An organic school garden … coming into being

This educational scenario is to be implemented at the 9th Primary School of Rethimno, which houses the regional "Science Laboratory Centre for Primary Education" [SLCPE]. Part of the SLCPE resources is the school garden, which has been under development for the last two years or so, covering an area of approximately 210 m^2. At the moment nearly 2/3 of the infrastructure of the garden has been built and established. In the following school year 2008-2009 the remaining 1/3 of the garden will be built and established, whereas it "organic nature" has to come into being.

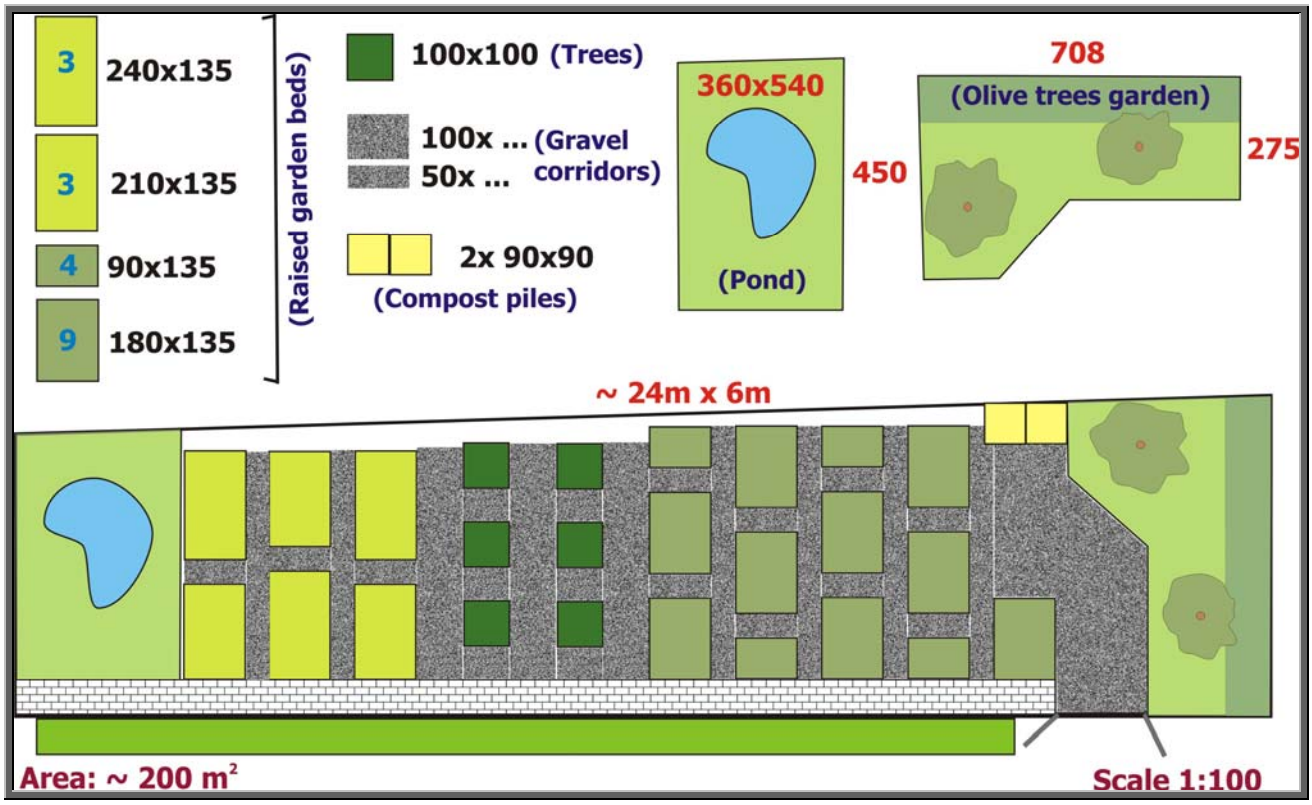


Fig. 1: A design of the school garden depicting the arrangement of raised beds and corridors.

In the beginning this area of the school backyard was mostly neglected and underdeveloped. After the building of the new school sector, where the SLCPE is housed, the development of the school garden was put forward as an idea and so far it has been perused by the administration and with the aid and personal work of teachers it has reached the point of a partial fulfillment. Designing a school garden has been a challenge for the school community, which involved us in a series of creative problem solving activities, like the kind of structure of the garden, the design and arrangement, the materials used, the teaching and learning activities we could involve the children in the development of the process etc.

After extensive research, discussions, advice of experts and estimations of cost we decided to build up a school garden in the "raised beds gardening" idea. Raised beds are popular because they are relatively easy to build, plant, weed, and maintain. We used "Ytong" blocks of various sizes according to construction needs and we built raised beds with 120 cm width for working space of various lengths, with corridors all around and a height of 45-50cm from the ground (cf. figure above). Since the soil can drain sooner and warm up faster in spring, they also enable us to plant earlier in the season. Moreover, children can work ergonomically, because they do not need to bend and hurt their spine and knees, whereas they can grow plants easier in a much more controllable setting (cf. URL: < http://www.garden.org/howtos/index.php?q=show&id=1308 >).

Photo 1: The area of the school garden as it was initially… a rather disappointing and distressing view to get to the endeavor of starting a school garden.

Photo 2: Part of the garden as it has been recently developed within the framework of the raised beds structure. Plants growing in the raised beds are depicted.

Photo 3: An aspect of the school garden close to the SLCPE building, spring 2008.

Photo 4: Children working in the school garden during a break, watering their plants, May 2008.

Hence, thirteen raised beds with corridors and watering system have been built. The olives garden on the eastern part of the garden has also been formulated as well as the area around the SLCPE building. For the coming September 2008, the composition columns, the PVC greenhouse and additional 4-6 raised beds need to be constructed for the setting to be completed to host the teaching and learning activities to follow during the school year 2008-2009.

