOs are also able to promote GeoPark training courses. From each workshop presented, FOs will collect evaluation data and will provide simple analyses to assess the development of the project. Each FO is supported by a small group of national scientists who help them to prepare and implement the workshops, and by the Earth Learning Log website where most of the teaching activities are published in a range of languages, including Portuguese. FOs are also supported by the new European Chapter of IGEO which is being developed by EGU member. The Chapter brings together organizations supporting geoscience education across Europe including the Associação Portuguesa de Professores de Biologia e Geologia (APPOG) in Portugal and organizations in Belgium, France, Italy, Spain and the UK. Further details of all the activity will become available when the EGU website education pages are redeveloped (EGU website).

Keywords: Earth Learning Log, Earth-science Education, European Geosciences Union, Training, Workshops

REFERENCES
 EarthScienceWeb website: <https://www.earthscienceweb.com/> (last accessed May 2019)
 European Geosciences Union (EGU) website: <https://www.eurogeo.org/> (last accessed May 2019)
 King, C. J. H. (2007). Evolving Geology: a 100-year-old profession in decline: an experience of the Earth Science Education Unit (ESEU). *Environmental Geology*, 52(1), 1-10.
 King, C. J. H. & Thomas, A. (2012). Earth Science Education Unit workshops - an evaluation of their impact. *Science Review*, 14(247) 25-25.

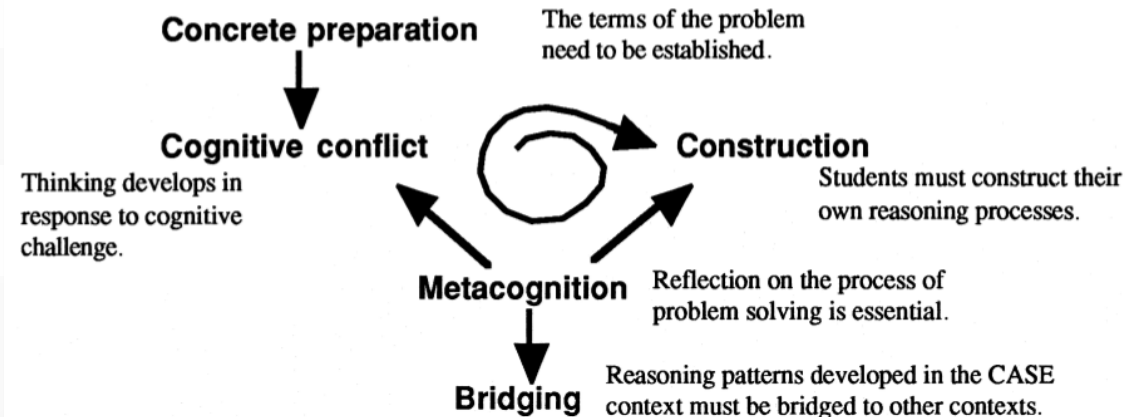
Workshop theoretical base: the CASE model

CASE - Cognitive Acceleration through Science Education Programme

- Aimed at the development of cognitive skills **through** science teaching
- Based on the work of educational psychologists Piaget and Vygotsky
- Successfully tested in the '90 in UK and used worldwide

The five pillars of CASE methodology

- 1. Concrete preparation:** preparing the ground, ensuring familiarity with the apparatus, the terminology, and the problem being addressed.
- 2. Construction:** collecting data and detecting patterns in the data.
- 3. Cognitive conflict:** when new data does not fit the expected pattern, challenging students' previous knowledge.
- 4. Metacognition:** reflecting on one's own thinking, verbally or on paper.
- 5. Bridging:** applying this new understanding to new contexts and to the real world.



Earth Learning Idea : 15 years on and still going strong!

The ELI team - Chris King, Peter Kennett, Elizabeth Devon, Pete Loader.

The **EARTHLEARNINGIDEA** ("ELI") concept was born in 2007 following a failed bid by the International Geoscience Education Organisation (IGEO) to present Earth science teaching workshops, to teachers in developing countries during the 2008 International Year of Planet Earth. Masterminded by the late Professor Chris King and two colleagues on a volunteer basis, the initial plan was to publish a new activity every week for the year on a specially designated website. Each activity presented an Earth science topic using an interactive, inquiry-based approach to educate and motivate pupils, whilst developing their thinking and investigative skills.

Secondary age (11-18 yrs) activities



There are now over 400 activities, many with accompanying teaching videos (based on the CASE model), and extension ideas. All are FREE to download with a new topic published every two weeks. Most are aimed at teachers and teacher trainers in developing countries and so use simple apparatus that might be available in classrooms with few resources, whilst focusing on fairly simple ideas. They are designed to cover the geoscience curricula of Primary to Upper Secondary education.

