Evaluation Tool for the Application of Discovery Teaching Method in the Greek Environmental School Projects

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Abstract

Greek school community emphasizes on the discovery direction of teaching methodology in the school Environmental Education (EE) in order to promote Education for the Sustainable Development (ESD). In ESD school projects the used methodology is experiential teamwork for inquiry based learning. The proposed tool checks whether and how a school program follows discovery teaching approaches under the principles and guidelines of EE and ESD. The criteria focus on the active teaching and learning which promote student discover, regarding the role of the community as a learning environment which can cultivate active, environmentally responsible citizens. The Evaluation Tool answers 3 research questions and 17 sub-queries with 47 criteria on the skills for implementation of discovery teaching method, the process of discovery teaching method and the learning environments.

Keywords: e*valuation tool; discovery method; school environmental projects*

1. Introduction

International Committee of Wise on Education in the 21st Century announced the following purposes for the students' education: learning to live together, learning to be, learning to know, learning to do (Delor, 1996). According to UNECE (2005), effective Education for the Sustainable Development (ESD) should be approached with the integration of the SD in the whole range of relevant educational fields. ESD has to provide well organized educational programs and develop initiatives on specific objects with meaningful learning experiences in educational institutions, workplace, families and communities. Learning is an adaptive process in which we learn to organize the world of our experiences, as we do not discover the truth but build viable explanations of our experiences (Osborne & Freyberg, 1985; Komis, 2004). Thus, knowledge is not transferred or accepted passively by the learners, but actively constructed by them (Olssen, 1996).

Bruner faces learning with the Socratic meaning, as a process of internal reorganization through discovery. Students learn on their own pace, voluntarily, by making use of their internal experience and capabilities, establishing a scientific way of working on learning like in Platon Dialectic (Mokias, 2008). According to Bruner, everyone can learn anything at any age with proper structure and organization the material and proportionate approach of teaching. Discovery Teaching Method (DTM) is the art of creating situations, where students take on the role of scientists in order to satisfy their curiosity. This curiosity is satisfied when individuals have constructed mental models to adequately explain their experience by developing and reconstructing the shapes and frames of their knowledge through the gained experience, under the assistance of their teachers (Driver et al, 2000). Rutherford & Ahlgren (1991) believe that teaching should be consistent with the nature of scientific inquiry, for this reason, they suggest teaching of Science and Technology to go on with steps of the scientific research, starting with questions about nature, focusing on the collection and use of evidence, providing historical contexts and perspectives, insisting on clear expression, using team approach. In the environmental didactic researches which are carried out in the school ESD projects, additional emphasis is given in the sociological nature of Science, more over than the specialized scientific ecological one that was given in the past in the Environmental Education projects (Meyer & Avery, 2001). As it is intelligible to all, traditional information transfer from the teacher to students is not effective any more.

Educators need to create new educational settings based on the active interaction with their learners, and mutually live and act these new ideas in collaboration with other participants of the learning process, such as classmates, schoolmates, members of learning groups, of the school and local community, etc (Savelava et al, 2010).

In recent years DTMs have been criticized for their effectiveness, and compared with the direct teaching, considered that they have equivocal results (Koliadis, 2002; Kassetas, 2008). DTMs often require much time and hard preparation, low levels of learning achieved, fear for false conclusions. Researches have shown that students persist to observe and interpret according to 'their own' pre-existing perceptions (Keys & Bryan, 2001; Llewellyn, 2001 στο Trautmann & MaKinster, 2005). Teachers, as well, express a wide range of conceptions about discovery learning, representative approaches and misunderstandings of the term. Some teachers define research as learning guided with questions, and other think of it as any kind of manual activity. Unsurprisingly, these varying interpretations and misinterpretations define the ways that investigation is applied in the classrooms. Teachers feel more comfortable relying on textbooks, lectures and laboratory demonstration exercises than to facilitate a research based on experience (Davis, 2003; Loucks-Horsley et al, 2003; Trautmann & MaKinster, 2005).