1.1 Curriculum area

Subject/discipline area	Many curriculum areas can be covered within the thematic framework of an "organic school garden". Science, ecology and environmental education, technology and crafts, mathematics, ICT, as well as language, history, geography and social studies, nutrition and physical education. Many of the designed activities are inter-curricular and integrated within a framework of formal, non-formal and informal educational settings.
Context/level of study	This scenario is prepared for children of the 6th grade of the primary school (11-12 year-olds), whereas the 5th grade children may also participate, depending on resources and staff availability. Its main purpose is to raise interest and sensitize pupils of this age in organic agriculture through gardening practices and experience on cultivating plants organically, developing a viable agro-ecological culture. It aims to provide children with opportunities to think and act as conscious and contemporary agro-ecologists within a viable development of societies which grow plants

	organically in respect with the environment, modern local and global agricultural economies and healthy eating habits. In other words, incorporating agriculture and organic gardening in the classroom helps students understand how humans interact with the environment and how food is grown. Further, agriculture and school gardening promotes awareness of a healthy lifestyle, helps students master even demanding science concepts, and exposes students to agricultural job opportunities. By designing, cultivating, and harvesting organic school gardens, children experience deeper understanding of natural systems and ecosystems and become better stewards of the earth. Nevertheless, unlike some other activities they participate in during their school years, gardening is an activity they can participate in for the rest of their lives. On a personal level, gardening builds confidence, self-esteem, and pride as children watch their efforts turn into beautiful and productive gardens. It also teaches them patience as they wait for a seedling to sprout or a tomato to ripen. Through gardening, children help to beautify the school grounds and develop aesthetic skills. The praise they receive from peers and classmates, parents, teachers, and community members will enhance responsibility, create a sense of community spirit and perhaps introduce them to the benefits of volunteering. The pedagogue will provide an introductory framework of approaches on organic agriculture and organic gardening. Acting as a mentor and facilitator will investigate together with children ways of developing an organic school garden and alongside with the aid of experts and on-site study visits, design and develop such a garden. Teaching and learning activities will include investigations, experimentation and inquiry-based activities, constructions, gardening practice, open exhibitions etc. All children will participate in these activities. A part of the activities will be introduced and discussed through science lessons, during the period of 3 teaching hours, which is allocated to the subject in the week's formal school timetable. Another part of the activities is to be conducted in the teaching hours of crafts and in the integrated hours of what is called in Greece "the flexible zone of activities". Nevertheless, several of the activities may also expand the morning sessions of the school towards the afternoon sessions of activities as well as after school clubs, such as the "school garden club", which is to be reactivated in September 2008. Another part of the activities is to be conducted during on-site study visits in organic and botanical gardens, University and research facilities. Moreover, free time activities of personal choice can be implemented during school breaks and afternoon sessions.
Topic domain	The following topics are to be integrated in the scenario: The life of plants and their main functions, growing plants organically from seed-plants in containers and greenhouses to raised bed organic gardening. Organic treatment of plant diseases collection of vegetables and seasonal fruits and healthy eating habits. Preserving the food with solar dryers etc. Sharing information over the internet and through the "Organic.Edunet" portal.
Pre-requisite skills/knowledge	Internet basics and research engines skills, producing posters and charts, group work and basic social skills, presentation skills, basic construction skills and handling of simple tools, basic knowledge of English in order to be able to understand simple texts.

1.2 Pedagogical Approach

A school garden, needless to say an organic school garden, offers a place to enrich teaching efforts with powerful hands-on activities and experiences that make learning come alive, ideas and concepts come into being. Developing a school garden is not rocket

science, neither a “build-it-and-it-will-come” endeavour, but rather an exercise which presents a certain level of complexity and must be “child-generated” in order to be “child-owned”. If children lack ownership, they will lack a sense of stewardship. Sustainability requires stewardship. If the garden is to be used, respected and cared for, then stewardship is the key. The foundation of success is not necessarily in proper construction or sound plant selection. Although these are important dimensions of successful organic gardening, it appears that it is not so much the garden, but rather the garden programme and the integrated activities that matter and make the difference, raise the educational added value. Successful (organic) school gardens are built on the foundation of committed people, bearing in mind that there might not be a garden in every school, *but* there is definitely a school in every garden. Dewey, in his classic text “Democracy & Education” (1944) contends that *“gardening need not be taught either for the sake of preparing future gardeners, or as an agreeable way of passing time. It affords an avenue of approach to the knowledge of the place farming and horticulture have had in the history of the human race and which they occupy in present social organization. Carried on in an environment educationally controlled, they are means for making a study of facts of growth, the chemistry of soil, the role of light, air, moisture, injurious and helpful animal life, etc. It is pertinent to note that in the history of man, the sciences grew gradually out of useful social occupations”*.

Therefore “Garden-based Learning” [GBL] can be defined simply as a set of instructional strategies that utilize a garden as a teaching and learning tool. The pedagogy is based on experiential education, which is practiced and applied in the living laboratory of the garden. Moreover, GBL has the potential to enrich basic education in all cultural settings. In cases where it is most effective, GBL is a pedagogy that is used with all children. It has something to contribute to each learning style, and to children at each developmental level. It cannot be viewed as a “make work” curriculum for slow learners or socially disenfranchised learners, although it has been shown to be a powerful tool in motivating and educating young people who have been identified with such labels.

Garden-based learning offers a context for integrated learning. An integrated curriculum is often associated with real-life problems in contrast with a traditional subject–based curriculum. This provides a vehicle for higher order thinking skills as students are challenged to move beyond memorization, to see patterns and relationships and pursue a topic in depth, within a thematic approach. They are engaged in actively and socially constructing and construing knowledge, rather than passively accumulating and accepting information and they also develop analytic and synthetic thinking. At the practical level developing GBL skills raises the importance of (organic) gardening practice, through which children gain firsthand experience with the seed-to-seed cycle, the rhythm and traditions of the harvest, and the taste, touch, and smell of fruits, vegetables, and flowers. Proponents of children’s garden programs talk of the multiple developmental benefits that school gardens can have on children–namely, emotional, aesthetic, and even spiritual in addition to the more obvious social and intellectual benefits, in a variety of contexts.

1.3 Learning activities

The first set of five activities is **introductory to this course or thematic scenario** and mainly aim to provide and elaborate information in order for the children to develop the activities to be implemented during the project. Activities 6 to 10 set up **the informative and practical framework for the organic gardening to begin**. Activities 11 to 13 are actually **the practice of organic gardening in school**. Activities 14 to 15 are project **relevant applications for the enjoyment of organically grown products**. Finally

on-going activities 1 and 2 deal with the certification of organic products produced in the school garden and set the activities of the current scenario within the framework of the "Organic. Edunet" project.