Great Soil Race



Primary/Junior age (5-11 yrs) activities



Innovative, Earth-related teaching ideas website




www.earthlearningidea.com
Earth Learning Idea
Innovative, Earth-related teaching ideas

EST A Earth Science Teachers' Association

EGU European Geosciences Union

ELI PAGES CHILDREN'S FUN RESOURCES TRANSLATIONS ELI IN THE WORLD

Keyword Search
Topics Alphabetical Index

The ELI Blog

Brickquake Video

Natural Hazard ELIs

Free open-source textbooks

Exploring Geoscience Across the Globe

Exploring Geoscience Across the Globe

Chris King

Chris King

Future Earthlearningidea activities



Critical minerals series



The Earthlearningidea in Feb 2023 :

- ELIs in English are currently being published at one per fortnight; over 400 English activities have so far been published
- ELI PDF, videos and PowerPoint files have been downloaded more than 6.2 million times
- ELI has been accessed in most countries and more than 12,500 cities globally
- ELIs have been translated into 10 other languages: Spanish, Catalan, Norwegian, Italian, German, Portuguese, Polish, Japanese, South Korean
- ELIs have been used as the basis of teacher training education workshops in many countries

Mining and the Green Revolution



Contact details

Web: www.earthlearningidea.com
Follow us on Twitter: @ELI_Earth
E-mail: pete@Earthlearningidea.com



Free open-source textbooks

Exploring Geoscience Across the Globe

Activities and questions

Chris King

Exploring Geoscience Across the Globe

Chris King

Chris King

New in 2023
Our website now includes videos of many of our activities in action



Natural Hazard ELIs

Sink Holes

Spaghetti Quakes

Quake Shake

Slinky Seismic waves

Tsunamis Alert!

Lava Simulation

Geoscience Education Field Officers: the activities repository



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Innovative, Earth-related teaching ideas



[ELI pages](#)
Children's Fun

[Teaching strategies](#)
Virtual Rock Kit

[Teaching videos](#)
Teaching workshops

[ELI translations](#)
ELI in the world

[Earth as a System \(27 activities\)](#)

[Earth Energy/Processes \(111 activities\)](#)

[Earth in Space \(13 activities\)](#)

[Earth Materials \(53 activities\)](#)

[Evolution of Life \(27 activities\)](#)

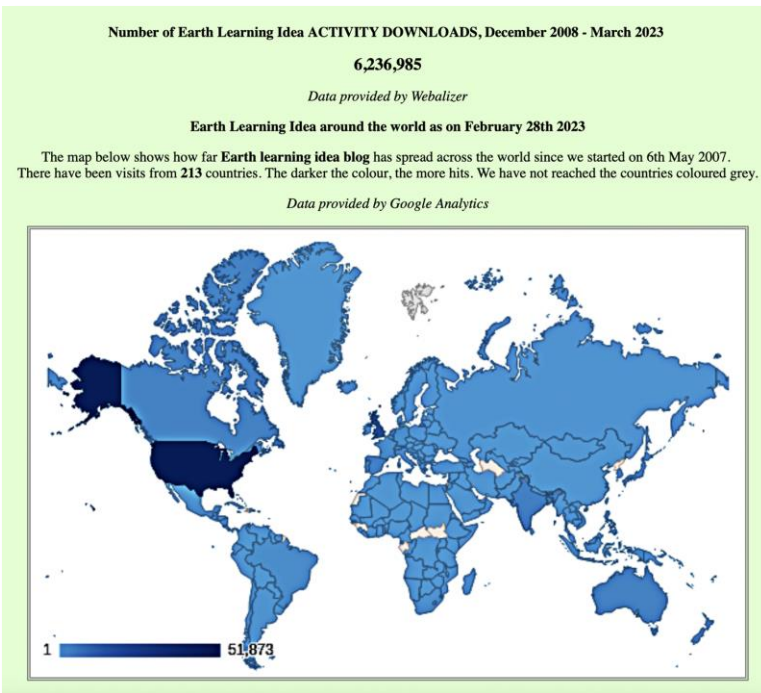
[Geological Time \(14 activities\)](#)

[Investigating the Earth \(83 activities\)](#)

[Natural Hazards \(21 activities\)](#)

[Resources and Environment \(41 activities\)](#)

