

Discovering the Environment around School, with Local Communities: A Reflection Approach of Required Skills

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Abstract

A Cretan Lyceum, with local communities, materialized an Environmental Education Project, with the subject of “Forest, Biodiversity and Quality of Life” based on the principles of the Education for the Sustainable Development. The project aimed to update, aware and mobilize students on issues related to the forests, wetlands, biodiversity, sustainability and quality of life, to develop an anti-consumer model by highlighting the traditional way of life and to involve them in the care-management of natural ecosystems. The project activities took place in two different natural ecosystems of Greece, in the north and south.

Objectives of the research were to draw attention to the skills that teachers and students need and cultivate for the implementation of Discovery Teaching method in projects of Education for the Sustainable Development which aim to cultivate the future environmentally and science literate active citizens. This research is a case study of content analysis of the project’s archival material by using the Evaluation Tool for the Application of Discovery Teaching Method in the Greek School Project of Environmental Education (Kalathaki, 2015). Were coded 7 research categories, such as the promoting of Critical Thinking and Problem Solving, Communication and Collaboration, Establishment of Requirements for Lifelong Learning, Promotion of the Sustainable Development, Cultivation of Active Environmentally Literate Citizens, Inquiry Skills, Use of ITCs.

Keywords

Discovery Teaching, local communities, skills, Education for the Sustainable Development, school environmental projects

1. Infroduction

Committee Delor (1996), in the report addressed to UNESCO “Learning the Treasure Within” identified four structural axes of Education, Learning to Know, Learning to Do, Learning to Live and Work Together, Learning to Exist. Building the Education of the future European citizens, Lisbon strategy summarized 8 key competences into communication in the mother tongue, communication in foreign languages, basic competences in mathematics, science and technology, digital competence, the way of learning, interpersonal, intercultural and social competences, ability of active citizenship,

entrepreneurship and cultural expression (EU, 2006; LEC, 2000). European system for VET (ECEVET, 2010) defines skills as the ability to apply knowledge and use know—how to complete tasks and solve problems. Basic skills needed to cultivate trainers and learners to enable them to meet the above objectives relating to critical thinking, creativity, the European dimension and active citizenship, which in their entirety, can contribute to achieving personal fulfilment, active participation and improve employability of the individual.

For the cultivation of the listed competencies and skills in schools required to implement modern teaching methods in terms of content, processing and organization of data and conditions of education for environment and sustainability. According to the UNECE (2005) Strategy for Education for the Sustainable Development (ESD), schools should be encouraged and be supported to adjust their curricula to the needs of a sustainable future. Formal ESD should be permeated by experience of life and work beyond the classroom. Global Action Program (GAP) on ESD, launched in Nagoya (Japan), reorients education and learning so everyone has the opportunity to acquire the attitudes, knowledge, skills and values to empower them to contribute to Sustainable Development (SD) and strengthen education and learning in all activities, agendas and programs that promote SD (UNESCO, 2014). In order to discover the world around with the scientific way of knowledge discovery, to discover the concepts in Educational processes, has to be followed scientific reasoning, hands-on activities, student-centered discussion, identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations (Espinosa-Bueno et al., 2011).

Meleses Lyceum of Crete (Greece) designed and implemented an Environmental Project, with the subject “Forest, Biodiversity and Quality of Life”, in school year 2007-2008, in the framework of “Open Environmental Classes Callisto” Program of the Greek Ministry of Education (circular, November 28, 2007, p. 587, March 18, 2008, p. 4395). “Open Environmental Classes” targeted, among others, to make rural activities and natural way of life familiar to students and learn more, by informing on issues of sustainable management of natural resources and experiencing of alternative tourism that is friendly to the environment. The referring School Project of Environmental Education (SPEE), with 5 months duration, based on the principles and objectives of Environmental Education (EE) and ESD, of Declaration of Tbilisi in 1977, the UNESCO Decade of ESD (UN, 2002) and the Strategy of ESD as formulated in Vilnius in 2005 (UNECE, 2005), all referred in the Circular of Greek Ministry of Education (2007). It was carried out by 36 students, members of the school environmental team, with the guidance of 3 teachers, with expertise in Literature, Biology and Informatics, who formed the pedagogical team and had the responsibility of the implementation.