At seminars, conferences and articles of the Greek school community, has realised the value of the discovery direction of teaching which need to be followed in the School Programs of Environmental Education (SPEE) in order to promote ESD (Lekkas et al, 2005; Spyropoulou, 2005; Flogaiti, 2006; Scoullos 2007; Circular of Greek Ministry of Education, 2007). Also, several abroad studies have demonstrated the value of the application of DTMs in EE (Bartel et al., 2003, Carlsen et al, 2000; 2001; Krasny & Lee, 2002). In Greek educational bibliography, such studies are few, even limited in Secondary education. It will be very useful to ascertain whether SPEE actually follows the DTM to educate students in SD. Teachers involved in EE programs, educational advisors and tutors, educational administrations and researchers are interested in the clarification and promotion of inquiry/research processes in the classroom by the DTMs.

The proposed Evaluation Tool checks whether and how a SPPE follows the discovery teaching approaches in the context of principles and guidelines of EE and ESD. The 47 criteria focus on those activities that promote students' research relating to the role of school and local community in the learning environment in order to cultivate active, environmentally responsible citizens who will be involved in the future, in a sustainable management of their place, their country, the world at large.

2. Method

To answer whether the SPEE apply the DTM to promote the principles of EE towards SD, needs to be an adequate overall evaluation. Based on the literature review, drawn up the following described Evaluation Tool for Content Analysis of the archival material of school environmental projects, consisting of 47 criteria, answering 3 research questions and 17 sub-queries (Tables 1,2,3). This Tool was founded on the basic principles of DTM, EE and ESD, as proposed by Earth Charter (2000), European Union (2001), Medies (2005), UN (2002), UNECE (2003; 2005; 2006) the findings of Cornell Science Inquiry Partnerships of USA (Trautmann, 2003), of the SEED Socrates/Comenius project for ESD-Schools, (Breiting et al, 2005), the Greek Ministry of Education, the Pedagogic Institute (P.I), the National Technical University of Athens (EMP), and other researchers and authors (Bruner 1960; Meyer and Avery, 2001; Trautmann et al, 2004; Flogaiti E, 2006; Matsagouras, 2007; Koliadis, 2002; Kokkotas et al, 2004; Huckle, 2006; Scott, 2007; Kamarinou, 2000). In this tool are concentrated and interweaved the criteria for DTM with those of EE and ESD school programs' design.

The research questions and sub-queries are: I. Skills for implementation of discovery teaching method (A. critical thinking/problem solving, B. communication & Collaboration, C. foundation of requirements for lifelong learning, D. promotion of sustainable development, E. cultivation of active environmentally literate citizens), II. Process of discovery teaching method (A. select forms of discovery teaching methods, B. levels of organization activities, C. educational strategy, D. teaching approach, E. evaluation F. ensuring active participation, III. learning environments (A. information technology and communications, B. classroom, C. laboratory of natural sciences, D. library, E. in the field, F. local communities).

3. Results & Discussion

3.1 Skills for Implementation of Discovery Teaching Method

In order to be successful a school project of ESD should cultivate to students those practical skills that will allow them to continue, after they leave schools, living sustainably (McKeown, 2002). These skills, among others, are the

ability to work partnering with others, to use procedures of knowledge, research, action, judgment, imagination, connection, evaluation and selection which move them from the awareness towards the practical knowledge and the action. Komis (2004) correlates these skills with DTM and specifies them into the ability of solving problems, developing critical thinking, investigating and searching for information on a wide range of data, decision making, reorganizing of the existing knowledge, modelling phenomena and situations of real-world, cooperating and jointing approaches of issues, transferring knowledge from one to another context, realising the ways we learn (meta-cognition), learning with interdisciplinary and cognitive ability of consciousness. It is necessary, teachers to have the abilities and appropriate competencies to effectively guide students in the discovery learning process and SD. Wilke et al (1987) identify four broad areas of knowledge, abilities, capabilities and skills that constitute professional competence of the teachers in EE: knowledge about environmental issues and problems, skills of teaching, implementation and evaluation of EE, abilities of searching and exploitation of information, capabilities of analysing environmental problems with their ecological and cultural impacts and the associated values.