<http://www.earthlearningidea.com>



ELI Translations

-  Castellano
[Proyecto Internacional de Investigación](#)
-  Català
[Projecte Internacional de Recerca](#)
-  Norak
-  Italiano
-  Deutsch
-  Português
(países de língua portuguesa)
-  Polski
-  Slovensky
-  Japanese
-  South Korean
-  Tamil

Teaching Resources

Topics & Teaching strategies

Teaching videos & workshops ages 5-11

Teaching videos & workshops ages 11-18

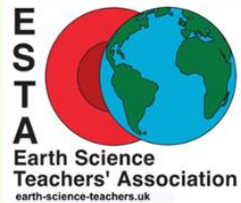
Geography teaching videos & workshops ages 11-14

Mining and the Green Revolution, ages 14-18

ELI Virtual Rock Kit

Geoscience textbooks

- > 400 available activities
- Explanatory videos
- Translated into different languages
- 2008 to 2023 \Rightarrow over 6 million downloads



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Shaken but not stirred? How earthquakes affect buildings

Make up a model as shown in either of the two photographs, depending on what materials you have to hand.



Photo 1: Model 'buildings' of different heights, using helium-filled balloons. (Photo: Peter Kennerly)



Photo 2: Blutak™ 'buildings', secured to a wooden base by more Blutak™. The middle 'building' is swaying as the base is moved backwards and forwards on the table top. (Photo: Peter Kennerly)

Show the model to the pupils and ask them to say which of the three structures will sway the most when the base is shaken forwards and backwards several times on the bench. Most pupils will say that the tallest structure will sway the most, but this is not always the case. The amount of movement at the top of each column depends upon the frequency with which the base is moved – a high frequency will cause the shortest structure to sway the most, while a lower frequency causes the tallest structure to sway the most. With practice you can find the right

frequency to get any of the buildings to sway the most – so that the pupils' predictions are wrong each time! Ask the pupils to suggest what relevance this demonstration has in the real world. Most will suggest that the model is showing what happens to buildings when they are affected by an earthquake. No doubt, pupils will relate their observations to images seen on T.V., filmed during a recent earthquake.



Damaged buildings in the Port-au-Prince neighbourhood of Haiti, after the 2010 Haiti earthquake. The tall block remains standing amid the ruins of lower, less well-constructed buildings.
Photo by Marcello Casal Jr/AB, licensed under the Creative Commons Attribution 2.5 Brazil license.

Show pupils the animated cartoon on the website below, to help them to relate the model aid to a high rise building. Ask them what may not be correct about the cartoon (*Tall buildings are not necessarily the ones to collapse in an earthquake, if they have been properly constructed*).
http://upload.wikimedia.org/wikipedia/commons/b/4/4/Edn_Tssq.pdf

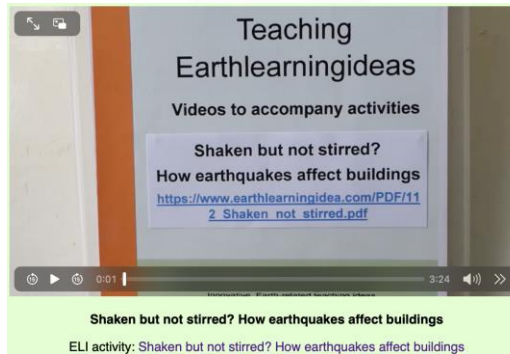
of the 'ground' and the movement of model 'buildings' of various heights.
Age range of pupils: 14 – 18 years
Time needed to complete activity: 10 minutes

The back up

Title: Shaken but not stirred?

Subtitle: How earthquakes affect buildings

Topic: A teacher-led demonstration of the relationship between the frequency of the shaking



Shaken but not stirred? How earthquakes affect buildings
ELI activity: Shaken but not stirred? How earthquakes affect buildings

Video demonstrations



Shaken but not stirred? How earthquakes affect buildings

ELI activity: Shaken but not stirred? How earthquakes affect buildings

Pupil learning outcomes: Pupils can:

- observe the movement of a structure when its base is shaken;
- establish a visual relationship between the height of a structure and the frequency with which it is shaken;
- relate their observations to the damage caused by an earthquake in a built-up area.

Context: The activity can be used to help

students to explore the effects of earthquakes in densely populated areas, and to dispel misconceptions about the relative safety of high rise buildings in seismically active regions.

