DELIVERABLE

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D2.4 – Best Practice Exchange Forum

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0.2	10/10/13	M. Schönfelder	UBT	Final version
0.3	01/10/15	M. Schönfelder	UBT	Final version after peer review

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Executive Summary

This document aims to summarize and report the Best Practice Exchange Forum taking place in Crete, Greece between 28/06/13 and 05/07/13 in collaboration with the EU-project PATHWAY. This large-scale event served as forum for the collection of case studies and best practices that effectively promote environmental education and training with use of enquiry-based learning methods.

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1. Introduction

1.1 Scope

This document aims to report the Best Practice Exchange Forum.

1.2 Audience

This report is addressed to the GreeNET project partners as well to all interested parties.

1.3 Definitions

Best Practices
A Best Practice is “a method or technique that has consistently shown results superior to those achieved with other means, and which are used as a benchmark to strive for“ (Burkhart 2010).

Inquiry
“Inquiry is the intentional process of diagnosing problems, critiquing experiments, and distinguishing alternatives, planning investigations, researching conjectures, searching for information, constructing models, debating with peers, and forming coherent arguments" (Linn, Davis & Bell 2004).

In educational contexts the inquiry process is often labelled as “Inquiry-based learning” (IBL) or “Inquiry-based Science Education” (IBSE).

1.4 Structure

Chapter 1 contains an overview of this document, providing its Scope, Audience, and Structure.

Chapter 2 provides the report of the Best Practice Exchange Forum with general information, a detailed description as well as photos.

Chapter 3 contains the appendix with an exemplary scenario elaborated at the Best Practice Exchange Forum

2 Report of the Best Practice Exchange Forum

2.1 Information

Title of the event	GreeNET Best Practice Exchange Forum
Country	Greece
Workshop language	English
Start Date	28/06/2013
End Date	05/07/2013
Organising Institute(s)	UBT, EA, GRNET (AK), University of Crete
Activity Type	International
Location	Crete, Greece
Total number of participants	27
Represented nationalities	Finland, France, Germany, Greece, Spain, Turkey, UK

2.2 Description

This large-scale event, open to teachers from the participating countries and to teachers from other countries, operated as the frame for the collection and formation of exceptional approaches to environmental education. Offering the opportunity to teachers from different countries to interact, discuss and compare, it resulted to the collection of outstanding activities focusing on environmental education a collective report on best practices on EE&T. For the purposes of the Best Practice Exchange Forum, two distinct approaches were followed with two participants' groups.

The first approach, the GreeNET investigation in the Green Ideas event, was a three-day event that engaged a group of 8 participants (educators, IT experts and agronomists) in hands-on green activities. Its purpose was the development of a unique technology-based model that would connect environmental education and the world of work. The group was given a pre-specified Design Challenge to deal with, which was: "How might we create educational activities using the enquiry-based model of learning?" In order to provide a solution to their design challenge, the participants interviewed two education professionals: Dr. Katerina Voreadou, biologist and head of education in the Natural History Museum of Crete, spoke of her line of work and explained how this has been updated to better serve the needs of school students and teachers. Ms. Kyriaki Triantafyllidou, an elementary school teacher, shared with the participants her unique experience of teaching a single child in the primary School of the remote island of

Gavdos, planning the curriculum with limited resources and budget, and being creative to the point of affecting significantly the ways education is carried out in rural areas. The highlights of these two discussions were the use of technology, the organization of activities in and out of schools, environmental education, the demonstration of the special needs of -rural areas' schools, the connection of education to the world of work, and the confrontation of students as little scientists - setting their own questions.