A. Critical Thinking/Problem Solving. The Strategy of ESD (UNECE, 2005) notices 18 states that the trainees at all levels should be encouraged to cultivate and use systemic, critical and creative thinking and deal with issues of both local and global context as preconditions for action for SD. Students should be assisted in developing creative and critical thinking (Greek Law 1566/1985) on the structure and function of Primary and Secondary Education, article 1. The key features of critical thinking according to Fisher (1992 into Koliadis, 2002), is readiness to use logic, based on the right arguments, willingness to challenge ideas while respecting the individuals' value and the desire to find the truth. The development of problem solving skills lies in the proper formulation of the problem, the detailed recording of data, the extensive data analysis and observation, the wording of alternatives, the relevant cases and important conclusions according to the principles of sustainability (P.I website, 2007; Komis, 2004; Millis & Cottell, 1998). Thus, teachers can build a multilayer target of discovery teaching and learning, working with groups faster and exploring deeper into the problem. Problem solving is a higher-level cognitive process that entails the coordination of a set of demanding and interrelated skills as it penetrates all subjects, since it structures and gradually secures the confidence to achieve the objectives, fosters experiential knowledge, skills and values, and develops collaborative actions to care for the environment (Komis, 2004).

B. Communication & Collaboration. Modern constructivists and scientists dealing with the psycho-sociology of the classroom, based on positions of Piaget and Vygotsky emphasize the role of inter-student communication and collaboration, in learning and mental development (Matsagouras, 2007). The skill of communication in the school environmental programs is being promoted through partnerships among students, teachers, external collaborators (agencies, parents, scientists, bodies, locals) and participation to environmental and social networks.

Promoting Sustainable Development (SD) requires global cooperation, given the fact that the local element has a universal character and the decisions of local communities formalize an overall economic and social policy worldwide. N. Kazantzakis, in 1956 had called on the BBC and the magazine Life and Letters of London intellectuals from all over the world, to establish an International Spirit to safeguard the political values and peacekeeping because "...the moment that now goes humanity, is critical, and all the world has now become a unique and tightly united organization, that's why a nation is unable to be saved, only by itself, if not saved all together. And if a nation is lost, this can also lure in loss all the others. We have forever left behind the season that a nation could be isolated and be saved or lost alone. Therefore, when talking to the people of your race today, you feel that at the same time you speak to all human races ..." (Anemogiannis G., 2000). In the same wavelength to Kazantzaki's views are the decisions of the International Conference of UNESCO and the European Union (2007), according to which, the SD derives and ensured from the global cooperation and consensus through which the solutions will be sought for the deal with global problems such as health, education and environment, based on a sound economic growth. The basic reasoning of SD is founded not only on the way that someone usually thinks about the things, but primarily on thinking about the relationships (Huckle, 2006).

C. Foundation of Requirements for Lifelong Learning. According to Scott (2007), in the future we need to think and work in difficult routes. We will need to reply to difficult questions that even we do not understand completely. The distant future will depend less on our compliance to be trained in order to do the right things now, and more on our ability to analyse, to formulate alternative questions and take our own decisions when we need to. Consequently, Life Long Learning equips us to choose the most advantageous, as the future unfolds. In an intergenerational project, civil, participatory action research in six American cities (Allentown and Philadelphia in Pennsylvania; Baltimore, Maryland; and New York City, Buffalo, and Rochester in New York), entitled "Garden Mosaics", Krasny & Doyle (2005) tried to remove barriers between the involved groups (youth, gardeners and teachers)so as to improve local conditions. The key elements of the project were to work with young people which would develop research questions,

the adults of the local community who participated in the investigations in order to answer these questions and the development activities, based on the results of research, which could benefit the total community.