Following up the activity: Pupils could:

- look for a relationship between the height of structures and the frequency of vibration by timing the movement to and fro of the base and using a range of heights for their 'buildings'; *In the model shown in Photo 2, the 21cm tall structure swayed at 1.7 shakes (cycles) per second; the 17cm structure at 3.1 cycles per second and the 13 cm structure at 4.0 cycles per second.*
- investigate other materials in place of the ones shown in the photographs, using 'staks' of different rigidity, and with different masses on top of their structures;
- carry out a web search for images of buildings which have survived/ been destroyed by the same earthquake and suggest reasons for their findings;
- carry out a web search for various engineering solutions in the design of earthquake-resistant buildings.

Underlying principles:

- All buildings have a natural frequency of vibration. They shake in response to the ground being shaken by the passage of seismic waves, generated by an earthquake.
- When the natural frequency of vibration is the same as the frequency of the seismic waves, the building is said to *resonate*, and it is at this point that the building sways the most and so is most liable to be damaged.
- Tall buildings are not necessarily the ones at most risk from earthquake damage.
- Engineering solutions depend on calculating the natural frequency of the building and on knowing the normal range of frequencies of the relevant types of seismic waves, before designing strengthening measures etc.
- Existing buildings can sometimes be made more earthquake resistant by adding extra

struts, or flexible joints. This is termed

retrofitting.

Thinking skill development:

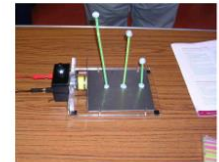
Students usually experience a cognitive conflict at the start of the activity, when the structure which they had expected to move the most does not always do so. Explaining why they were wrong involves metacognition. Linking the model to real earthquakes is a relatively simple bridging skill.

Resource list:

- a model or three high rise buildings, made up before the lesson. Photograph 1 shows three helium-filled balloons on 'party sticks' cut to different lengths, fixed to holes drilled in a block of wood. Photograph 2 shows three drinking straws with blobs of Blutak™ of similar mass, fixed to a wooden base with more Blutak™.

Useful links: See below. Also see the Earthlearningidea activities: 'Quake shake – will my home collapse?', 'Surviving an earthquake', and 'Earthquake through the window – what would you see, what would you feel?'

Source: Based on an idea by Peter Loader, in 'Teaching Earth Sciences', Vol. 36 No. 1 2011. A more sophisticated method, using an electrically operated shaker table, is given in 'Innovations in Practical Work: Seismology', 2007, Gatsby Science Enhancement Programme, ISBN: 978-1-901351-72-9.



Model 'buildings' using an electrically operated shaker table, from the SEP kit. (Photo: Peter Kennerly)

Details of publications and equipment, including a working seismograph, capable of recording real earthquakes, are given on the website:
<http://www.sep.org.uk>

Geoscience Education Field Officers: the activities repository in social media



<https://www.facebook.com/earthlearningidea>



https://twitter.com/ELI_Earth

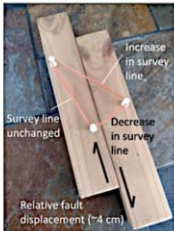
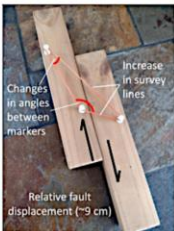
Earth Learning Idea

Innovative, Earth-related teaching ideas

MONDAY, 17 APRIL 2023

Forecast earthquakes by monitoring movement on faults

The new ELI today is 'Slip-sliding away; how does monitoring fault creep help to forecast earthquakes?'

This earthlearningidea is a simulation and case study of a monitoring survey used to monitor the slow creep along fault planes that leads to the build-up of strain prior to its release in an earthquake.

Go to our *Natural hazards* category to find other activities about earthquakes.

Posted by Earth Learning Idea at 09:11

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ABOUT EARTH LEARNING IDEA
ELI is publishing FREE Earth-related teaching ideas, designed to be practical resources for teachers and teacher-trainers all over the world. We publish new Earth Learning Ideas every two weeks. Some of these activities require the use of some basic school laboratory equipment and some include abstract ideas. We label these activities ELI+. Each activity is designed to create pupil participation for maximum learning. All activities are free to download and most require minimal cost and equipment. Best of all, they are fun!

FIND OUT MORE
The Activities
www.earthlearningidea.com
eli-team@earthlearningidea.com

- a new Blog update every Monday
- a new activity posted every 2 weeks
- New videos uploaded all the time.

<http://earthlearningidea.blogspot.com/>

Geoscience practical activities on natural hazards in a rapidly changing world

In this workshop we are presenting a few **examples of practical labs:**

- addressing some topics **included in the Geosciences curriculum** for different age groups;
- useful for **understanding the functioning** of our planet and its **most common natural hazards**;
- requiring students to **apply their new learning** to the other situations and **to real phenomena happening on the Earth**;
- fostering **students' awareness and positive attitudes** towards the protection and sustainable management of our planet.