Activity 1: Introducing the course, forming groups of students and groups of supporters

Learning tasks/activities	Brainstorming in the classroom and formation of spider diagrams on the white board and/or on paper in order to identify children's ideas and preferences about gardening and organic gardening products and options. The spider diagrams may become classroom posters in another crafts teaching hour. The children start forming groups and start having ideas of investigation. They discuss their assistance resources from other teachers, parents and/or experts. Groups of volunteers formulate to support the gardening projects.
Learning objectives/outcome(s)	To identify children's ideas and preferences and put them down in writing. To examine pupils' interests on organic gardening and explore possible expressions of those interests. To establish groups of pupils for further project work and supporting groups of volunteers (teachers, parents, experts etc.).
Tools/Resources	Spider diagrams to briefly identify aspects of the course and the undergoing scenario on organic gardening. Newspaper articles and advertisements of organic products on the clipboards for reading and further elaboration.
Assessment strategy (Feedback and/or evidence)	Informal feedback through classroom discussion and a second, reflective look at the spider diagrams, with possible additions and/or alterations.
Time allocated	A double session (two consequent teaching hours 45' each, a total of 90'). A follow-up meeting with the parents in an afternoon session.

Activity 2: Retrieving information and initial planning activities

Learning tasks/activities	Children visit the School Computer Laboratory and perform research activities using search engines with key words like: gardening, school gardens, organic gardening, organic products, cultivating plants etc. Children are also introduced and navigate in the "Organic.Edunet" portal. Pieces of the retrieved information are discussed and checked for their validity and then saved and/or print out for further elaboration. Back in class or in the Science Laboratory, the information is discussed and ideas about possible activities in the school garden are encouraged to arise. The possibilities and constrains of the school garden to become organic are also introduced. A need for more information and assistance of experts is expected to arise, in order to provide foreground for the following activity.
Learning objectives/outcome(s)	To search for project relevant information over the internet using research engines and key words. To discuss and assess the validity of relevant project information. To introduce children to the "Organic.Edunet" web portal. To list an indicative set of potential project activities and discuss their feasibility in practice.
Tools/Resources	School Computer Laboratory, search engines, texts and hypertexts, photos,

	maps and charts. Initial itemization of possible project activities in a list.
Assessment strategy (Feedback and/or evidence)	Arrangement of the pieces of information on notice boards and attempts to interconnect them within a thematic approach to the project. A list of potential activities to be tackled in the course of the project development and possible selection of the more sound ones.
Time allocated	A double session (two consequent teaching hours 45' each, a total of 90') in the School Computers Laboratory and A double session (two consequent teaching hours 45' each, a total of 90') in the Science Laboratory or in class.

Activity 3: Inviting experts in school to talk about organic gardening

Learning tasks/activities	After studying the relevant information retrieved during the previous activity, the children list questions about organic gardening and organic practice in the school garden, which they would like to ask an expert. Four to five experts such as experienced organic farmers, researchers, agriculturalists and/or practitioners are invited to school in a morning conference session to be attended by children of the last two grades (at least). Children ask their questions to the experts, whereas the session is videotaped to be reviewed in class for several issues to be reconsidered. Possible establishment of collaboration with these experts is sought and potential study visits in organic fields, greenhouses and/or research facilities are discussed and planned ahead.
Learning objectives/outcome(s)	To approach and interact with experts in the field of organic gardening by asking questions as they develop from previous information elaboration. To establish potential collaboration with experts and their institutions. To plan ahead one or two on-site visits in organic gardening facilities.
Tools/Resources	Children will develop question cards and notes to ask the experts. The video tape of this session will be available to them for reviewing and reconsideration and remain as documentation and record in the Science Laboratory Library.
Assessment strategy (Feedback and/or evidence)	Children will be asked to write a short essay about their experience with the interaction with experts to conclude with proposals and possible future developments of the organic school garden
Time allocated	A whole morning session of 5 to 6 teaching hours, in the form of a small school conference.

Activity 4: A study visit to an organic garden and/or a botanic garden

Learning tasks/activities	As a consequence of the interaction with experts during the previous activity, children will plan an on-site visit to an organic garden and/or a botanic garden and perhaps a second one in a collaborating agricultural research facility like the "Institute of olive tree and subtropical plants of Chania" (cf. URL: < http://www.nagref-cha.gr/indexen.html >). Children will be encouraged to take interviews of key figures of the site and also photos and videos. Upon return to the School Science Laboratory, all this information will be analyzed, discussed and considered thoroughly.
Learning objectives/outcome(s)	To encounter a first-hand experience of an organic garden, confront the difficulties and asses the benefits of such a practice.

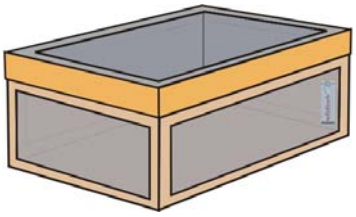
	To take interviews and ask informative questions to obtain project related information. To collect photos and videos and extract information out of the depicting images.
Tools/Resources	Tape recorders, digital photograph cameras and video cameras, notebooks.
Assessment strategy (Feedback and/or evidence)	Start a dynamic, on-going concept map to include acquired information and transform it as the information load increases and new links are formed between concepts and well as cross-links between clusters of concepts in order to enhance meaningful learning. This concept map will develop during the course of the project as additional concepts and/or clusters will be added and modified, it the form of an on-going formative assessment of the whole process. Later on, these concept maps can be reconsidered and transferred to a computer software application, such as "Inspiration" and/or "CMaps" (cf. URL: < http://cmap.ihmc.us/Publications/ResearchPapers/TheoryCmaps/TheoryUnderlyingConceptMaps.htm >).
Time allocated	A whole morning session for the on-site study visit(s) and a double session (two consequent teaching hours 45' each, a total of 90') in the School Science Laboratory for elaboration of information and further development.