Objectives of this research were to draw attention to the skills that need and, also, cultivated during the implementation of discovery method for teaching the future environmentally and science literate and active citizen in the studied project. In order Discovery Teaching (DT) to be effectively and successfully implemented in SPEEs, are required skills of educators and learners, which are cultivated on the way, such as critical thinking and problem solving, communication, foundation of lifelong

learning, promotion of Sustainable Development (SD), cultivation of active and environmentally literate citizen (Kalathaki, 2015b). The skills that are essential to the building of understanding are both physical and mental skills, concerned with generating evidence and using evidence to test ideas that may help to explain an event or phenomenon being studied. Skills for scientific inquiry involve knowledge and understanding, not only knowing how to generate, collect and interpret data but also understanding why it is important to work scientifically.

The skill of problem solving penetrates all school didactic objects. Problem solving structures gradually secures the confidence to achieve the educational objectives, for instance of a SPEE, because fosters experiential knowledge, skills and values and develops collaborative actions to care for the environment (Koliadis, 2002). Over the years, a main approach is clearly evident in the science education literature that comes to the enhancement of students' and teachers' understandings of the nature of Science. When students and teachers build up by themselves the scientific inquiry, when they design and conduct a scientific investigation in the schools, they come eventually to understand science and scientific inquiry as mirror what scientists do (Espinosa-Bueno et al., 2011).

Students have alternative ideas on the relationships among organisms, difficulties to categorize living beings, limited understanding of the concepts of producers and consumers, they fail to realize the energy flow in ecosystems, to make teleological thoughts on that other organizations exist only for the people benefit, or that the number of producers is large to satisfy consumers, etc. (Driver et al., 2000).

One different mode of teaching ESD, in Community-based learning, is schools action as social agent, both working as part of the community and inviting the community to be involved as a resource, in decision-making processes (Opertti, 2009). Participatory approaches have proven particularly useful in the development of educational projects in new subject areas and in collaboration with teachers, having each one a unique mission and audience by using the learners' experience of the workplace (Krasny & Lee, 2002). Teachers and students practiced in the social participation and the community engagement, provid the vehicle for science to act in the real world (Vatrikas & Toya, 2007).

The specific character of transformative teaching and the use of innovative approaches and methodologies is based on the assertion that the "learner" cannot benefit from them in the course of a traditional "information transfer" or simply by receiving descriptive information about the new methods (Savelava, 2010). ESD engages formal, non-formal and informal education (settings and provisions), is a lifelong endeavor which addresses context, content, pedagogy, global issues, and local priorities in order to transform learning, by transformation of thinking for change (Opertti, 2009). As the curriculum expresses and reflects society's values, attitudes, expectations and feelings about its welfare and development, the competency-based approaches of the curriculum may, possibly, offer a progressive way to address learners' diversities, to cope competently with different types of situations (Opertti, 2009). Competencies are socio-historical constructions mainly developed through learning situations. With this vision, the competency-based approach provides an innovative way of conceiving and organizing the curricular structure, objectives and discipline-contents, for developing people who

will be autonomous, critical and assertive citizens, ready to undertake initiatives to improve their quality of life. The aim of the UNECE Strategy of the ESD was to encourage UNECE member States to develop and incorporate ESD into their formal education systems, in all relevant subjects, and in non-formal and informal education in order to equip people with knowledge and skills in sustainable development, increasing their opportunities for acting for a healthy and productive life in harmony with nature and with concern for social values, gender equity and cultural diversity (UNECE, 2005).

