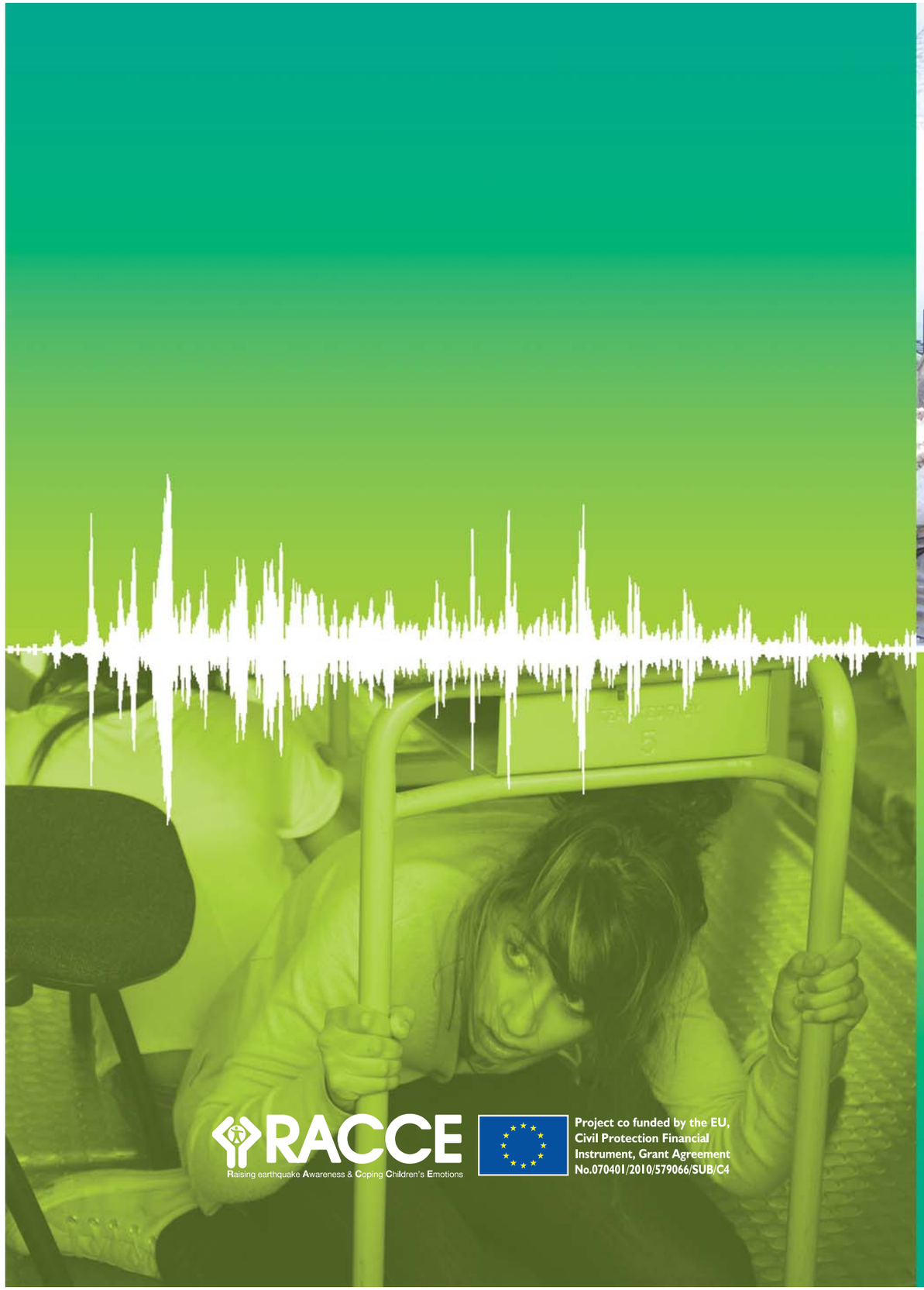

RACCE
Raising earthquake Awareness & Coping Children's Emotions

Project co funded by the EU,
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Instructions for the Educational Kit

EARTHQUAKES & VOLCANOES

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EARTHQUAKES & VOLCANOES

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RACCE

CONTENTS

I. INTRODUCTION

Seismic hazards and related phenomena, as well as volcanic eruptions, in some areas, are the most common natural disasters for the Mediterranean countries. Recent earthquakes in Italy, Greece, and Turkey have proven how vulnerable, in such events, the modern cities are, while the tragedies in Sumatra, Haiti and recently Japan have shown dramatically their great impact in human lives and resources. As a consequence seismic risk is a high priority for Civil Protection worldwide. Despite other natural disasters, earthquakes are totally unpredictable making the role of prevention more important than any other case.