Table 1. Evaluation Tool for the Application of the Discovery Teaching Method in the School Environmental Programs Regarding the Required Skills of Students and Teachers

Research Question	Research sub-queries	Criteria for the application of the Discovery Teaching Method in the programs
I. Skills for Implementation of Discovery Teaching Method (DTM)	A. critical thinking/problem solving	1. Analysis, synthesis, evaluation of the decision 2. Understanding of the problem components (social, economic, political) 3. Recording of data and observations 4. Formulation/wording of suggestions, solutions, alternatives, assumptions, conclusions, scenarios
	B. Communication & Collaboration	1. Promote partnerships between students, with teachers 2. Development of collaboration with external partners (parents, scientists, agencies, local community) 3. Participation in school environmental networks 4. Interviewing, development of discussions 5. Participations to conferences, workshops, round tables
	C. Foundation of requirements for lifelong learning	1. Highlighting personal experiences 2. Intergenerational cooperation with agencies, organizations, parents, community
	D. Promotion of sustainable development	1. Development of components of sustainability (care of environment, solidarity, social justice) 2. Development of sustainability dimensions (ecological, economic, social, cultural, personal)
	E. Cultivation of active, environmentally literate citizens	1. Suggestions on eco-management 2. Develop of social, political action/social interventions 3. Developing knowledge, skills and values required by active and critic citizens

D. Promotion of Sustainable Development. Vare & Scott (2007) are referred to the Education for the Sustainable Development (ESD) as building the capacity to think critically on what the experts say and to consider ideas, to explore dilemmas and contradictions inherent in sustainable living. Within the framework of ESD projects, the proposed solution does not involve directly the adoption or implementation. The solution needs to be desired by society and aim at the general prosperity, to involve more those who have the final decision, and those who will suffer any consequences. It is certain that such decisions will effect on the environment and will motivate the engaged citizens to take the specific and appropriate actions in order to protect it, ensuring children's future. School surveys could be used, except in the conquest of scientific knowledge in the subjects of science in the school laboratories and classrooms, also to discover the local environments. According to Carlsen (2001), even though the underlying phenomenon is unknown, as the "health" of a stream, it contains much knowledge that is taught in the schools and is included in the local context. This knowledge is based on knowledge about nearby enterprises and industry, climate patterns, if mosquitoes are a problem in the spring, if the stream dries up in summer etc. The knowledge of these phenomena is a resource that can be used in learning relevant scientific concepts such as biodiversity and its relation to the habitat, chemical and microbiological analyzes, geography, hydrodynamics, diseases and defense mechanisms etc. Even more important is that, by focusing on a local issue, and upon

consideration that is created in a social context, the existing knowledge of students (usually partly scientific) is recognized and legitimized as a conceptual resource (Krasny & Doyle, 2005). Benefits include cognitive opportunities for students to use prior knowledge in learning the new scientific knowledge by using all the sources they can have access to.

E. Cultivation of Active Environmentally Literate Citizens. The last years' concern has been developed around the turn of the dominant paradigm of social and political education in conjunction with the desired objective and positive model of citizenship (Karakatsani, 2005). Basis of this model is the citizen who is not merely updated or informed, but is also active, can undertake a responsible role to contribute to the community life, to take initiatives at local community, at national and wider world context. Future active and environmentally literate students can be taught inquiry, in order to come into socio-cognitive conflict and realize the discrepancy between subjects of similar cognitive capacities on the problem solving or judgment on a subject (Doise & Mugny, 1984). In this conflict, when a person has a problem and formulates an estimate, receives from the social environment a coherent response, thus, the person realizes that, apart from his own point of view, there are also, and other considerations.

3.2 Process of Discovery Teaching Method

According to the Strategy of UNECE (2005), ESD must use a wide range of educational methods, participatory and oriented processes, on finding solutions tailored to learners. Apart from the traditional methods, should be used, debates, conceptual mapping, philosophical quest, values clarification, simulations, "scenarios", modeling, role playing games, educational games, information technology and communications, research/surveys, case studies, visits and learning in the field, work plans, projects, study of best practices, building on experience from the workplace and problem solving.