Activity 5: Reconsidering and listing (organic) garden project activities

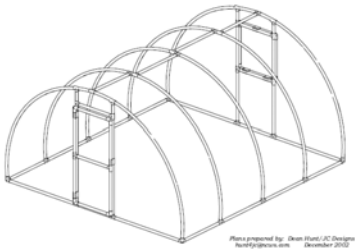
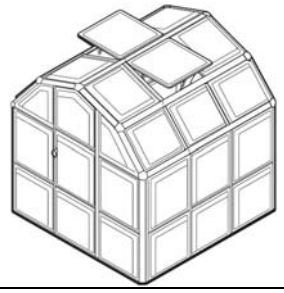
Learning tasks/activities	After having elaborated all available information so far children may compare their latest ideas with initial ones and reform some of them, reject others and add new ones. The main task of this process is to create a list of activities to be conducted in the school garden, whereas some ideas of making an organic garden are expected to emerge with the aid and intervention of the pedagogue. This list of activities to take place may be an indicative one and certainly not a finite one, since other activities may be incorporated as the project develops. Group work is also distributed according to pupils' interests and further investigation is planned. Assistance from supporters, volunteers and/or experts is also included in the picture.
Learning objectives/outcome(s)	To create an elaborated set of activities for the development of the project and put it up on a poster. To decide which activities each group will get involved and which could be done in whole class sessions.
Tools/Resources	A poster of activities created in a whole class session with distributed group work for children.
Assessment strategy (Feedback and/or evidence)	Informal feedback through classroom discussion and a second, reflective thinking, with possible additions and/or alterations.
Time allocated	A double session (two consequent teaching hours 45' each, a total of 90') in the Science Laboratory or in class.

Activity 6: Studying greenhouse models

Learning tasks/activities	An inquiry-based science investigation where pupils will study the greenhouse effect inside model greenhouse boxes. The sides of cardboard boxes with lids are cut off and replaced with plastic film (see side drawing). Then these greenhouse models are taken outside in the school yard or in the garden on a sunny day and the raise of temperature over time left in

	the sunshine is studied. Data is collected in tables and/or charts and each group of pupils writes up a short report of results. Open issues for further investigation are expected to arise such as: what is the temperature that we need for plants to survive in "real" greenhouses? what creates the greenhouse effect? what happens when we have ventilation in the box i.e. open one or two of the side fames? etc. Most of these ideas and results may also be uploaded on the Organic.Edunet portal.
Learning objectives/outcome(s)	To investigate the greenhouse effect through model greenhouses in order to understand the concept for further application in the garden greenhouses To measure temperature inside the model greenhouses over time and create charts and/or diagrams. To understand deeper the greenhouse effect at the micro level of the models and the garden greenhouses, as well as triggering projections at the macro level of the global greenhouse phenomenon.
Tools/Resources	A worksheet with an open investigation activity on these model greenhouses. The boxes, the plastic film and basic tools for the construction.
Assessment strategy (Feedback and/or evidence)	An assessment leaflet with some open questions for further investigation (homework). A couple of designed concept cartoons can be implemented (cf. URL: < http://conceptcartoons.com/index_flash.html >) in a framework of formative assessment to evaluate deeper understanding or relevant concepts.
Time allocated	A double session (two consequent teaching hours 45' each, a total of 90') in the school yard or the garden for the investigation. One teaching hour (45') for the elaboration of data, discussion and formative assessment.

Activity 7: Constructing greenhouses out of PVC pipes in the garden

Learning tasks/activities  	After having elaborated the concept of the greenhouse effect on the models, the construction of one or two greenhouses in the school garden may follow. These greenhouses are to be built with readily available materials like PVC pipes and various joints and greenhouse plastic films. There are several available designs on the internet (cf. URL: < http://www.pvcplans.com/ >), such as tunnel greenhouses (see side drawing), house-like with **Λ** roof greenhouses etc. Alternatively, readymade greenhouses either plastic and/or metallic can be bought and assembled. Such greenhouses are available in various sizes from many companies around the world. Plastic ones appear very attractive and safe for children since they use polypropylene synthetic material instead of glass and also come with a built-in ventilation system (e.g. URL: < http://outstanding-keter.co.il/GreenHouses.asp >). Many groups of children can work successively with the help of supporters and volunteers until the construction of the project is done and the greenhouses are ready for housing the plants in the school garden.
Learning objectives/outcome(s)	To experience the construction of an educational greenhouse in the school garden made of common materials. To be able to read designs and plans and follow basic instructions and safety rules in the development of simple and low technology projects.

	To manipulate safely simple tools and achieve simple construction arrangements. To enhance a sense of ownership of project constructions i.e. greenhouses in order to increase commitment of stewardship in action.
Tools/Resources	Greenhouse designs, available construction materials (PVC tubes, joints, plastic film) and basic tools. A worksheet of the applied construction for dissemination on the "Organic.Edunet" portal and further use by partners.
Assessment strategy (Feedback and/or evidence)	Development of problem solving skills and creative planning as a reflective practice during the construction and on the construction. Feedback from peers and supporters during the construction and through relevant discussions.
Time allocated	Groups of pupils may work on the construction during technology and crafts hours or in the "zone of flexible activities" and/or in the afternoon sessions. Preparation of materials and infrastructure can be taken care of by supporters, local community members and volunteers after school time or during afternoon sessions.

Activity 8: Studying the garden soil – the root of it all and start thinking organically