Image: NOAA, permitted use

The workshops we are presenting today address:

- **Earthquakes**
 - **Shaken but not stirred?** How earthquakes affect buildings
 - **Quake shake:** will my home collapse when an earthquake strikes? investigate why some buildings survive and others do not
 - **Spaghetti quakes** Why are big earthquakes so much more destructive than small ones?
 - **Earthquake prediction** - when will the earthquake strike? Modelling the build-up of stress and sudden release in the Earth that creates earthquakes
- **Tsunamis**
 - **Tsunami!** What controls the speed of a tsunami wave?
- **Landslides**
 - **Failing slopes** - Modelling how rock cliffs and slopes can collapse
 - **Sandcastles and slopes** - What makes sandcastles and slopes collapse?
- **Lava flows**
 - **Extrusion** - See how they run

What causes buildings to collapse in an earthquake?

Possible causes

- Magnitude of earthquake
- Distance from epicentre
- Earthquake depth
- Level of economic development
- Building design
- Building standards
- Corruption
- Ground conditions



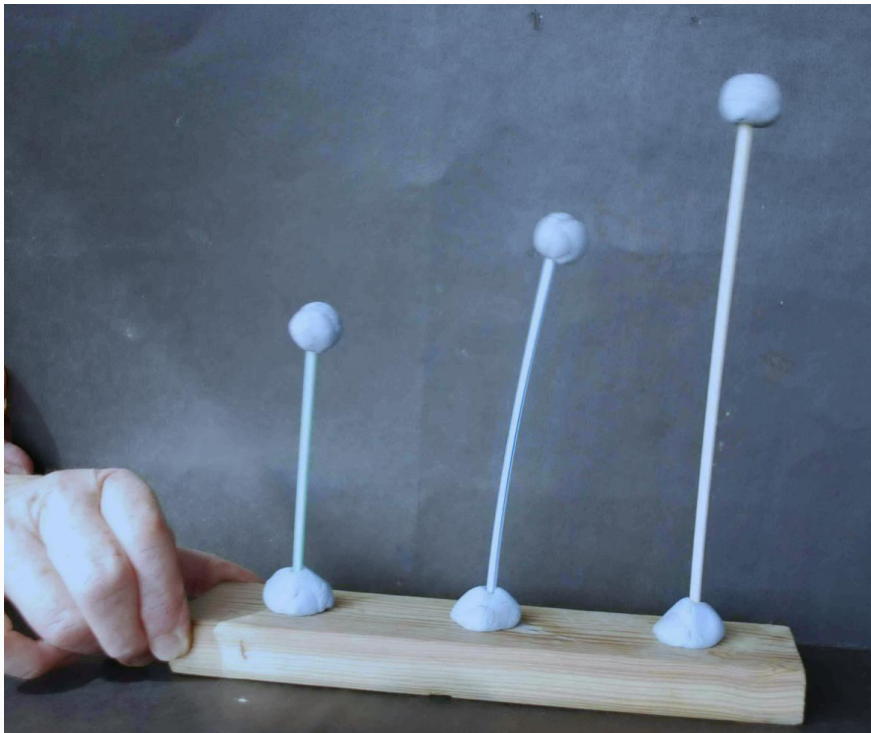
Gölcük Mosque, Turkey

Izmit earthquake Turkey (7.4 mag) 17th August 1999

Images:

Peter Kennett, Earthlearningidea and
Eric Marti - Associated Press (New York Times) August 20 1999

RESONANCE

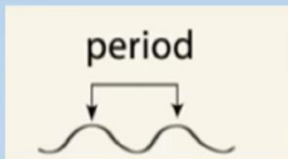


Photos by Peter Kennett - EarthlearningIdea and Marcello Casal Jr/AB, licensed under the Creative Commons Attribution 2.5 Brazil licence

Shaken but not stirred? How earthquakes affect buildings

https://www.earthlearningidea.com/PDF/112_Shaken_not_stirred.pdf

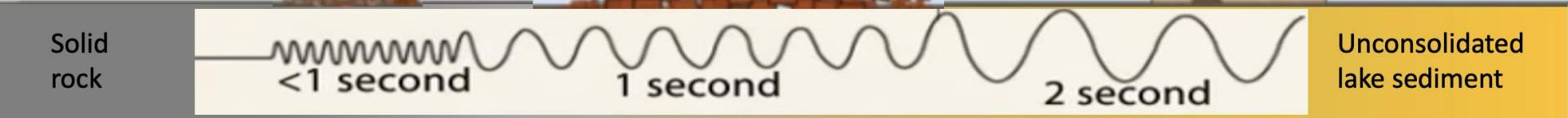
Earthquakes generate horizontal ground motion