Table 2. Evaluation Tool for the Application of the Discovery Teaching Method in the School Environmental Programs Regarding the Following Process

Research Question	Research sub-queries	Criteria for the application of the Discovery Teaching Method in the programs
II. Process of the Discovery Teaching Method (DTM)	A. Selection of the suitable type of discovery teaching method	1. Inquire 2. Guided discovery 3. Didactic research
	B. Levels of organization activities	1. Informational: collect information, data 2. Organizational: comparison, categorization, layout, ordering 3. Analytical: data correlation 4. Practical: explanation, interpretations, predictions, reviews, reorganizations
	C. Educational strategy	1. Solitary work 2. Work in groups (assignment of responsibilities, allocation of roles, initiatives)
	D. Teaching approach	1. Interdisciplinary/multidisciplinary approach 2. Connections to the curriculum 3. Approach of critical pedagogy (examination of real life situations)
	E. Evaluation	1. Selection of assessment type 2. Self-evaluation, meta-cognition
	F. Ensuring active participation	1. Participation to the program design and structuring 2. Jointly target selection 3. Use of innovative teaching techniques (concept maps, dramatization, role playing, confrontation, moral dilemma, brainstorming, lecture, discussion, modeling, simulation, interview, case study, et al)

A. Selection of the Suitable Type of Discovery Teaching Method. There is a variety terminology of the discovery learning and teaching in the literature. Some of the used terms of inquiry are: exploratory learning, structured inquiry, open-ended research, peer review, interactive research, didactic research, review, guided discovery, guided research, inductive method, with dominating terms of discovery and inquiry based learning and teaching (Anderson, 2002). According to National Science Education Standards (NRC, 1996), inquiry is a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing in the light of experimental evidence; using tools to gather, analyse, and interpret data; proposing answers, explanations, and predictions; and communicating the results.

B. Levels of Activities. An environment project developed in three research levels through interactive protocols and explorations. These levels are the features / basic concepts, the individual sub-programs, activities and experiences (Meyer & Avery, 2001). The levels of learning hierarchy define different types of learning that were conquered with different skill categories of graded difficulty (Matsagouras, 2007). At the first level, called informational, learning involves collecting information through the senses and memory functions, which is usually expressed orally. At the second level, called organizational, learning is achieved by comparison, classification, arrangement and hierarchy and inter-correlations of data which is eventually being integrated into a broader conceptual schema. At the third level, called analytical, learning related to an inter-linking of data is being sought through a process of analysis and inductive reasoning processes. Finally, at the fourth level, the practical, the person uses a deductive way to organize the knowledge in patterns, principles, and models, to explain, interpret, predict, evaluate, reorganize and generalize data structures beyond the surface.

C. Educational Strategy. In the pyramid of Drews & Milligan (2000) learning processes holds the basis of peer learning, followed by practice and discussion at groups. When children work in groups, learn more and easier, develop social skills, improve self-esteem, and enjoy the activities involved. Learning in groups has profit on the duration of memory than on the quantity. After all, learning is apprenticeship, namely membership in a group, assigns roles, responsibilities, collective action, with guidance and encouragement from the teacher who mediates between the scientific community and the community of children (Tobin, 1993). These groups promote self-understanding through mutual support and feedback, generate the empirical basis for learning, encourage interaction, confidence and resolutely and eventually help to achieve the goal of "learning to learn" (Tennant, 1997). The group cooperation learning promotes socialization and democratization of society and ensures conditions of experiential learning (Kamarinou, 2000; Matsagouras, 2000). Therefore, contrary to the traditional view, which considers the information as the more important in the education, in the group cooperation learning, the teaching process is considered equally, if not more important, than of acquired knowledge (Matsagouras, 2000).