Taking into consideration these highlights, the participants organized their thoughts in specific thematic areas and further elaborated their ideas, sharing them with their peers with post-its. The thematic areas were: technology, technology connecting schools, kids with special needs, curriculum, museum and technology, out-of-school activities, school and the world of work, and a thematic area with general ideas. After discussing their views with their peers, all participants were asked to vote in order to keep the most popular thematic area(s) and further work on them. The thematic areas that received the highest number of votes were: technology, school and the world of work, and out-of-school activities. The participants were asked to further reflect on these two distinct thematic areas and come up with ideas that could connect them while at the same time promoting environmental education scenarios based on the inquiry based learning model. The thematic solutions proposed by the team were the following: ***1.Implementation***: school gardens in all schools producing vegetables and teaching students agriculture, students developing their own product ideas, virtual businesses at local/international level, ***2. Collaboration and networking***: interviews from experts (real-time or with videos), collaboration with local communities and farmers, visiting the experts in their real world, older people teaching students old and forgotten techniques, training events with local communities, ***3. Technology and web-tools***: online communication platform, facebook for students, information wiki. The end-result of this process was a suggestion for an educational system promoting *environmental education, use of technology, communication with experts, interaction with older generations to benefit from their experience,* and *connection with the world of work.* The proposed educational approach was called 'Nature's Ark': the formation of a European network of school gardens in all types of schools, supported by a specially-made communication and instructive platform. Students will choose their preferred plants to grow, also making sure they are appropriate for their region's microclimate. Moreover, students will use the online platform to explain their experience, offer valuable tips, ask for information and discuss their project with experts. This tool will prove very beneficial for schools in remote areas without actual access to scientific institutions or without the possibility to discuss the project with their peers. In addition to the above, students will be expected to investigate the market for their grown plants and design a communication strategy to collaborate with professionals in their area. 'Noah's Ark' elevates the well-established educational approach of school gardens to a new level, adding contemporary elements such as technology and connection with the world of work. Ultimately, 'Noah's Ark' will help students take the leading role in the educational process, with each taking over a different role according to their personal interests. Then, the team created a very interesting and self-explicit prototype, followed by a time plan for the realization of the idea and the management of specific steps, such as the formation of a prototype, the arrangement of a meeting with representatives from the

Ministries of Education and Agriculture, the participation in festivals and the training sessions of teachers, etc.

The second phase of the Best Practice Exchange Forum was held during the Pathway Summer School and was addressed to teachers and educators from across the EU. During this six-day event the 19 participants got introduced to the different steps of IBSE for the development of an enquiry-based environmental science lesson. Its purpose was the development of scenarios using the enquiry approach and hands-on-activities with an environmental issue. At the first day the participants were requested to create a concept map about their own imaginations of enquiry-based science education. After a common discussion in the plenum, a short interactive presentation about the most important issues of IBSE was held. The presentation included the different steps of the enquiry approach and its variations (open, structured, guided). Afterwards the participants worked in groups to construct their own academic models of enquiry-based science education. In addition to the model construction, the participants were expected to support their ideas and explain their developed model. Following this process, the teachers were given a set of tools (e.g. thermometer, feathers, ice, cotton, etc.) and worked in groups to carry out a scientifically orientated experiment in order to discover the material best fit for insulation. The question to find out by group work for example would have been "Do downy feathers or cotton keep you warmer?". The teachers had to engage in group work in order to decide on the best way to use the provided tools in order to come up with a well-established response. Beside a scientific-oriented question the participants had to establish and formulate hypothesizes possible evidences, analyses, explanations, ways to communicate outcomes and reflections. In practice, the teachers tried to implement the different steps of EBSE within this experiment; this process aimed to make the concept of EBSE clear to all and to demonstrate in action what the implementation of EBSE in classroom would involve.

Having participated in these initial steps, the teachers developed their own IBSE scenario regarding an already chosen green topic. The initial choice and the finalization were done in groups to provide the teachers the possibility to discuss their ideas with their peers. For this purpose four main topics were given:

1) Bioenergy
2) Achievement of Honeybees
3) Ecosystem of temperate forests
4) Rainforests affected by climate change

The participants compared and interact about these topics in their groups and also discussed how these issues could compile for an enquiry scenario. Therefore they had prepared previously materials, information and links. Subsequently the participants worked out their own scenario using the different enquiry steps with a content related to their group topic. The planning process involved step-by-step design of the educational scenarios, description of the supplementary activities and finally the digitization of the educational scenarios with use of ICT tools. At the last day the scenarios were presented to each other and in the plenum. At least it followed a reflection of the scenarios and the feedback of all participants. Scenarios to following topics were elaborated:

1) Bioenergy
    a. Calorimetry
    b. Conversion of Energy from Sun to Green Electricity and Biofuel
    c. Use of Bioenergy
    d. Biogas

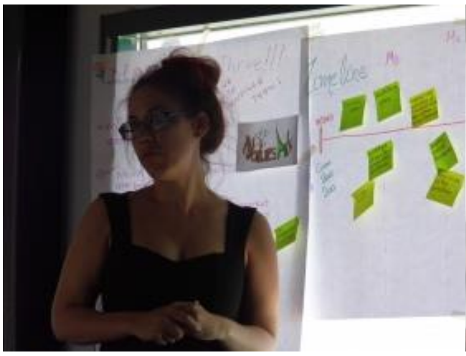
2) Achievement of Honeybees
    a. Bee Mortality
    b. Bee's Cells
    c. Communication
    d. Killerbees
    e. Pollination