In EU, a huge amount of resources, efforts and actions have been dedicated to the prevention and raising of awareness for the seismic risk, as well as for the elaboration of projects and initiatives to minimize the risks for humans and economy. However, gained experience from Italy and Haiti, as well as results of other studies worldwide (Armenian experience etc.) have shown that Civil Protection was not prepared enough to palliate the emotional shock and burden that such events can cause to children. The problem appears more intense when referring to disabled children for which less attention has been paid.

The natural risk assessment and its further step in finding how to mitigate these risks, give to education and outreach activities an important and peculiar role. A long term effort in implementing innovative educational activities is essential to convey information able to contribute for a better understanding of peculiar territorial features and related hazard and risks. As already mentioned, unlike other natural phenomena, earthquakes are unpredictable and in a few seconds can wreak destruction and forcing hundreds of people to flee their homes. People, especially children feel completely helpless in the face of this natural hazard. Humans are usually overwhelmed by their feelings of fear and anxiety, thus their behavior in such cases is spontaneous and not necessarily leads to a life saving behavior.

For this reason, all children and adults should learn to live with earthquakes, to know the self-protection measures, to be able to cope with negative and in some cases disastrous consequences. Therefore, in order to alleviate the emotional burden and assisting children to cope in case of major natural hazards, a training educational product was designed: "Earthquakes and Volcanoes" and it actually is a mobile kit in the form of a small suitcase that includes a series of educational tools.

The advantages of this product are:

- The educational kits are portable packets that can travel. Thus, it can transfer knowledge concerning earthquakes and volcanoes even to the most remote schools that are far away from major urban centers, Environmental Education Centers and any other institution that is concerned with environmental education.
- All around the world people are concerned for the seismic activity, especially in Mediterranean, therefore, they should be prepared in case of an earthquake.
  This product is a mean for the preparedness including useful information and knowledge, even for those who cannot visit a relevant institution like a museum.
- The educational kit "Earthquakes and Volcanoes" is a comprehensive training package that uses all necessary information and knowledge regarding earthquakes and volcanoes and contains both hard copies and electronic material (theoretical part, activities, instructions for the teacher and children, evaluation, etc.)

This educational product project is thus addressed to children, including those with movement disorders. It is focused on raising awareness, improving knowledge on earthquakes and the best practices and responses and final helping children cope, in a primitive level, with their emotions regarding those two phenomena.

The Mobile Educational Kit is one of the most important deliverables of RACCE .The experiential Educational Project can be connected with school curricula.
Additionally, basic guidelines to cope with children emotions, are prepared, by an expert group, as an important source of the Kit that refers to the identification of unexpected children's emotions or behaviours and palliation responses to children's depression through edutainment activities in case of Seismic or Volcanic disasters.
The pedagogical approach of the product is that of the **Educational Pathway** (Scenario) that helps classrooms to work individually and in various places the main topics of the deliverable, using various scientific and pedagogic tools.
This product is also addressed to children with movement disorders and for this reason RACCE has collaborated with specialists on Educational Approaches for children with special needs, in order to produce the appropriate material for cases where there is the need to support children with special abilities.

The main objectives of this educational product are:

1. Acquisition of knowledge regarding:
   - the natural phenomena and especially earthquakes and volcanoes,
   - the necessary preparedness actions before, during and after an earthquake or a volcanic eruption,
   - the suitable behavior towards other people in need (children with movement disorders) and the ways to support the community in general in a case of a natural disaster.
2. Assessment of prior knowledge that children might have concerning earthquakes and volcanoes, plus verification or not of the conquered knowledge.
3. Breaking myths relatively to natural phenomena.
4. Raising awareness and coping children's emotions regarding earthquakes and volcanic eruptions, throughout various educational activities and interactive games.

2. SUITCASE CONTENT

As mentioned above this educational kit includes all necessary material and tools that will help children to palliate the emotional burden and help them cope in case of a serious seismic hazard, by raising awareness and improving their knowledge on earthquake and volcanic disasters.

Analytically, the kit includes:

I. Hard copies

Theoretical Handbook (addressed to educators)
Suitcase Instructions - Educational Approach (addressed to educators) (present book)
Activities Instructions (addresses to educators)

II. Leaflets

Case studies (adjusted for children)
Guidelines (addressed to educators or other adult groups)
Evaluation sheets (adjusted for children and educators)
Receiving Form (addressed to educators)

III. Digital material

CD (adjusted for children)

IV. Educational Activities

Fourteen educational activities that include educational material in various forms like 3D models of the earth and a volcano and a tsunami generator. (adjusted for children6-13 years old).