**Small buildings
(1-2 stories)
resonate at
< 1 second period**

**Medium buildings
(~10 stories)
resonate at
1 second period**

**Tall buildings
> 2 second period
(30 stories – 3 sec period
50 stories – 5 sec period)**



Quake shake: will my home collapse when an earthquake strikes? investigate why some buildings survive and others do not

https://www.earthlearningidea.com/PDF/Quake_Shake.pdf



Images: Earthlearningidea and
Earthquake Engineering Research Center Library, University of California at Berkeley, permitted use

Earthquake prediction - when will the earthquake strike? Modelling the build-up of stress and sudden release in the Earth that creates earthquakes

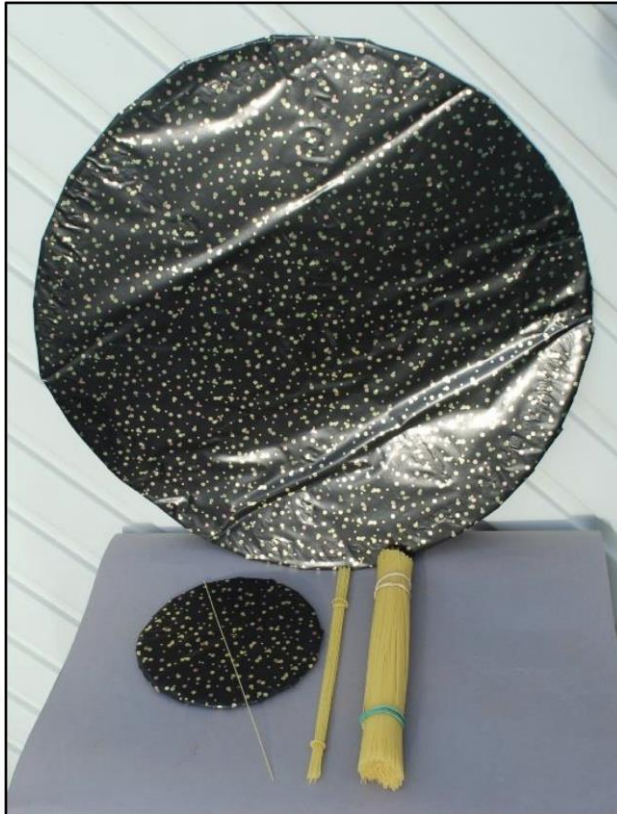
https://www.earthlearningidea.com/PDF/49_Earthquake_prediction.pdf



Images: Peter Kennett, Earthlearningidea

Spaghetti quakes Why are big earthquakes so much more destructive than small ones?

https://www.earthlearningidea.com/PDF/300_Spaghetti_quake.pdf



Spaghetti Quake



Image: Peter Kennett, Earthlearningidea

Spaghetti quakes Why are big earthquakes so much more destructive than small ones?