D. Teaching Approach.

EE is objectively an interdisciplinary field of research and teaching (Flogaiti, 2006). Environmental issues are extremely complex and complicated, not univocal considerations, that's why they require interdisciplinary approaches. There where we live, the natural environment (natural resources, natural processes) interacts with the social (social groups, social functions) resulting in diverse inter-correlations, which can not be studied through a single cognitive domain. Interdisciplinary approach eliminates the boundaries of the courses, examines the phenomena in multifaceted way, facilitates lifelong learning and contributes to the qualitative improvement, since the entailing processes of generalization, of abstraction and composition lead to higher-level knowledge (EMP, 2007). In critical pedagogy, students are treated as researchers, active in the learning process, empirical in the most part. (Huckle, 2006). Students develop a critical view of the present, the history and the future, learn about existing social and cultural structures, processes and democratic alternative solutions, develop knowledge, skills and values that are required by active and critic citizens. Some discovery teaching techniques are exercises, educational visits, demonstration, problem solving, interrogator replies, brainstorming, case studies, role playing, simulation, discussion, interviews with experts, debates, ethical dilemmas and concept maps. Most of them are innovative techniques that can be developed mainly outside the classes.

E. Evaluation.

The evaluation of the environmental programs can take place during the materialization as formative, or at the end, as final evaluation and assessment. At the end, before the results presentation in the school and local community, usually is developed a good evaluation effort of materials, methods, behaviours and benefits of the program which offers feed back to the participants and new ideas for the next school year. The evaluation provides information about the organization of the program, the quality of design, the connections of activities to pursued objectives, offering the possibility of intermediate changes to the initial design (Zygouri, 2005).

The initial evaluation is carried out before the beginning of teaching in order to estimate some variables associated with the development of the teaching and project (Koutouzis M. & Chatziefstratiou I., 1999). In the formative evaluation the emphasis is given on the way that a project is implemented, a lesson or a process. So we can identify problems or obstacles to the development and implementation of the project and make the appropriate corrective interventions. Formative evaluation allows the evaluator to focus on specific procedures and identify interactions and problems during design, development and implementation of an educational project, in order to improve it. Final evaluation reflects the results of educational efforts in relation to the difficulties and problems encountered in its implementation and notes the total supplied effectiveness and usefulness of the educational project.

F. Ensuring Active Participation. Learning at school is observing, memorizing, understanding, also requires students' attention and cognitive activities that are not possible without undertaking the responsibility for their own learning (NRC, 2000). The deriving active participation and involvement of the students is being ensured by the initial setting teaching goals. Teachers should assist students to become active in class and set goals using their natural mood for exploration, understanding new things and learning (Vosniadou, 2001). The dealing of students with the EE is carried out with dialog, intense student participation and co-formulation of the teaching process, means and objectives of the program (Vatrikas & Toya, 2007). Saying active involvement of students in the learning process, the current educational literature describes directly or indirectly classrooms where students ask, explain, comment, communicate, exchange ideas and information, support and control the accuracy of data and counterpoise respond dialectically by reasoning the different positions, hypothesize, investigate, experimented, and finally result in informed opinions, solutions and proposals (Matsagouras, 2000). The focus of the project on a local environmental problem or issue enables direct experiencing of the problem and contributes significantly to the direct involvement, namely the function of the conscious citizen who can become active (PI, 2007).

3.3 Learning Environments

The curriculum is a set of learning activities, materials, resources, through which students construct knowledge. Teaching is not just the transfer of knowledge, but the organization of those conditions in the classroom and the planning of those activities which will promote the construction of the knowledge. Teachers create the learning situations, interacting with students, by providing their own ideas and concepts for the cognitive objects, their views on teaching and learning (Driver et al, 2000). Several factors influence learning, such as the teaching, the context of education and understanding of this context by the students, physical and emotional state of teachers and students, genetic factors, the initial knowledge, interests, abilities, learning needs. More specifically, the factors that affect the discovery learning are preparedness for learning, motivation, curiosity, desire affirming, reciprocity and willingness to cooperate with others (Komis, 2004). "Human beings, by their nature, seek knowledge" as Aristotle said. The structure of knowledge itself and the general level of cognitive development of the individual are of key importance. Effective is characterized that learning environment which is a product of interaction between the specific characteristics of the learners and the existing opportunities for experiences that can offer the objective surroundings (Birch & Gussow, 1970 into Vygotsky, 1997).