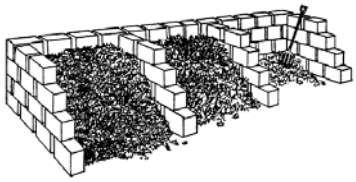
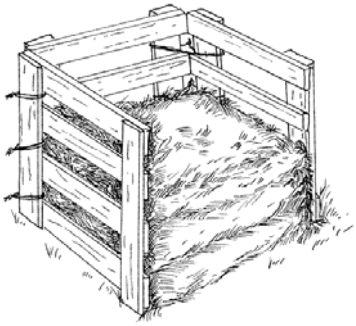
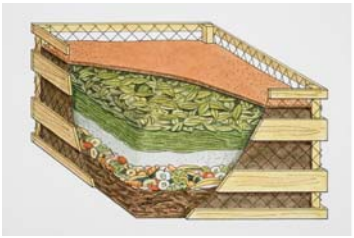
Learning tasks/activities 	A major issue in organic gardening is the preparation of soil, especially the last 10 cm in a raised beds garden arrangement. The basic principle might sound simple as it is "feed the soil in order to feed back the plants for you". Thus, the main research question that arises is how to "feed" the soil and moreover how to "feed" the soil organically? The main scope of organic gardening is to improve "living soil" with its myriad of microbes and earthworms, rather than degrading it by saturating it with artificial and frequently toxic chemical fertilizers. Soil should be viewed and thought of as a "living organism" and not as a sum of a few unrelated and separate parts. When plants are grown conventionally, petro-chemical fertilizers are used to "feed" the plant directly, which can result in excessive growth and poor cell structure, which in turn can increase the attack of insects. With organic growing, organic matter and natural minerals in the soil "feed" the soil micro-flora and worms. They in turn "feed" the plants by releasing the essential nutrients that the plants need. This provides sustained, regular growth and strong cell structure. The novice gardeners, children in particular, must be patient enough because it takes time for soil fertility to build up and a balanced ecology to develop, alongside with possible insect damages and crop failures in the early stages. These ideas on organic soil basics constitute a framework for experimentation, discussion and development of arguments. Children may study different soil samples and also grow plants in them to realize substantial distinctions.
Learning objectives/outcome(s)	To identify different types of soil and realize the distinction between organic soil and chemically fertilized one. To understand the importance of "healthy" soil in organic gardening by collecting information and by conducting relevant investigations. To develop, support and juxtapose arguments regarding organic and non-organic soils
Tools/Resources	Investigations through planting seeds (e.g. beans) in different soils and watch them grow and crop over time, providing separate soil conditions, organic and non-organic.

	Children can be provided with selective texts and/or designed concept cartoons to develop pros and cons arguments on organic soil and soil with chemical fertilizers.
Assessment strategy (Feedback and/or evidence)	Designed concept cartoons for the development of arguments, in oral and/or written form. Revision of on-going concept maps in order to add concepts and restructure the "soil" cluster of ideas.
Time allocated	Two or three double sessions (two consequent teaching hours of 45' each, a total of 90') in the school garden for the investigation and in the laboratory for discussion and development of arguments.

Activity 9: Studying decomposition columns made out of plastic bottles

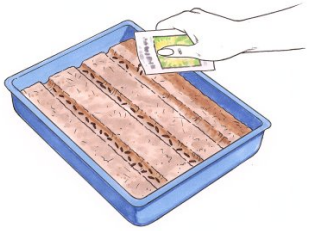
Learning tasks/activities 	Compost in the soil appears to be the cornerstone of organic gardening. But, before children experience how compost is made in the garden they can do a small scale experiment by constructing a decomposition column out of a soda plastic bottle (see picture aside). Decomposition involves a whole community of large and small organisms that serve as food for each other, clean up each other's debris, control each other's populations and convert materials to forms that others can use. The bacteria and fungi that initiate the recycling process, for example, become food for other microbes, earthworms, snails, slugs, flies, beetles and mites, all of which in turn feed larger insects and birds. The decomposition column can act as a miniature compost pile or landfill, or as leaf litter on a forest floor. Through the sides of the bottle one can observe different substances decompose and explore how moisture, air, temperature and light affect the process. Children will work in groups of four to design, construct and operate a decomposition column to be left outside in a protected place in the school garden. Drawings, observation texts and charts can be written down on a small diary to be kept during the activity.
Learning objectives/outcome(s)	To understand the main concepts and ideas of decomposition by constructing a decomposition column out of readily available materials. To investigate further how a decomposition column works and recognize it as a model of how parts of an ecosystem work. To keep a small diary and to organize information in drawings, texts, tables and charts. To work collaboratively in groups of four and share ideas and experimental practice.
Tools/Resources	Plastic bottles and basic tools for the construction of a model of a decomposition column.
Assessment strategy (Feedback and/or evidence)	Diaries and small essays about the development of the process of decomposition. Designed concept cartoons for the development of arguments, in oral and/or written form regarding the decomposition process. Revision of on-going concept maps in order to add concepts and restructure the "decomposition and soil" cluster of ideas.
Time allocated	A double session (two consequent teaching hours 45' each, a total of 90') in the school yard or the school garden for the setup of the activity. A frequent visit of the decomposition column, on a daily basis or on every second day period, by members of each group in order to observe and record the developments of the project.

Activity 10: Building a compost chamber and compost heaps

Learning tasks/activities    	Compost, the "brown gold", is the magic ingredient of organic gardening. Composting is a natural process that recycles plant materials. Essentially, bacteria and other organisms feast on carbon-rich matter and digest it producing humus, a rich, stable medium in which plants thrive. Compost provides nutrients to make soil rich and fertile, and keeps it moist and airy by opening up the soil, also trapping and draining water. Most organic materials can go into compost such as: straw, cut grass, organic waste from the kitchen, weeds, plants, leaves, animal manure, wood ash, feathers, cotton cloth, bits of leather or paper, soil. Materials that should not be used are: cooked food, large pieces of wood, plastic, metal, glass, crockery, wire, nylon, synthetic fabrics, coal ash, seeding grass or very tough weeds. A compost pile should start with a layer of sticks for drainage, followed with layers of grass, leaves, manure and soil. Consequently, wet and dry are mixed and brown and green are alternated. Big leaves are chopped up, a final layer of soil is added, a hole in the middle is made to let air in and water the heap, covered with grass or with a cloth to keep it damp (see side drawings). After about five days the heap will heat up as bacteria work to break it down. The compost must be kept damp. About six weeks later the compost pile should be turned by taking it out and then put it back again, or move it to the next bin if we use the three chamber system, but always keep it damp. It is to be turned again every few weeks. After three months or so it should be tested. If it is dark, crumbly, light and moist, it is ready to use. It is usually spread before planting in a raised bed and when potting, and/or put around growing plants every two weeks. It should not be left to dry out, thus it is better used in the early evening, when it is cool, and covered with mulch to keep it damp. The above mentioned process is obviously a lasting and on-going activity, also a patience exercise, which can be cut down in steps to be followed and manipulated by pupils, with the facilitation of the pedagogue and supporters. The compost chambers have to be built in collaboration with children, teachers and supporters and then run in cycles over periods of time, as an educational and recycling activity integrated in other on-going school activities. The children keep their groups as set up in the previous activity.
Learning objectives/outcome(s)	To understand the main ideas and concepts of composting at a larger scale in chambers at the school garden, by building compost heaps and studying over time. To investigate the micro-organisms which are responsible in the making of compost by collecting information and/or conducting field studies. To apply compost in the cultivated plants and observe their growth.
Tools/Resources	Compost chambers and/or bins, an essential infrastructure for the conduct of this activity. They will have to be built following particular designs and standards and with the aid of teachers, supporters and volunteers. The handling of basic garden tools safely is also important as well as patience over time needed to actually realize the processes of this activity and reach some fruitful results.
Assessment strategy (Feedback and/or evidence)	Diaries and small essays about the development of the process of composting in the garden. Designed concept cartoons for the development of arguments, in oral and/or written form regarding the production and use of compost. Revision of on-going concept maps in order to add concepts and restructure the "compost" cluster of ideas.