https://www.earthlearningidea.com/PDF/300_Spaghetti_quake.pdf

Modelling magnitude with *spaghetti*

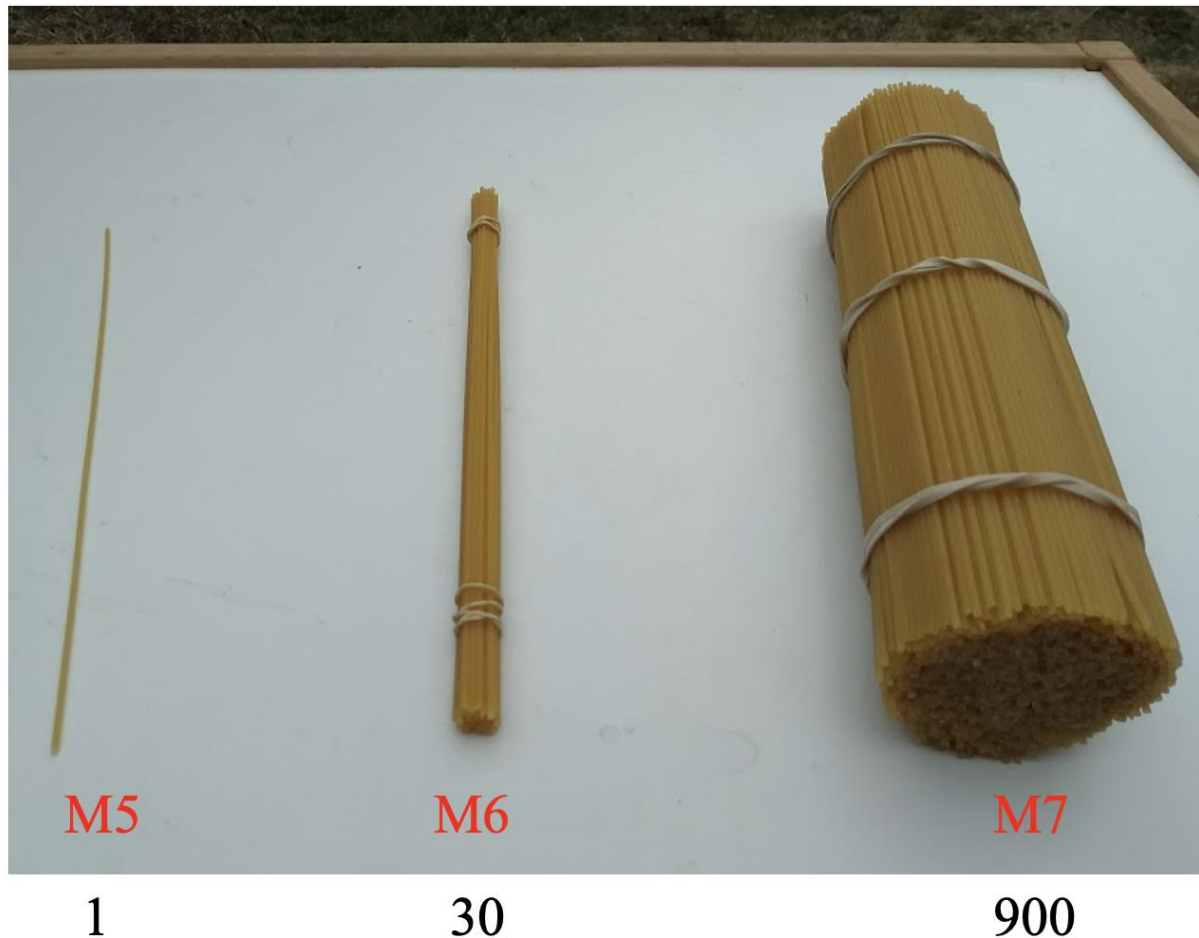


Image: Pete Loader,
Earthlearningidea

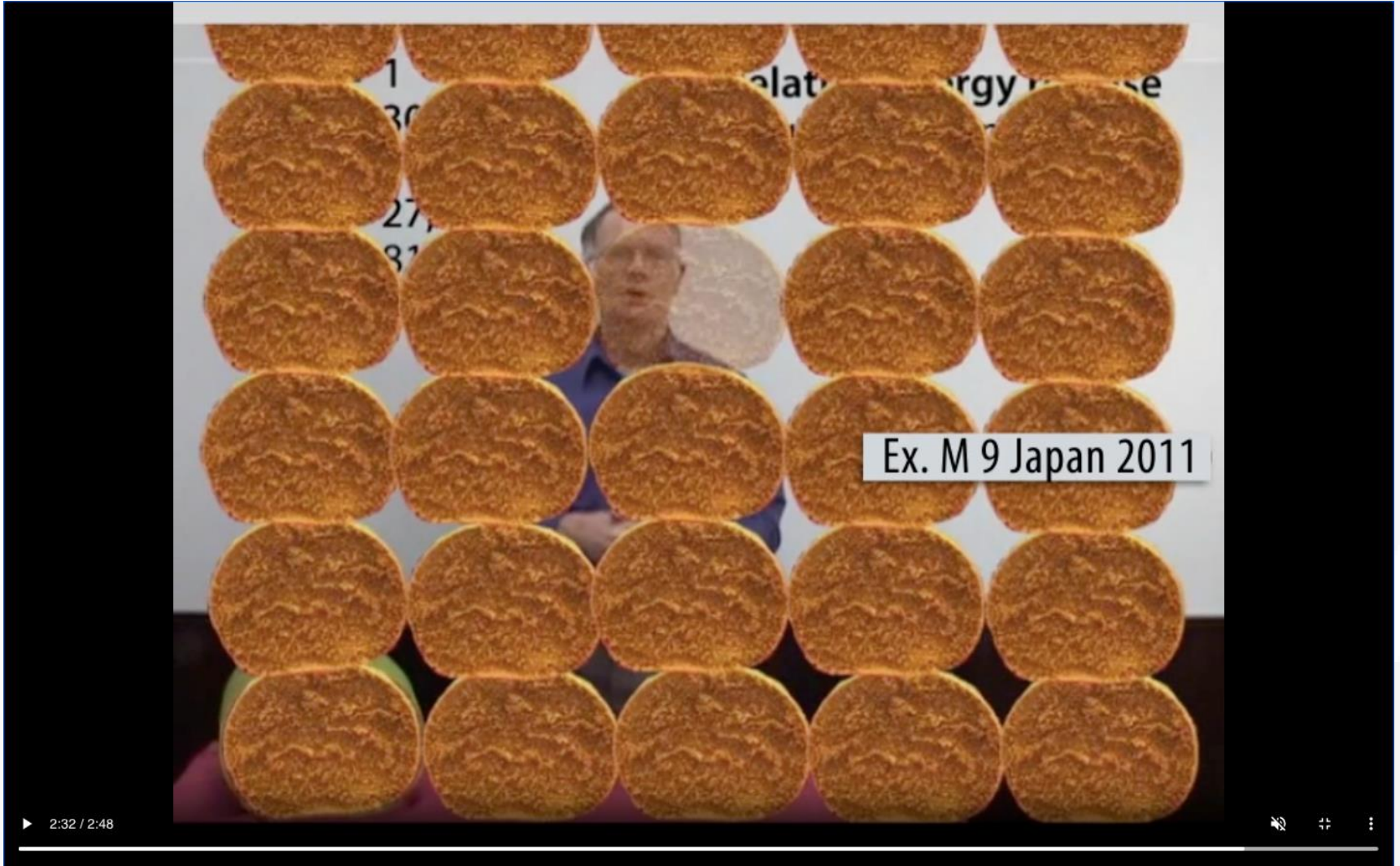
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Tsunami! What controls the speed of a tsunami wave?