3) Ecosystem of temperate forests
    a. Deadwood
    b. Future-Trees
    c. Plants as CO_2 Repository

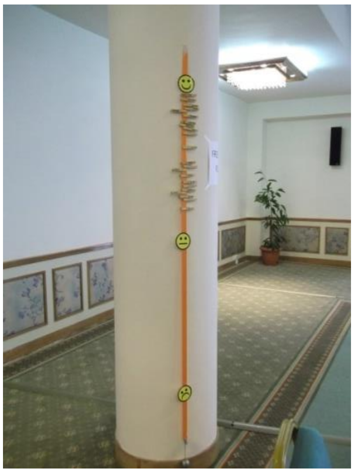
4) Rainforests affected by climate change
    a. Acid Rain
    b. Adaptions of Plants on Climate Change
    c. Climate in Rainforests
    d. Climate Change and Rainforest's Future

The last step of the second phase was to create again a concept map about the imaginations of enquiry-based science education to visualize the increase of expertise of the participants after planning an own enquiry scenario.

2.3 Photos






3 Appendix

An exemplary selected good scenario is presented in the appendix. It was elaborated during the Best Practice Exchange Forum in collaboration with the PATHWAY Summer School.

Ecosystem of Temperate Forests - Plants as CO_2-repository

An IBSE – Scenario for Grade 6, Biology

Introductory Story

The teacher comes into the classroom and brings along some bars of „The Good Chocolate“, to reward their students doing a good job.

The teacher tells the students that he/she was wondering what the different logos on the packing wants to say. He/she tells and shows the students what he/she found about it the day before.

CO_2

Phase 1 - QUESTION

The teacher shows the students some pictures and tells them that…

CARBON NEUTRAL PRODUCT

PLANT FOR THE PLANET
Trees for Climate Justice

- …the company produce carbon neutral products
- … for every fifth bar the company is going to plant a new tree to ensure the carbon neutrality

- [ ] Open
- [x] Guided
- [ ] Structured

CO_2

Phase 1 - QUESTION

While talking about the chocolate-story, the following question remained open:

Students propose different questions

* **What does carbon have to do with planting trees?**
* **What does „Carbon Neutral Products“ have to do with planting trees?**

Why do you think this is the case?

Students propose different statements on the black board and choose one together (Hypothesis)

* **Plants store CO_2**
* **Plants store carbon**

☐ Open

☒ Guided

☐ Structured

Phase 2 - EVIDENCE

The teacher gives the students the following two instructions and the associated equipment:

1. *Measure the concentration of CO_2 of a closed system!*
2. *Measure the concentration of CO_2 when you burn a piece of wood/plant in this closed system!*

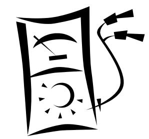
Students have to plan the experimental setup and implement the experiment in 3 groups.

- [ ] Open
- [X] Guided
- [ ] Structured

Phase 2 - EVIDENCE

Equipment for each group:

- CO_2 measuring instrument (alternative lime water equipment)



- Glass/Beaker

- Funnel

- Wood/Plant

- Matches

☐ Open
☒ Guided
☐ Structured

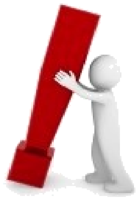
Phase 3 - ANALYSE

The teacher requests the students to collect the data of each group in a table, analyse and discuss the results in their groups.

	Concentration of CO_2 [ppm min^{-1}]	
	Closed System	Burned plant in closed system
Group 1		
Group 2		
Group 3		

- [ ] Open
- [x] Guided
- [ ] Structured

Phase 4 - EXPLAIN



The teacher asks the students if their hypothesis is proven and to formulate answer based on the experiment.

Were the hypotheses clearly proven by the experiments?