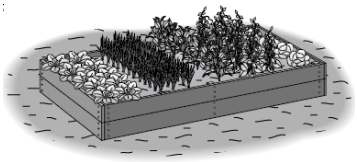
Time allocated	Two double sessions (each of two consequent teaching hours 45' each, a total of 90') in the science laboratory and in the school garden for the setup of the activity. A frequent visit of the compost heaps, on a daily basis or on every second day period, by members of each group in order to observe and record the developments of the project.

Activity 11: Growing seeds in seed-starting pots and trays and/or in the greenhouse

Learning tasks/activities	   It is important for organic gardening to start with seed-plants to be transplanted in the raised beds at later stage, or at least this appears to be a basic phase of the process of an "organic certification" of produced crops, at least in case such a certification is intended. The various starting containers should be selected to suit the needs of the varieties to be grown. Commercially available flats, seed-starter trays, cell-packs, peat-pots, and flower pots as well as plastic-foam or paper cups and aluminium baking trays are typical containers. Each container should have adequate drainage for the plant roots not to rotten. If containers have been used previously, they have to be cleaned with a mild bleach solution to prevent the spread of plant diseases. A light-weight sterile seedling mix should be chosen to start the seeds, usually mixed with enough water to moisten. It is then used to fill the 2/3 of the containers and plant the seeds. Using for example seed-starter trays, small vegetable seeds should be sown in rows, usually in at a rate of eight to ten seeds every 3 cm or so. Row indentations are made about 1 cm deep with a label or pencil and the seeds are sprinkled evenly in the rows. Then the seeds are covered with the potting mix and pressed lightly to ensure contact between the seeds and the soil. These, for instance, are practical activities, which may have not been performed before by the majority of the children, even from those who grow up in rural areas nowadays. The children continue to work in groups of four and plant their seeds in the various containers. The selection of seeds to be planted is an important and serious issue that needs to be discussed in class and identify the respective resources to obtain local varieties of seeds as well as organically developed ones. After the seeds are put in the containers they are to be transferred to the greenhouses to grow in a protected environment.
Learning objectives/outcome(s)	To select the appropriate seeds for planting in starting seed containers by searching for relevant information and seeking the assistance of experts. To prepare the planting pots with the adequate soil and follow basic instructions and/or regulations for planting the seeds. To practice the planting of seeds in various containers and experience its value. To take care of the planted seeds in the greenhouses and to observe their progress regularly.
Tools/Resources	Various containers to be used for planting the seed as well as available soil mix. The greenhouses are needed for the growing of the seed-plants, which must have been constructed at an earlier stage. Information about the local and/or organic seed varieties to be planted can be sought over the internet, in books or in collaboration with experts.
Assessment strategy (Feedback and/or evidence)	Informal feedback through classroom discussion and decision making processes over the appropriate seeds to be planted. Designed concept cartoons for the development of arguments, in oral and/or written form regarding the planting of seeds in containers.

	Revision of on-going concept maps in order to add concepts and restructure the "seed-plants" cluster of ideas.
Time allocated	Two double sessions (each of two consequent teaching hours 45' each, a total of 90') in the science laboratory and in the school garden for the setup of the activity. A frequent visit to the containers with the plants in the greenhouses, perhaps on a daily basis, by members of each group in order to take care of them, observe and record their development.

Activity 12: Putting the young plants in the raised beds

Learning tasks/activities	  The most important reasons to grow organically vegetables and seasonal fruits in raised beds are because they: (a) simplify permanent planning of what areas may be compacted and which areas are protected from crushing field traffic, (b) contribute to overall strategy to boost yields from four to sixteen times compared to conventional yields per equal-sized areas, (c) improve efficiency of labour, fertilizers, materials, (d) enhance plant growth and health, (e) make major savings of irrigation water, (f) extend growing season length. Moreover, the plants arrangement can be an easy and playful activity for children, provided they keep some standard geometrical distancing rules that various plants need to grow in raised beds. They can easily be protected from bad weather conditions by sheltering the plants using various easy techniques and simple materials and they can easily be turned into small greenhouses conditions demanding (see drawings aside). The children continue to work in groups of four and take the seed-plants from the greenhouses and transplant them in the raised beds. An important issue at this stage is the combination of plants to be put is each raised bed in order one to attract "useful insects" fro the other fro instance and to grow up in harmony and organically. Information and advice from experts as well as facilitation from pedagogues, supporters and practitioners is to be sought at this stage.
Learning objectives/outcome(s)	To prepare the raised beds accordingly by enriching and refreshing the soil to accept the new plants. To decide and organic combination of plants to be set up in each raised bed after having elaborated information and advice from elders and from experts. To transplant the seed-plants from the greenhouses to the raised beds following particular techniques and practice.
Tools/Resources	The raised beds needed for this activity have been constructed at an earlier stage. Basic handling of garden tools in necessary. Photographic and video documentation is to be kept during this activity to be elaborated later during the development of the plants.
Assessment strategy (Feedback and/or evidence)	Informal feedback through classroom discussion and decision making processes over the appropriate combination of seed-plants to be transplanted in the raised beds. Designed concept cartoons for the development of arguments, in oral and/or written form regarding the transplanting of seed-plants in raised beds. Revision of on-going concept maps in order to add concepts and restructure the "transplanting in raised beds" cluster of ideas.