https://www.earthlearningidea.com/PDF/45_Tsunami_demo_final.pdf



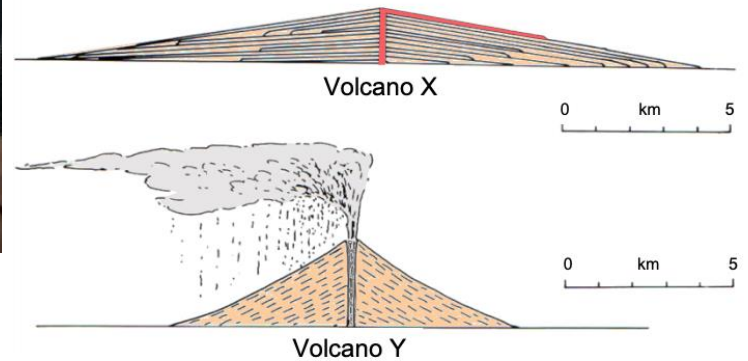
Images: Peter Kennett, Earthlearningidea and
David Rydevi: skylark292@gmail.com, public domain

Extrusion - See how they run

<https://www.earthlearningidea.com/Video/Extrusion.html>



See how they run



Images: Giulia Realdon, diagram: Earthlearningidea

Failing slopes - Modelling how rock cliffs and slopes can collapse

https://www.earthlearningidea.com/PDF/210_Slope_failure.pdf



Images: Earthlearningidea and
Gattoarturo - Opera propria, CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=19454117>

A tribute to Professor Chris King

(1949 – 2022)

GEFOs run this workshop in the memory and honor of Professor Chris King.

He was a guide and an inspiration not only for us but for many generations of Geoscience teachers across the world.



Bring EGU workshops to your area!

- This and **other workshops** are also available **free of charge** (funded, up to a certain number, by EGU) in your area
- **How?**
 - Identify topics of interest and possible dates
 - **Write to the GEFO in your country** (see next slide) to check availability
 - Collect at least 10-15 registrations
 - Provide a suitable classroom for the activity (projector, microphone, if needed, water, other depending on activity required)



Images: Giulia Realdon, Xavier Juan

Contacts to request EGU or IUGS-IGEO GEFO for teachers' workshops

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Don't forget to fill in the evaluation form

- Go to: <https://forms.gle/2CR2QYyFK6tbXdTBA>
- Or frame the QR code:



In memory of Chris King
1949 - 2022

Sandcastles and slopes - What makes sandcastles and slopes collapse?

https://www.earthlearningidea.com/PDF/66_Sandcastles.pdf



Images: Peter Kennett, Earthlearningidea

Geoscience practical activities on natural hazards in a rapidly changing world

Candan Kafali | Dragos Tataru | Fotios Danaskos | Gina P. Correia |
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