In 1997, in the World Conference of UNESCO, adopted the broader term of “Education for Sustainable Development”, for all levels of Education. EE and ESD have principal objective to engage students in environmental research, to inquiry and discovery learning, as practiced in the real world, with the main target ensuring the rights of future generation. ESD argues that the current promoted political and social treatment includes three directions: 1. Education on citizenship, as an attempt to understand the history, politics, governance, management and political processes, 2. Education through citizenship, covering the generally defined empirical cognition as a component of learning through practice and implementation, 3. Education for citizenship which aims to develop knowledge and understanding of tools, as well as teaching skills, abilities, values, capabilities-moods that give students the opportunity to participate actively, sensitively and responsibly. Since skills are the key element for Europe’s economic and productivity growth and for job creation, should look ahead and match future skills better to future needs, particularly for new types of jobs such as “green” jobs and other growth areas (EC, 2009).

2. Method

The research is a case study of content analysis of the SPEE archival material which aimed to clarify the appropriate skills for implementing the DTM in SPEEs with the target of cultivation of future environmental and science literate citizens. The research questions related after the formulation of the problem, fixed the objectives, selected the techniques and the research sample (Cohen & Manion, 1994; Bell, 1997; Iosifidis, 2003). The archival material of the project, consisting of printed and digital documents, photographs and videos examined in structured and defined way, making discourse analysis. The content of printed and digital archival material examined in a structured manner by discourse analysis in order to satisfy the criteria of the Evaluation Tool for the Application of DTM in the Greek SPEEs Kalathaki (2015b) and the Instrument to Assess Pedagogical Content Knowledge of Inquiry Application to High School of in-Service Science Teachers (Espinosa-Bueno et al., 2011) that took into consideration for preparing a more specific tool to cover the research demands, with codified 5 different categories of skills for inquiry based teaching the future science and environmental literate citizens. In parenthesis are some indicative criteria that browsed by the reading of archives, in any ways of their expressions:

A. Critical Thinking and Problem Solving (think about everyday problems and display relevant historical aspects, from evidence to develop explanations to the posed questions, develop descriptions,

make predictions by using evidence, make the relationships between evidence and explanation, recognize and analyze alternative explanations and predictions).

B. Communication and Collaboration (discussion, sharing with others, dissemination, team learning and working, experiential learning, collaborations).

C. Establishment of Requirements for Lifelong Learning (exploitation of previous and current generations' knowledge, experience and culture).

D. Promotion of the Sustainable Development.

E. Cultivation of the Active Environmental Literate Citizen (participation, engage, involvement, undertake initiatives, actions and activities in personal basis, in the community framework).

F. Inquiry skills (predicting, planning, carrying out an investigation).

G. Use of ITCs (gather bibliographic information and data to be used as evidence, make presentations, use web 2.0 technologies).

The last two categories (Inquiry skills and ITCs skills) penetrate transversally the rest so they do not referred separately in the research results. New technologies accelerate data collection, classification and analysis, minimizing the time between discovery and application in educational processes (Rutherford & Ahlgren, 1991).

The content analysis was done in four stages (Cohen & Manion, 1994; Bell, 1997; Iosifidis, 2003). At the first stage, an initial theoretical elaboration and clarification of the research themes and questions took place. In the second stage, became accurate determination of the research sources and fixed the archival material of the Application Forms (AFs) and the Final Reports (FRs) of the SPEEs. To triangulate the data and results were interviewed three teachers who coordinated the studied project (Iosifidis & Spyridakis, 2006). In the third stage, was defined the phrase as recording and analysis unit, and the material was, also, codified in the above mentioned different categories. The complexity and mixed character of theoretical and applied research contributed to be used the sentence and paragraph as the recording unit.

3. Results and Discussion

Promotion of SD was a key objective of the project. Students guided to connect SD with the target of getting acquainted of the synthesis of bio-communities of two different ecosystems and ways of management and protection that have been already successfully implemented in Crete and elsewhere. This way of approach the project subject enabled students to understand the need of the environmental care and the ecological sustainability and cultivate skills which ensure the quality of life. The project seems to have cultivated in a relative good grade the above referred skills, also from the point of view of grouping by Griffin et al. (2012) and Delor Committee (1996) that of knowing, doing, living, working, existing and more specifically working as communication and collaboration-teamwork, and the living in the World as citizenship with local and global life and career, personal and social responsibility, including cultural awareness and competence.