A. Information Technologies and Communications. Developing skills and access to ICTs for all, in an open and attractive learning environment that supports active citizenship, is a strategic objective of the 'Education and Training 2010' of European Union (EU). Article 5A of the Greek Constitution states that everyone has the right to inform and participate in the information society. Facilitating access to electronically handled information, as well as the production, exchange and diffusion thereof constitutes an obligation of the State. The development of ICTs has impact on all sciences because accelerate data collection, classification and analysis, and thus decreases the time between discovery and application (Rutherford & Ahlgren, 1991). The discovery in the fields of services based on the Internet at reasonable matching of the properties is a new/another requirement for semantic web services which can't be offered by traditional information retrieval techniques (Kovács et al, 2008). The content analysis by Kokic (2012) indicated that the majority of the current primary teacher education programs in Croatia include goals that could be linked to information literacy standards and future teachers are most frequently taught how to evaluate information, but lack of guidelines for the fair use of the issues of information, such as imitation and plagiarism. There are not many programs that include goals related to determining the nature and extent of the required information and fair use of information principles in educational environments. This issue has been immersed during last years and seems to occupy the intense interest of the ICTs educators in the future.

Table 3. Evaluation Tool for the Application of the Discovery Teaching Method in the School Environmental Programs Regarding the Learning Environments

Research Question	Research sub-queries	Criteria for the application of the Discovery Teaching Method in the programs
III. Learning Environments for implementation of the Didactic Teaching Method	A. Information Technology and Communications (ICTs)	1. Use of PC (software, multimedia) 2. Internet access (websites, web-services) 3. Use of Fax, SMS, emails 4. Use of robots (sensors and instrumentation digital data collection) 5. Utilization of media
	B. Classroom	1. Discussions, lectures, presentations, readings, et al
	C. Laboratory of Natural Sciences	1. Experiments, constructions, et al
	D. Library	1. Use of school, municipal, online libraries
	E. In the Field	1. Measurements, observations, recordings 2. Educational visits to museums, areas of ecological, archeological, cultural interest 3. Attend of educational programs offered by the Environmental Centers
	F. With Local Communities	1. Connection to the daily life 2. Local, national, global dimensions of the issues 3. Placing the issue in local historical and social context

B. Classroom. According to Vosniadou (2001), teachers should design the learning environments in schools to encourage students to learn actively, to cooperate with other students and use tasks that are meaningful materials and genuine. Modern learning environments for students are the classroom, the laboratory, the field, the library, the ICT environment and multimedia. A revision of the lessons in classrooms, of what the teachers consider as teaching by using questions will be very interesting for the tutors, mentors and trainees. Very important is how teachers lead students to ask questions. To develop inquiry in classroom, asking questions becomes a fundamental item, but asking questions depends on how open or close the strategy is (Epinosa Bueno et al, 2011). Obomanu B.J. & Akporehwe J.N. (2012) showed in a research that home related science activities, by using relevant examples from everyday life at home, enhanced students' performance in basic science concepts better than utilizing only school science or classroom activities.

C. Laboratory of Natural Sciences.

Pedagogic Institute (PI, 2007) suggests to conduct experiments and other laboratory exercises in the school Science laboratories for the study of ecological factors of the studied ecosystems in the environmental project. For the needs of this study are prepared appropriate worksheets used in real and virtual laboratories.

D. Library. Libraries, museums, educational institutions, research laboratories worldwide, organizations, corporations, non-governmental organizations and other sources through Internet, can be exploited in every classroom. The various web search engines provide easy ways of selecting and convenient access to complex and extended material. The huge quantities of information can be accessed and managed effectively in a short time, developing the ability of selection, comparison and evaluation of data by teachers and students. Thereby, concepts, facts, events and thoughts are developed through images, texts and sounds, resulting in understanding, writing and presentation to become more creative and thorough.