3. EDUCATIONAL APPROACH

The activities proposed by the educational kit "Earthquakes and Volcanoes" have been developed on the basis of a child-centered approach that prioritizes students' interests and needs, and is called **Project-Based Learning (PBL)**. PBL is a learning approach which aims at in-depth knowledge investigations, engaging students' interest and motivation. It is based on the principles of social constructivism. Students review their existing knowledge to detect learning needs, gaps and/or misconceptions, and access new knowledge. They also work collaboratively (in groups), actively supporting each other's work and learning.
Activities in PBL are designed to provide answer(s) to a central question(s), solve a problem or study an issue of the real world. In terms of context, students encounter and investigate the particular concepts or dimensions which constitute the main issue they explore in order to develop content knowledge of high-quality. Apart from the content knowledge, learners can also develop the so-called 21st century skills which include language, communication and presentation skills, organization and time management skills, inquiry skills, self-monitoring, reflection and self-direction skills, social and collaboration skills, critical thinking and problem-solving skills among others.
In PBL students are encouraged to search for, apply and reproduce knowledge within a multimodal framework. Students are encouraged a) to use a variety of resources and sources of information (including ICT[1], Museums and/or Science Centers among others) and
b) create their own artifacts to construct knowledge in a variety of ways (e.g. create a model, a report, a videotape, a drama play, a piece of artwork etc).
To bring their investigation into completion students are engaged in processes such as:

- Asking questions
- Debating
- Making predictions
- Conducting experiments
- Collecting, recording and analyzing data
- Drawing conclusions
- Presenting their findings to others

In extent, the teachers role is also distinctive and different in the PBL approach. Teachers (or educators) in PBL do not take up the role of knowledge experts who transmit what they know to the children. They rather become facilitators of the learning process assisting students to organize their inquiry, access resources, think successfully through the challenges, consolidate their knowledge and reflect on the whole process.
In practical terms, teachers in PBL can facilitate children's learning by helping them to:

- Clarify and define the main concepts and dimensions of a topic/issue/problem
- Access the appropriate level of information in a variety of sources and resources
- Organize experiments, exercises, fieldwork or educational visits
- Select the right type of information so that answers to questions are clear, full, coherent and age-appropriate
- Develop rich, multimodal and demanding modes of knowledge reproduction and presentation of results (traditional paper and pencil reports are replaced by presentations which combine language, technology, picture, movement, sound, 3-D constructions and/or any type of artwork)
- Assess the results of their investigation and the quality of the knowledge they develop as well as the level of difficulties their encounter and the success of the solutions they come up with
- Become aware of the applicability of the knowledge and skills they develop in their everyday life

1. ICT stands for Information and Communication Technology.

4. EDUCATIONAL SCENARIOS

The activities of the educational kit "Earthquakes and Volcanoes" are simulating a problem project and specifically an educational scenario that follows the above pedagogical approach. The **educational scenarios** (or **educational pathways**), is a comprehensive interdisciplinary approach to a topic, which in this case is the natural disaster due to an earthquake or a volcanic eruption and rely exclusively on innovative educational approaches and methodologies (Problem Based Learning).

Learning through educational scenarios is the result of a student-centered learning process. The role of the educator is strictly to coordinate, without responding directly to the student's questions and constantly encourage the children to discover their own knowledge.

This educational kit scenario can be implemented in three stages:

I. The preparatory stage
II. The experiential stage
III. The completion, verification, stage.

Particularly important is the fact that the three main stages of the educational scenario are inseparable, consecutive and coherent. This means that during the implementation of the scenario none of the three stages should be omitted in order to secure the maximum efficiency of the product.

5. USING THE EDUCATIONAL SUITCASE

In order to implement the educational activities and the useful tools of the educational kit, the educator should be prepared regarding:

- The extra materials that might need
- The recognition of the knowledge that his group of children has as well as the number of the children
- The time available to implement this product

5.1 INFRASTRUCTURE MATERIAL

In order to implement the kit, there is the need of **personal computers (PC)**, **internet accessibility**, all the usual school supplies such as pencils, colors, rulers, scissors, glue, blue tack etc. and some more hi-tech equipment like a video camera.

5.2 IMPLEMENTATION

Through these three stages, children learn how scientists investigate and interpret natural phenomena, which helps them to develop scientific thinking.