A) Critical thinking, problem solving

The SPEE, according to the European Union Strategy for ESD (UNECE, 2005), aimed to cultivate knowledge, values and friendly attitudes towards the environment, especially the development of critical thinking by solving environmental problems.

Understanding of the social, economic and political components of an environmental issue. Teachers applying the discovery method in the project, built up a multi-layered target of discovery, with teams worked in different speeds and depths of the issues. In classical problems (exercises) the students have all the elements in ahead while in problem solving, the problems were open, conducting an investigation to find the data, like researchers work. The studied project aimed at fostering critical thinking, as stated in its objectives: “the cultivation of observation ... building capacity of search, observation and recording” (AF). The development of the skill of problem solving depends on the correct formulation of the problem, the detailed recording of data, extensive data and observations’ analysis, in formulating alternative solutions, underlying assumptions and key conclusions, factors that they did not evaluate in this project.

By using DTM, students practiced in recording, analysis, synthesis, evaluation of observations, so they could make assumptions, scenarios, conclusions, recommendations and formulate alternative solutions which can lead to decisions making. “The students compared local to other forest ecosystems in North Greece, visited areas that have head to the management and protection of the environment in order to be able to formulate their own proposals and to develop initiatives for the development of their homeland ... Will be analyzed findings and motions on the issue, so students will have direct involvement in solving the problems that will be placed” (AF).

Students’ alternative ideas on the relationships among organisms of an ecosystem. The developed activities aimed at changing students’ alternative ideas and realization of the dramatic role of humans to overthrow the ecological balance. In all phases of the program, teachers tried to guide the students to link SD with the quality of life of active, environmental literate citizens and to put themselves in this syllogism. In the FR is written “as far as the theme of the program: a. the principles of ESD as expressed by UNESCO have been satisfied, and developed the dimensions of sustainability”.

Discovery learning is directly linked to our experiences, results and influenced by the context in which it takes place, derives from experimentation and practice (Komis, 2004). In ESD, problem solving builds the ability to think critically on what the experts say, consider ideas and explore dilemmas and inherent contradictions in sustainable living (Vare & Scott, 2007). Teaching with such orientation involves the organization of the curriculum around issues in society (Krasny & Lee, 2005). In the benefits are included the cognitive opportunities for students to use their prior knowledge in learning of new scientific objects by utilizing all the sources they can access.

B) Communication and collaboration

Innovative Educational Techniques to Cultivate the Skill of Communication. The objectives of social content jointly discussed by the teachers and students, expected to “better acquainted with the teachers

which will bring them closer together, decrease the distance of teacher-student and love more school” (AF). Some of the innovative educational techniques applied in the program to cultivate the skill of communication were interviewing, comprehensive discussions, workshops and round tables. Communication of the program participants was facilitated by the use of telephone, fax, sms and emails, whenever it was not directly feasible. Also, “the conference presentation of the project was designed to be at the school on May 9. Invitations were given to the school community, local municipal authorities and cultural bodies”. “There will be a round table with local bodies and citizens, where students will present the program, highlighting images of the visited areas, and set subjects for open discussion” (AF).

Participatory Approaches: Teachers, who designed and implied this SPEE, emphasized in the moral, economic, emotional, political, in a word social, current concerns and quests of Sciences. They taught in a dialogue frame, as they had to take care about the intensive students’ participation and conformation of the process, the teaching instruments and the objectives of their learning procedure. By the practice in the SPEE, teachers developed a different approach of learning than the traditional which they mainly use in the classrooms for science teaching. In the beginning of the project designing, were taken into account the students’ ideas on natural resources, gleaned from Driver et al. (2000), such are the organisms can always find a livelihood to survive, also produce many more descendants than those can sustain the available resources, etc.

Developing Collaborations. One of the project objectives was “developing partnerships with schoolmates of other schools (via internet), promoting the idea that the environment has no borders-we are all citizens of a global village”. They wanted also “development of cooperation with actors both from our place and of sites to visit” (AF). The assistance by the school teachers, scientific experts, local municipal authorities and residents of the study areas was planned in order to get the “acquaintance with the principles and agencies of the local community will help them to understand how the Public Administration works” (AF). Participation in the national school environmental network “Biodiversity source of life”, coordinating by the EEC Kastoria and borrowing of museum kit “The Forest” from the Natural History Museum of Athens provided the environmental team with specialized educational material suitable to meet the needs of the program (AF, FR).