Hypothesis 1 ☐ proven
☐ not proven

Explain why (reasons):

____

____

☐ Open
☒ Guided
☐ Structured

Phase 5 - CONNECT

Teacher starts a conversation about CO_2 in general and develops together with the students the following facts:

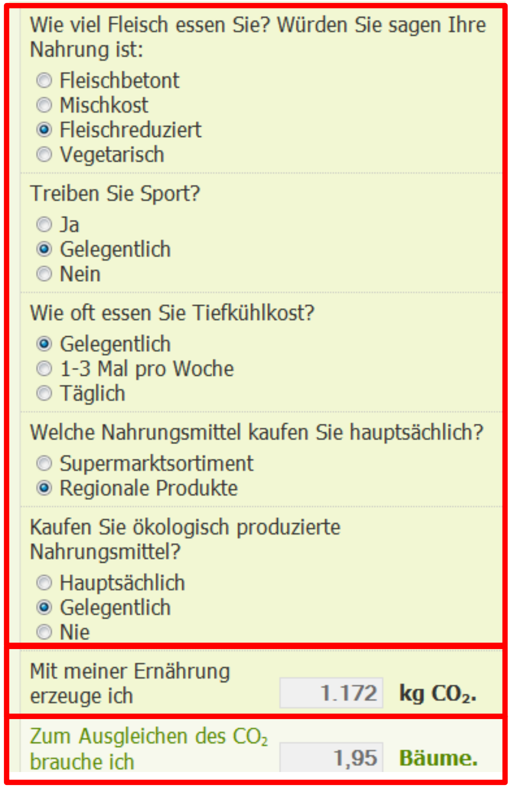
- Nature, humans, industry, etc. produce CO_2
- The amount of CO_2 is a global problem

☐ Open
☐ Guided
☒ Structured

Phase 5 - CONNECT

The teacher requests the students to calculate their CO2 consumption using the CO2 calculator:

http://nachhaltig-sein.info/co2-rechner-ernahrungessen



Wie viel Fleisch essen Sie? Würden Sie sagen Ihre Nahrung ist:
- Fleischbetont
- Mischkost
- Fleischreduziert
- Vegetarisch

Treiben Sie Sport?
- Ja
- Gelegentlich
- Nein

Wie oft essen Sie Tiefkühlkost?
- Gelegentlich
- 1-3 Mal pro Woche
- Täglich

Welche Nahrungsmittel kaufen Sie hauptsächlich?
- Supermarktsortiment
- Regionale Produkte

Kaufen Sie ökologisch produzierte Nahrungsmittel?
- Hauptsächlich
- Gelegentlich
- Nie

Mit meiner Ernährung erzeuge ich 1.172 **kg CO_2.**

Zum Ausgleichen des CO_2 brauche ich 1,95 **Bäume.**

Questionnaire about the habit of:
- Eating
- Types of food
- Doing sports

Amount of CO_2 production

The needed amount of trees to balance the CO_2 production

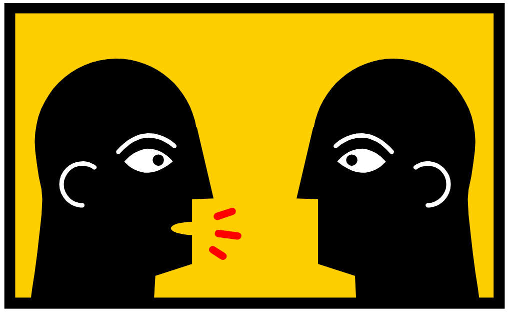
☐ Open
☒ Guided
☐ Structured

Phase 5 - CONNECT

Task:

Make an avarage of the calculated CO2-consumption and calculate the needed trees just of your school (1000 students)

Teacher takes again the wrapping of the chocolate and requests the students to discuss about the idea of „The Good Chocolate“ in 3 groups.



- [ ] Open
- [X] Guided
- [ ] Structured

Phase 6 - COMMUNICATE

Task:

Visualise your results of the experiment and the calculator and make a campaign for „The Good Chocolate“ in which you describe your results.
(poster, leaflet, homepage, movie,… in two lessons)

- ☐ Open
- ☒ Guided
- ☐ Structured

CO_2

Phase 7 - REFLECT

Discussion in groups

Reflect about your inquiry process and how did you come to your campaigns.

What is the conclusion for the future and your own life?

- [ ] Open
- [x] Guided
- [ ] Structured

CO_2

REFERENCES

http://die-gute-schokolade.trnd.com/ („The Good Chocolate“)

http://www.plant-for-the-planet.org/en/product/chocolate („The Good Chocolate“)

http://nachhaltig-sein.info/co2-rechner-ernahrungessen (CO_2-Calculator)