I. *The preparatory stage*

The main goal of this stage is for children to develop initiative behavior, self confidence, collaborative spirit, assessment skills and decision-making capacity.

- Learn to work together and collaborate
- Develop their social skills
- Investigate, observe and draw out conclusions and solutions

Plus, they learn to use new technologies. This stage includes the following three basic steps: the first approach (1), the emergence of key questions (2) and the personal exploratory/research phase (3).

The way to realise:

- Children, with support from educators at school or any other education center, explore basic concepts about the natural phenomena, earthquakes, volcanoes and the disastrous impact these might have on humans. This exploration can be supported by three organiser maps: 1 **'advance organiser'** and 2 **concept maps**.
- Children make questions that reflect the sub-topics they need to investigate in order to complement their existing knowledge.
- Students form groups that will investigate the various sub-topics and start developing hypotheses around each question.
- Each group carries out its own research to collect information about the sub-topic it investigates using a variety of resources including the supportive material of this educational kit.

I: The first approach regarding natural phenomena

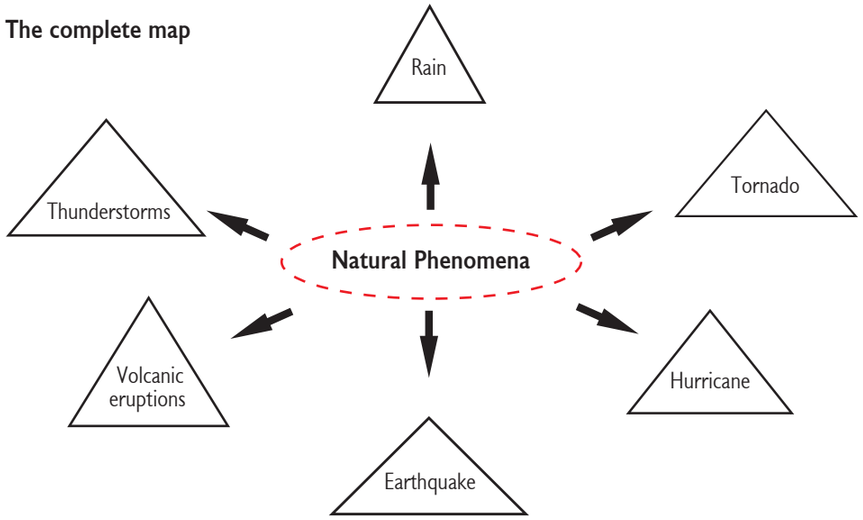
- The discussion starts with a series of images presenting natural phenomena. Children are engaged with a brainstorming to name all the natural phenomena they know, using **Activity 1**, which can eventually be organised in a concept map similar to the following (concept map 1):