C) Establishment of requirements for lifelong learning

Experiences Influence the Context and Content of Environmental Learning. When educational programs aim at personal development of students, the same will pursue in the future, when they have removed from the bearings of the formal education. “The project aimed to cultivate knowledge in regards matters of Ecology and SD, values and behaviors, skills on problem solving, finding and developing ways of communication and collaborations and foundation requirements for lifelong learning” (Teacher 2). The objectives of aesthetic content were related to the “development of aesthetic criteria based on the harmony of nature, environmental awareness and culture, development of self-awareness and self-esteem, enjoyment, diverse and fruitful living in the student company,

identification and cultivation of deeper artistic, technical and scientific bents, skills, circumstances and sensibilities of students” (AF). Students of the environmental team, coming from different villages, had the opportunity to develop discussions and interviews with the elders of their villages on the use of forest land in the past, nowadays and ask them to make predictions and suggestions for the future, grounding an intergenerational communication (AF, FR).

Knowledge about the Local Context. School surveys for local environments can also be exploited to the conquest of scientific knowledge in the Science lessons. According to Carlsen (2001), even though the underlying investigated scientific phenomenon is unknown, such as “the health of a stream”, it contains knowledge about the local context. This knowledge is based on knowledge of the nearby enterprises and industry, climate projects if mosquitoes, for example, are a problem in the spring, if the stream dries up in summer, etc. Knowledge of these phenomena is a resource that can be used in learning relevant scientific concepts in Physics, Chemistry, Geology, Biology, etc. Thus, by focusing on a local issue and endorsement of its creation in a social context, the existing knowledge of students (a portion is detailed scientific) recognized and entitled as a conceptual resource. Constructivism emphasizes on the active role of the students in solving real problems, which creates motivation for them (Kordaki, 2000).

Formal, Non-Formal and Informal Education in Lifelong Learning. Many and varied activities took place inside and outside the classrooms, with school and local communities, for the protection and exploitation of two distant and different natural environments which are situated on the south and north of Crete. The project aimed to update, aware and mobilize students on issues related to the forests, wetlands, biodiversity, sustainability and quality of life, to develop an anti-consumer model by highlighting the traditional way of life and to involve them in the care-management of natural ecosystems. Ultimate objective was to infuse them in the development entrepreneurship in their place, exploiting the integrated taught science subjects that linked to the environment and the social, economic and cultural ones that are linked to the local sustainable development. In this project, teachers introduced the issue and decided about the appropriate methods and techniques for gathering and analyse data in a discovery learning procedure. Students followed the teacher’s instructions, to discover the correct relationships between variables, to define the relevant problems to their interests and needs, since they are the ones who decide the acceptable solution to the problem or the inquiring issue. In “PROJECT 2061” of the American Association, relating to the objectives for learning and teaching Science, the first chapter of the book “Science for all Americans” states that: teaching of Science should be extended beyond the school, since children learn from their parents, siblings, other relatives, peers, adults with some authority figure. They learn from the films, television, radio, any records and archives, trade books and magazines, by computers, from visits to museums and zoos, sporting events, concerts, and also from textbooks, in the school environment generally.

D) Promotion of the sustainable development

The Subject of the Project, ESD Issue. Project Axes were the promotion of anti-consumption pattern

and the emergence of the traditional lifestyle. Students visited agro-tourism units in different areas and quite distant from each other, such as in Macedonia and Crete prefectures. In agro-tourism unit Selena they informed about the electrical autonomy afforded by renewable energy sources (Teacher 1). On the business level, agro-tourism is the link between the primary and secondary to the tertiary sector, i.e., the agricultural and livestock production to manufacturing touristic services (Agrotouristiki AC, 2007). Students, by visiting and staying at agro-tourism units of their region and Prespes, had the opportunity to understand the importance of agro-tourism in the SD of rural areas as it is an economic activity that creates, sustains and stimulates the local market, provides new jobs, offers an additional income to rural families and keeps the population in the countryside.