E. Field.

The Environmental Centres provide educational and training programs for students, teachers and adults rich in activities that take place, mainly, in natural environments, ensuring experiential learning of the ecosystem functioning, biodiversity, natural resources etc. In "Project 2061", concerning the objectives for learning and

teaching of the American Association for the Teaching of Science, the first chapter of the book "Science for all Americans" stated: Teaching Science should be extended beyond the school, since children learn from their parents, siblings, other relatives, peers, adults. Learn from films, TV, radio, records, trade books and magazines, computers, from visits to museums and zoos, sporting events, concerts, as well as textbooks and the school environment in general. Teachers of Science should take advantage of the wealth of behavioral elements of the broadening the social context of teaching and learning, in collaboration with adults in various ways NRC (2000). Fiskum & Jacobsen (2012) showed differences in the children's outcomes from outdoor education: the children with an easy or a withdrawal temperament are good functioning both indoor and outdoor. Their outcomes from outdoor education is an increased vitality, which might be seen as a short time benefit. The children with a difficult or a mixed temperament increased their vitality in outdoor education too. Additionally they often showed unwanted behavior indoor, which was mainly absent when they were observed outdoor. Consequently, outdoor education may contribute to reduce behavioral problems, and consequently give these children a long time benefit.

F. Local Communities. Noteworthy in recent years is the development of educational theories that consider learning as a process of participation in a community of practice, rather than as an individual process of discovery of the established truth (Wenger, 1998; Carlsen et al, 2001; Mokias, 2008). In Socio-cultural theories, many scientists, with pioneering Vygotsky (2000), have supported the socio-centric view of development, where the personal thought is built up based on social interaction. The higher mental functions derived from social life, which first appeared as interpersonal and then internalized by the child. During the transition from the public to the private knowledge, the child is in the Zone of Proximal Development, where the role of the teacher is crucial to facilitate the transition. Thereby, cognitive development is achieved through the mediation of social events and cultural tools and with the internalisation. Avery & Carlsen, 2001) believe that social participation and community involvement, provides the vehicle to science to act in the real world and to EE to engage students in environmental research by giving them the feeling that they are doing something that is designed in a social context for the future of this society (Helms, 1998; Meyer & Avery, 2001). Thereby, students study the environmental science content through deepening in several levels of "community" such as the classroom, the local geographical and political area, the expert community. Students carry out interviews, gather data and present their findings to local bodies and people, to planning committees. Thus, they earn experience in micro-and macro-sociological level of science, which is appeared in the real world through the study of environmental problems.

4. Conclusions

The proposed Evaluation Tool answers whether and how a school project has designed and applied discovery teaching approaches under the principles and guidelines of EE and ESD. The 3 research questions and 17 sub-queries are referred to the skills for implementation of discovery teaching method, the process of discovery teaching method and the suitable learning environments inside and outside the schools. The 47 criteria focus on the active teaching and learning which promote student discover, regarding the role of the community as a learning environment which cultivates active, environmentally responsible citizens.

The discovery teaching and learning are difficult to apply, but are challenging to those teachers seeking effective methods of teaching (Epinosa Bueno et al, 2011). For most teachers, the shift from traditional presentation of new knowledge to discovery is a difficult transition, despite the consensus that has been developed for the value of the inquiry based learning. The local communities in conjunction with physical and technical ecosystems as learning environments, the research activities carried out in the school projects of EE need to be designed on the axes of Environment and Society with the view to developing the ecological, social, economic, cultural, personal dimension of sustainability in order to cultivate the future active citizens who will care for the environment, solidarity and social justice. The educational policy makers need to rethink the ways in which learning can occur in schools in ways similar to those that we learn in our daily lives, and incorporate the modern trends in Education and Science teaching by using communities in the school curricula. Thus, learning is viewed as participation, and Science as practice.

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