Concept Map 1

The beginning

Developing further

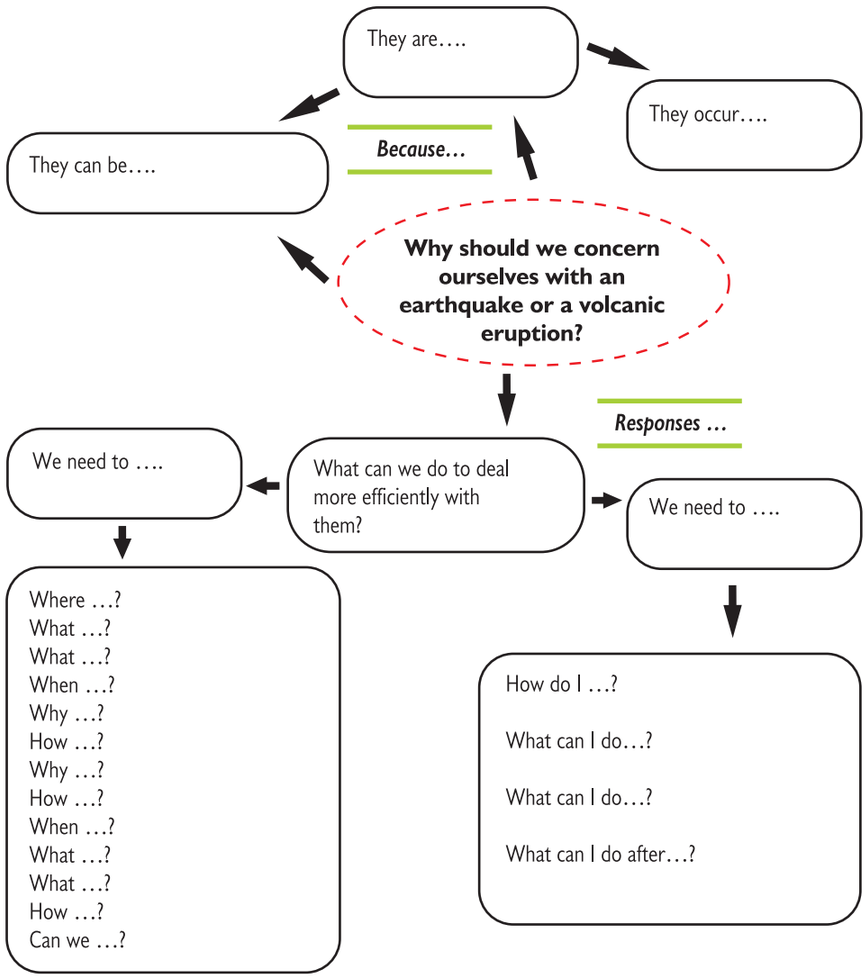
The complete map



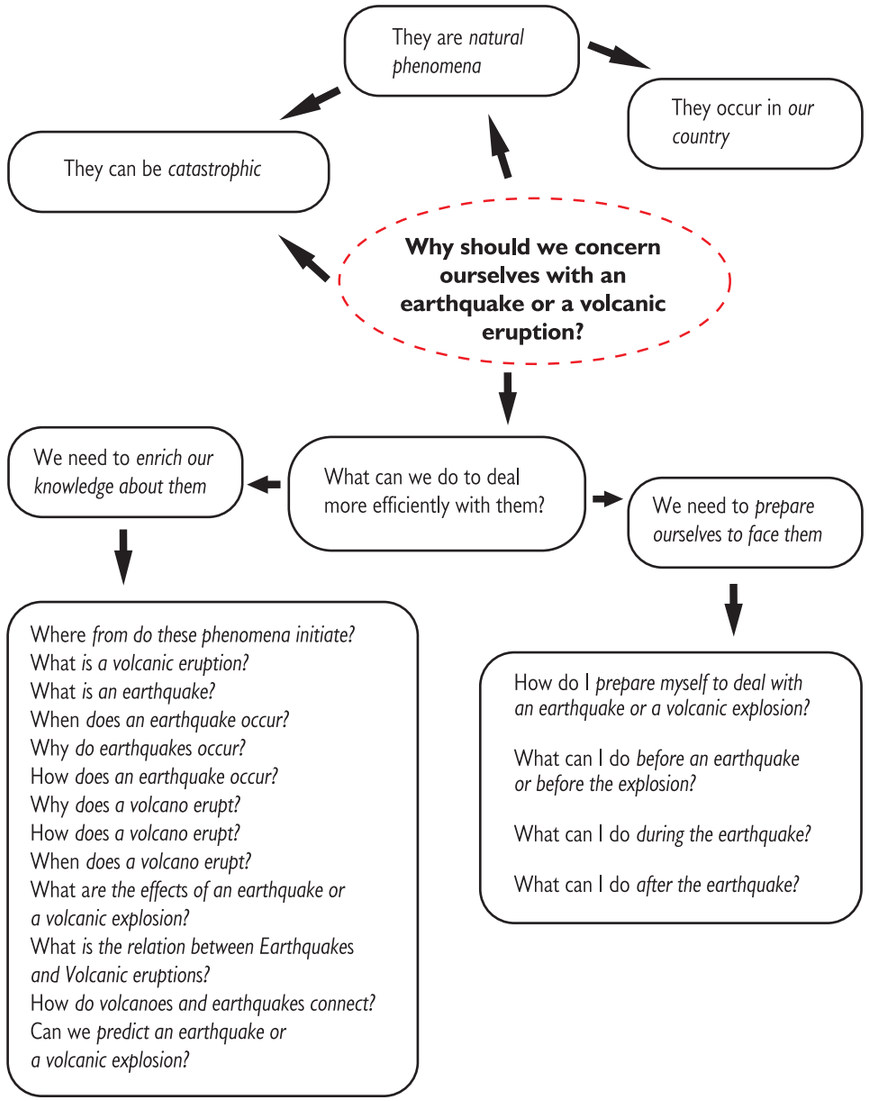
2: The emergence of key questions

- Then children have to think about natural phenomena that occur in their own country. Once the children realise that their own life is being affected by earthquakes and/or volcanoes discussion can lead to the next concept map (which is actually an '**advance organiser**' of children's research). This map is developed around the single question "**Why should we concern ourselves with an earthquake or a volcanic eruption?**". Through a brainstorming during which children are called to consider the impact an earthquake or the eruption of volcanoes can have in people's lives they are called to organise their responses into three general categories which could ideally be six basic sub-topics (see **Activities Guide** book).