Ensuring the Rights of Future Generation. Objectives of social content included clarifying the rights of future generations in a unique axis that we have borrowed the environment from our children. The perception of biodiversity and the importance of conservation can lead to “sustainable management of natural ecosystems and their exploitation on the basis of the rights of future generations” (AF). As Teacher 1 said, been intended, also, students become acquainted with the synthesis of bio-communities of different ecosystems, ways of management, care and protection of natural ecosystems and to be educated about the values of ESD. “Targets of social content, that we discussed together with students, were the configuration of a code of values and attitudes towards themselves, their team and the environment ... promoting ethical values of solidarity, volunteerism and protection of the rights of animals and humans” (AF).

E) Cultivation of the active environmental literate citizen

Social and Intellectual Development of Students. Activities were designed and developed to improve students’ perceptions about the flow of energy from the producers to consumers in ecosystems and man’s position in it (Teacher 3). “The students will come to discover the forest communities, be informed about the management practices developed in areas of exceptional natural beauty, to understand the geophysical and cultural specificity of areas with different biodiversity than of their place, to perceive the structure and function of an ecosystem” (AF). The project ATC21S has been designed to help that process of social and cognitive growth on the foundation of a conviction that students develop and grow socially and intellectually both naturally and through intervention by school and community-based programs.

When DTM is applied in the classrooms, students are taught in a way of becoming active learners, not passive recipients of published knowledge, so they become knowledgeable, skilled and empowered to create and co-create solutions. After all, this and next generation of leaders will have to discover a new, their way to a more sustainable societies, because, sadly, we currently do not know how to create such a world (McKeown, 2011).

Undertaking Action. “Our students will be able to submit proposals for their own local areas ... shall undertake initiatives of developing extended discussions for the management and exploitation of the unique forests of our region..., participate in decisions and management practices of our municipality ...

develop a pathway in the situated gorge near the school, with indications of biodiversity and historical monuments” (AF). The environmental team undertook the domiciliary informing citizens about the proper management of waste, participating to the campaign of the Municipality of N. Kazantzakis on recycling. “With the experience gained from their participation in the educational program and their youthful enthusiasm encouraged locals in the recycling policy of the villages” (Teacher E1). Many linked scientific subjects that are taught in school courses were discussed during this action, facing the application of scientific theory in the industry and the everyday life.

4. Conclusions

Abilities and understandings for Science as inquire, that mentioned by Bybee (2004), referred in Espinosa-Bueno et al. (2011), are the identification of questions that can be answered through scientific investigation, design and conduct a scientific investigation, use of appropriate tools and techniques to gather, analyse and interpret data, development of descriptions, explanations, predictions and models by using evidence, critical and logical thinking to make the relationships between evidence and explanation, recognition and analysis of alternative explanations and predictions of Science advances through legitimate scepticism, communication of scientific procedure and explanations, use of mathematics in all aspects of scientific inquiry.

The studied project was designed to cultivate an anti-consumption pattern, and emerge the traditional lifestyle, for a more sustainable management and care of natural ecosystems that will ensure the rights of next generations. Emphasis was given in the cultivation of values of ESD for ecological viability, beauty, accountability, social justice, solidarity and tolerance (Flogaiti, 2006). The designed educational actions and activities, as visits, discussions and suggestions for the sustainable management of students’ homeland, aimed to develop citizens who are not merely informed but is also active, sensitized and can undertake a responsible role to contribute to the community life, acting innovatory at local and wider context.

Concluding, the aims, actions, activities and process of the studied project served in a relative good level the demanded skills for inquiry based teaching the future science and environmental literate citizens regarding critical thinking and problem solving, communication and collaborations, foundation of the requirements for Lifelong Learning, promoting Sustainable Development, science and environmental literacy for future active citizens. As Savelava (2010) says, educators need to create new educational settings based on the active interaction with their learners, and in doing this, mutually “live” and “act” these new ideas in collaboration with other participants of the learning process (classmates, schoolmates, members of learning groups, etc.).

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