Time allocated	Two double sessions (each of two consequent teaching hours 45' each, a total of 90') in the school garden for the setup of the activity. A frequent visit to the containers with the plants in the greenhouses, perhaps on a daily basis, by members of each group in order to take care of them, observe and record their development.

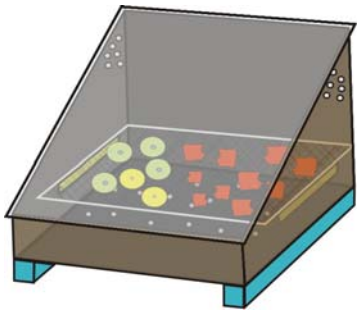
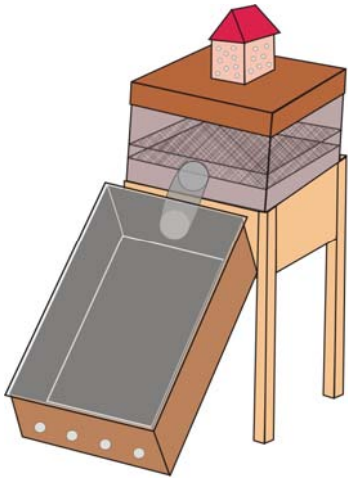
Activity 13: Nurturing the plants and keeping them healthy

Learning tasks/activities 	When plants are established in the raised beds, it appears to be a good time for some more formal pieces of information about the nature and functioning of plants to come into the picture, alongside with a harmonic nurturing by the children. Thus, the root system, the leaves and branches, the flowers and fruits as well as the concepts and processes of photosynthesis, respiration and transpiration, units usually found in most primary and early secondary science curricula can be taught formally in the science laboratory as well as in the school garden, which may now act as a live learning site and exhibit mainly manipulated by children with an increased sense of commitment and stewardship. In this sense, teaching and learning activities become more interesting and apt, situated in a long created, non-threatening and highly familiar environment. At the practical level children will have to learn how to nurture their plants and how to deal with insects and diseases organically. The need of expert assistance and pedagogical facilitation is rather apparent at this stage and needs to be provided adequately, in order to implement some difficult and demanding pieces of knowledge and traditional practice, didactically transposed in a way to fit the level of the organic school garden approach.
Learning objectives/outcome(s)	To understand the main parts of plants and their basic functions, through a sequence of a formal teaching intervention in the science laboratory and in the school garden. To investigate with inquiry-based activities the main functions of plants (photosynthesis, respiration and transpiration) and produce short essays, tables and/or charts. To nurture the plants in the school garden and observe their development in a short group diary. To collect information about plant diseases and their organic treatment and apply some techniques in practice.
Tools/Resources	Equipment and materials to be used for a series of experimental activities in investigating how plants function within the ecosystem. Science text books and DVDs on the topic of plants and organic gardening. Group diaries and notebooks.
Assessment strategy (Feedback and/or evidence)	Designed concept cartoons for the development of arguments, in oral and/or written form regarding the plants and their main functions, but also about organic gardening. Revision of on-going concept maps in order to add concepts and restructure the "plants and their functions" and "organic gardening" clusters of ideas.
Time allocated	Four double sessions (each of two consequent teaching hours 45' each, a total of 90') in the science laboratory and in the school garden for the setup of the inquiry-based activities and the elaboration of information and/or data. A frequent visit to the raised beds with the plants, perhaps on a daily basis, by members of each group in order to take care of them, observe and record their development.

Activity 14: Harvesting the crop and cooking for healthy nutrition

Learning tasks/activities  	The significance of health benefits of eating fruits and vegetables is widely documented, and yet most children do not eat the recommended daily amount. Growing fruits and vegetables in an organic school garden improves children's attitudes toward these healthy foods and motivates reluctant eaters to try them. The garden can be used as a hands-on tool to teach healthy nutrition lessons, including the importance of fruits and vegetables and proper food preparation techniques. Activities may include a comparison of the importance of nutrients in the health of humans and of plants and a study of the nutritional value of the various crops in the school garden. Identification of the parts of the plant represented by common fruits and vegetables and discussion about the difference in nutritional value of various plant parts. Conduct of a blindfolded taste test using organically grown vegetables and conventional vegetables from supermarkets. Harvest a salad raised bed garden and give the children a chance to organise a salad party for school classmates. Creation of daily menus that include all components of a balanced diet coming from the organic school garden. Creation of food journals that highlight how many fruits and vegetables are eaten in a week by school children and make tables and charts to be presented in school assemblies in posters and/or power point files with comments on healthy eating and the value of organically grown products. Perhaps these can also be published and disseminated to the local community as part of the final school events, at the end of the year. Children may work individually as well as in pairs and/or groups of four to deliver these activities in the science laboratory and in the school garden.
Learning objectives/outcome(s)	To collect information about the nutrients of organically grown fruits and vegetables in the school garden To compare organically grown fruits and vegetables with those which are conventionally grown. To appreciate the value of a balanced healthy diet with organically grown fruits and vegetables, incorporate it in their daily lifestyle and possibly affecting others' nutritional lifestyles as well. To design poster and/or power point presentations about the above mentioned issues to disseminate information and experience to classmates and the local community.
Tools/Resources	Various presentation and testing materials and tools found in the science and computers laboratories as well as facilities and utensils accessible at the school kitchen.
Assessment strategy (Feedback and/or evidence)	Designed concept cartoons for the development of arguments, in oral and/or written form regarding the nutrients of organically grown fruits and vegetables and the healthy eating habits and lifestyle. Revision of on-going concept maps in order to add concepts and restructure the "nutrients of organic fruits and vegetables" and "healthy eating" clusters of ideas.
Time allocated	Two double sessions (each of two consequent teaching hours 45' each, a total of 90') in the science laboratory and in the school garden for carrying out some of the indicative activities mentioned above. Some time also needs to be allocated for pupils to present their work to school classmates as well as to the local community.