The '**advance organiser**' could be similar to the following:



Complete Example



The emerged questions can be divided into two categories:

The first (a) includes the questions regarding the general knowledge over those two natural phenomena and the second (b) includes the questions related with the psychological and physical preparedness that children should have in order to be able to deal with an earthquake or a volcanic eruption. These categories will help the educator to cover all the desired knowledge.

3: Research phase

During this phase:

- The pupils are divided into groups (the number of the groups is up to the educator and the number of the students) Usually, the smaller the group is, the more productive it appears to be.
- Each group can investigate up to three (or more if the educators believe that the children can respond) questions from those posed and recorded on the 'advance organiser'. For this purpose they use a worksheet which consists of three parts: 'Hypothesis', 'Research' and 'Verification'. In the 'Hypothesis' part, each group can write down a hypothesis that answers each question-issue based on preexisting knowledge. The children are expected to have deficient knowledge, which is the second part of the worksheet.
- During their research, children may use either the literature from their school or the resources (links featured in the kit) including the supportive material of the Kit (theoretical handbook). At the 'Research' part of the worksheet they can write down the answers they found as conclusions of their research.

"Hypothesis"		"Research"	
"Question 1?"	"Question 2?"	"Question 1?"	"Question 2?"
....	....	....	....
"Question 3?"		"Question 3?"	
....		....	

II. *The experiential stage*

The aim of this stage is the approach of the desired knowledge through personal experience.

The way to realise:

- Implement the educational activities of the kit.
- Visit educational centers and organizations relevant to the thematic questions.

III. *The verification stage*

The aim of this stage is for children to develop their skills on:

- Verify (or reject) the hypotheses.
- Present new information.
- Evaluate the gained knowledge.

The way to realise:

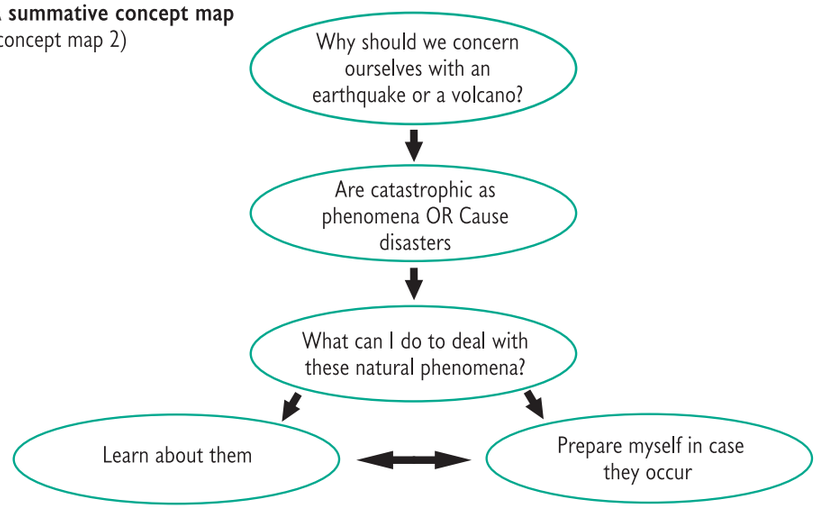
- Once the group completes the experiental stage, children can fill in the 'Verification' part on the worksheet.
- Each group presents the results of their research to the rest of the class.
- Children assess their knowledge by comparing the hypotheses with the facts facts of their research and evaluate the use of the new knowledge in their daily lives.

"Verification"	
"Question 1?"	"Question 2?"
....	....
"Question 3?"	
....	

Completion

At the end children are called to re-organise the sub-topics of the 'advance organiser' into a 'summative' concept map that will clearly show a comprehensive overview of the path that followed and the way to approach a question/problem. the relationships between them.Ideally, children should come up with something like concept map 2. This activity procedure allows educators to assess children's knowledge and the understanding they developed.

A summative concept map
(concept map 2)



5.3 TIMETABLE

The proposed timetable is an indicative way to implement the scenario. Each organization/institution/school that wishes to implement this program can customise the product to its specific needs, level of knowledge and particular circumstances.
In general, the duration may be approximately thirteen (13) hours to complete the scenario.

The preparatory stage — ***Approximately 7 hours***

Indicatively, **two hours** can be dedicated for the initial discussion on natural phenomena (activity 1 and concept map 1) and **two hours** for the questions arising around them (advance organiser). The group separation, the selection of the emerged questions that each group will operate and the submission of hypothesis might have duration of approximately **one hour**. At least **two** more **hours** is needed for the personal research that children will realise on their own.