Activity 15: Preserving our food naturally and traditionally

Learning tasks/activities  	Drying out food in the sun is an ancient technique and practice, know even to the ancient Egyptians and to the nomads of Asia, Latin America and Africa. Dehydrating food, not only preserves it in high quality, but it also makes it storable in a fragment of space, since dehydrated food occupies 1/3 to 1/6 of its original dimensions and keeps about ¼ of its original mass. A solar dryer is basically a box or frame with a plastic cover with adequate ventilation and circulation of hot air. Or, in a more advanced design, two boxes, one used as a collector and air heater and another one used as a dryer (see drawings aside). Constructing solar dryers or dehydrators out of one or two cardboard boxes appears to be a rather easy and interesting task for children and young adults. Solar drying is a fast way of dehydration, which also preserves nutrients better. It takes about three days for fruit/vegetable strips and slices and about two days for leaves and herbs. No chemicals are added and the only source of energy needed for the process is the renewable solar energy. Basically, when food is dehydrated, its moisture is taken away, in order not to get spoiled or rotten. The content of water in fruits, vegetables and herbs is at the range of 5% to 25%. The temperature inside the dehydration boxes should be enough to evaporate food moisture without “cooking” the food. Approximately 50-60 °C appears to be an adequate temperature. Constant flow of dry, hot air inside the dehydration box is needed in order to evaporate the food moisture and water. It is important for the process of dehydration to be completed in the shorter possible time and in a temperature which will not affect the quality, taste and colour of the food. Dehydrated fruits, vegetables and herbs should be stored in airtight containers and treated accordingly before consumption. Other ideas of preserving food produced in the organic school garden could be canning and pickling, fruit marmalade or tomato souse (salsa) making etc. Children work in groups of four to construct solar dehydrators to be used for drying out vegetables, fruits and herbs produced in the school organic garden. In collaboration with volunteers, parents and/or supporters other ideas of natural and traditional ways of preserving food may also be processed, providing children with some practical skills for viable practices in modern societies, which may have been forgotten in recent years, but rather appear to be gradually redefined and valued on different grounds of environmental recourses management.
Learning objectives/outcome(s)	To investigate traditional ways of preserving food and experience solar dehydrating as a food preservation technique. To construct solar dryers out of cardboard boxes and readily available materials and put them in action by dehydrating vegetables, fruits and herbs from the organic school garden. To experience other ways of preserving food, such as canning, pickling, marmalade making, tomato sauce making etc. with the assistance of parents and supporters. To estimate the value of traditional ways of preserving food seen within the framework of an ecological way of living with respect to the environment and its resources.
Tools/Resources	Cardboard boxes and a few common materials are needed for the construction of the solar dryers to be applied in practice by children at a later stage. Supporters and volunteers seen as human resources needed in the supervision of the constructions as well as in the presentation of other ways of traditional preservation of food, e.g. children’s grandfathers and grandmothers.
Assessment strategy	Designed concept cartoons for the development of arguments, in oral

(Feedback and/or evidence)	and/or written form regarding the traditional ways of preserving food and solar dehydration. Revision of on-going concept maps in order to add concepts and restructure the "preservation of food" cluster of ideas.
Time allocated	Two double sessions (each of two consequent teaching hours 45' each, a total of 90') in the science laboratory and in the school garden for the construction and set up of the solar dryers. Drying out fruits, vegetables and herbs in the garden may also take some "personal" free time and involvement of children, for example in taking care and reorienting the solar dryers every hour or so during the school day and then take them inside over night and then take them out again the following day etc.

On going activity 1: Certifying an organic crop

Learning tasks/activities	The certification of an organic crop appears to be an essential process, even if the crop is of small scale like the one developed in an organic school garden. Nevertheless, the certification process requires a continuous examination and control of soil samples, plant development and harvest analysis, always following particular national and EU standards. The respective organizations and/or agents are distributed locally throughout the country and it is planned to get in touch with them from the very initial stages of the project, in order to seek for advice and support on its development making feasible an eventual "organic certification" of garden products. It appears to be important for children to get involved in this process and to follow its stages in order to become more conscious and committed agriculturalists and agroecologists, as well as consumers, always seeking for high standards of quality.
Learning objectives/outcome(s)	To sensitize children in the quality control of organic products by getting involved in the year-round measurements of the respective evaluation committee. To aware children of the high standards of quality they should demand as consumers of organic products in the market.
Tools/Resources	Apart from following up some measurements conducted by the organic products certification committee, no other tools or resources are needed.
Assessment strategy (Feedback and/or evidence)	Informal feedback through classroom discussion and discussion with committee members as well as with experts.
Time allocated	This is a year round activity in collaboration with the organic products certification committee, experts and supporters.

On going activity 2: Participating in the "Organic.Edunet" portal and uploading pieces of project work

Learning tasks/activities	Throughout the development of this educational scenario and as parts and/or projects of it are completed, they can be uploaded on the portal of the "Organic.Edunet" since they are all enrolled in its activities. This can be done by groups of children as well as in whole class sessions at the school computers laboratory, over time basis depending on the project activities development. In this way, dissemination of ideas and/or activities

	can take place amongst all partners in the “Organic.Edunet” project.
Learning objectives/outcome(s)	To upload project work on the portal of the “Organic.Edunet” for dissemination and communication with partners.
Tools/Resources	The computer laboratory and basic software.
Assessment strategy (Feedback and/or evidence)	Informal feedback through classroom discussions and the writing of an essay about the process of communication and dissemination of project activities over the internet.
Time allocated	This is a year-round activity in collaboration with partners from the “Organic.Edunet” project, experts and supporters.

A few general remarks

This educational scenario, described in the previous sessions, is a year-round scenario for the development of an organic school garden, with a set of activities put in an indicative sequence. Nevertheless, parts of these activities may be altered and/or modified in respect to children’s participation and their needs and demands, as they are brought about during the course of implementation.

The on-going *concept maps* construction is a formative type of assessment tool with a final product, which can also be used for a summative, final project assessment.

The design of *concept cartoons* throughout the phases and within the activities of this educational scenario is, apart from another formative assessment technique, also an argument production activity reinforcing the argumentative skills of the pupils, which are mostly needed in discussing controversial issues (e.g. organic *vs* non-organic products, compost *vs* chemical fertilizers etc), but also help in the didactical transposition of demanding concepts (e.g. the greenhouse effect, photosynthesis, fertile soil etc.). The child’s point of view is the starting point for more advanced messages to be conveyed and communicated through classroom discussion.

The scenario over all is composed of child centered activities, which act both at the conceptual level as well as at the practical and emotional levels. This constitutes a holistic approach, which appears to be a prerequisite of modern schooling pedagogies.