↓

The experiential/research stage — ***At least 3 hours***

Three hours for implementing the proposed activities included in the educational kit. The visit to an educational center or organisation can last from one hour to several depending on the educator and the children's needs. Keep in mind that the present duration for implementing the proposed activities is the minimum.

↓

The completion, verification, stage — **Approximately 3 hours**

About **two hours** for comparing the results of the experiential stage with their hypothesis and personal research. At last **one** more **hour** for the 'summative' concept map 2 and the presentation of each group to the rest on their selected questions.

↓

Complete Timetable

Stage	*Approximately Duration*
The preparatory stage	7 h
Activity 1	1 h
Concept Map 1	1 h
Emergence of key questions "advance organiser"	2 h
Hypothesis	1 h
Personal Research	2 h
The experiential stage	3 h
Implement the various activities	3 h
Visit educational centers and organizations	free
The completion, verification, stage	3 h
Verification	2 h
Concept map 2	1 h

In general, the educational kit can be used directly from schools by borrowing or downloading it from project's website it and managing the use on their own. Or, on the other hand, it can be used partly from schools by elaborating with an educational center or museum that have this kit and may support and guide the educator.

An indicative path for Environmental Education Centers and other institutions to implement the kit within **three days** can be as the following:
1st day: Initial discussion, selection of questions, separation groups and formulating hypotheses.
2nd day: Personal research and implementation of activities.
3rd day: Comparing, verifying the results and presenting the conclusions.

Concerning schools, the teacher can determine the period in which they will complete the scenario depending on the time available during the school year.

6. EVALUATION

The evaluation procedure is really important especially when it comes to educative tools like this kit. While it is created and structured from experts on this field there might be particular factors and conditions that are not envisaged. Thus, the evaluation and feedback from the implementation of this product will provide necessary information for the improvement of the specific product or future ones.
Educators and each child should complete the corresponding evaluation. Regarding children's evaluation there are two steps designed in order for the educator, to be able to assess children's knowledge and their development concerning these thematic topics. There is one evaluation that the children should complete twice during the use of the educational kit. Once at the beginning of the process and one more time at the end. This way, the educator, the children and the experts that will get the feedback, can clearly observe the development on children.
When evaluation sheets (3 in total) are completed, make the copies you might need for your archive and place the originals in the Kit to return them to the responsible organisation. This way RACCE can use the results to extract some results that will be shared through the official web site of the program. (racce.nhmc.uoc.gr/en)

7. MANAGEMENT- TRANSPORTATION

The educational Kit **"Earthquakes and Volcanoes"** is available from the **Natural History Museum of Crete**, after consultation with the coordinator Mr. Charalambos Fassoulas and after completing the receiving form.

Borrowing museum kit is free. The transportation is a responsibility of the educator or the school.
The educators should contact with the:
Education Department of the **Natural History Museum of Crete**
tel.: **2810 393277, 2810 393278**

8. LITERATURE

1. Allen, S (2004). Designs for learning: Studying science museum exhibits that do more than entertain. Science Education 88: 17-33.
   http://learningspaces2008.pbworks.com/f/Allen_Exploratorium.pdf
2. Bamberger, Y, Tal, T. (2006). Learning in a Personal Context: Levels of choice in a free choice learning environment in science and natural history museums. Science Education 91(1) 75-95.
   https://files.me.com/lamerasp/0lyp1q
3. Beswick, N (1990). Resource-based learning. London: Heinemann
4. Cox-Petersen, A., Marsh, D, Kisiel, J, Melber, L (2003). Investigation of Guided School Tours, student learning, and science reform recommendations at a museum of natural history. Journal of Research in Science Teaching 40(2) 200-218.
   http://www.johnballzoosociety.org/AZAVA/admin/Cox-Petersen%20JRST.pdf
5. Falk, J., Storksdieck., M. (2005). Using the contextual model of learning to understand visitor learning from a science center exhibition. Science Education 89: 744-788
   https://files.me.com/lamerasp/1eebkm
6. Gammon, B. (2003). Assessing learning in museum environments: A practical guide for museum evaluators. London: Science Museum.
   http://sciencecentres.org.uk/events/reports/indicators_learning_1103_gammon.pdf
7. Griffin, J (2004). Research on students and museums: Looking more closely at the students in school groups. Science Education 88: 60-70
   http://turtlenodes.com/museums/fieldtrips/2c_Griffin2003_StudentsandMu-seums.pdf
8. Hein G.E. (1998). Learning in the Museum, New York, Routledge
9. Hofstein, A. and Rosenfeld, S. (1996). Bridging the gap between formal and informal science learning. Studies in Science Education, 28: 87-112
10. Rocard, M., Csermely, P., Jorde, D., Lenzen, D., Walberg-Henriksson H. and Hemmo, V. (2007) Science Education Now: a renewed pedagogy for the future of Europe, European Commission, ISBN - 978-92-79-05659-8.
    http://ec.europa.eu/research/science-society/document_library/pdf_06/report-rocard-on science education_en.pdf
11. Barrows H.S., 2000. Problem-based learning applied to medical education. Springfield, IL: Southern Illinois University School of Medicine.
12. Barrows H.S. & Tamblyn R., 1980. Problem-based learning: An approach to medical education. New York: Springer.
13. Boud D. & Feletti G. (Editors), 1997. The Challenge of Problem-based Learning. 2nd ed. London, Kogan Page.
14. Collins A., Brown J.S. & Newman S.E., 1989. Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L.B. Resnick (Ed.), Knowing, learning, and instruction: Essays in honor of Robert Glaser (pp. 453-494). Hillsdale NJ: Erlbaum.
15. Flogaitis E. & Alexopoulou I., 1991. Environmental Education in Greece. European Journal of Education 26 (4): 339-345.
16. Georgouli E., Bakoyannis S. & Giannakoulias P. 2003. Teaching IT in Secondary Education through Problem-Based Learning could be Really Beneficial. ITiCSE'03, June 30-July 2, 2003, Thessaloniki, Greece.
17. Grammatikopoulos V., Kousteiios A., Tsigilis N. & Theodorakis Y., 2004. Applying dynamic evaluation approach in education. Studies in Educational Evaluation 30: 255-263.
18. Hmelo C.E., 1998. Problem-based learning: Effects on the early acquisition of cognitive skill in medicine. Journal of the Learning Sciences, 7, 173-208.
19. Hmelo C.E. & Lin X., 2000. Becoming self-directed learners: Strategy development in problem based learning. In D. Evensen & C.E. Hmelo (Eds.), Problem-based learning: A research perspective on learning interactions (pp. 227-250). Mahwah, NJ: Erlbaum.
20. Hmelo-Silver C.E. & Barrows H.S., 2006. Goals and Strategies of a Problem-based Learning Facilitator. The Interdisciplinary Journal of Problem-based Learning 1 (1): 21-39.
21. Hmelo-Silver C.E., 2004. Problem-based learning: What and how do students learn? Educational Psychology Review, 235-266.
22. Lampert M., 2001. Teaching problems and the problems of teaching. New Haven, CT: Yale University Press.
23. Leinhardt G., 1993. On teaching. In R. Glaser (Ed.), Advances in instructional psychology (pp. 1-54). Hillsdale, NJ: Erlbaum.
24. Mentzelou P., 2004. The design of a Web-Based Information Technology Student Support System for Higher Education. Proceedings of the IEEE International Conference on Advanced Learning Technologies (ICALT'04)
25. Newman M., 2003. A pilot systematic review and meta-analysis on the effectiveness of Problem Based Learning. Learning & Teaching Subject Network Centre for Medicine, Dentistry and Veterinary Medicine (LTSN-01) UK. p5
26. Nioras A., Loukopoulos Th. Antonis K., Prentzas D., Papazoglou P., Lampsas P. & Karkanis S., 2001. Hybride Learning Methods in Distance Life Long Education. Technological Education Institute of Lamia, Department of Informatics and Computer Technology.
27. Schmidt H.G., Machiels-Bongaerts M., Hermans H., ten Cate T.J., Venekamp R. & Boshuizen H.P.A., 1996. The development of diagnostic competence: Comparison of a problem-based, an integrated and a conventional medical curriculum. Academic Medicine, 71, 658-664.
28. Schoenfeld A.H., 1998. Toward a theory of teaching-in-context. Issues in Education, 4, 1-94.
29. Siasakos K., Panta M., Kaimakamis G., 2008. Implementation of PBL method in the teaching of the course Management Information Systems-MIS. 4th Greek Conference of Information Didactics. 28-30 March 2008, Patra, Greece. P. 517-522.
30. Zografakis N., Menegaki A.N., Tsagarakis K.P., 2008. Effective education for energy efficiency. Energy Policy 36: 3226- 3232.
31. http://www.e-yliko.gr/htmls/programs/eu_progrs.aspx
32. http://kee.gr/html/english_main.php
33. http://www.ypepth.gr/en_ec_home.htm