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Secondary teachers' conceptions of creative thinking within the context of environmental education

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Creative thinking in Environmental Education (EE) remains greatly under researched topic. Research on teachers' conceptions of creative thinking within EE context is also limited, although their role in facilitating creative thinking in students is well documented. The small-scale qualitative study presented here investigates Greek secondary teachers' conceptions of creative thinking in EE. Empirical data were collected based on non-structured interviews with 20 secondary teachers with diverse backgrounds and subject expertise. Among the findings of the study is that participants view creative thinking as a thinking process that can or should be enhanced within the context of EE. All four key components identified in the literature in definitions of creativity – process, person, product, and context – are present in participants' conceptualizations, with the most prevalent being that of process. Teachers conceptualize creative thinking as an inherent component of environmental problem-solving; they claim that EE pedagogy offers a favourable environment within which it can be nurtured; and they attribute ethical dimensions to it by pairing creativity with social and ecological responsibility. The participants' frames of thinking about creativity support the views of scholars who emphasize the links between EE and creative thinking and connections with broader theoretical approaches that currently dominate research on creativity. The study provides a starting point for further research on creative thinking within the context of EE.

Keywords: teachers' conceptions; creative thinking; environmental education; secondary education

Addressing "Creativity" in Light of Recent Theoretical Approaches

Research on creative thinking is an actively growing field of study with a wide array of theories and perspectives (e.g., Runco, 2007). However, despite the numerous theories and definitions of creative thinking coined by scholars from various disciplines the term still remains to a great extent elusive and vague (e.g., Kampylis & Valtanen, 2010).

Shifts in the study of creativity over recent decades point not only to theoretical diversity in the field; they also emphasize complexity over linearity (e.g. Runco, 2004), the collective character of creative processes (Paulus & Nijstad, 2003), the "situatedness" of activities instead of the "universality" of the construct (Plucker & Beghetto, 2004) as well as its ethical coordinates (Craft, Gardner & Claxton, 2008). Among current trends in the conceptualization of creative thinking is the recognition that it is not an exclusive "talent," related mostly to the arts and cul-

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ture, which works at the level of extraordinary. Rather, creative thinking is a potential that all are capable of and that may be expressed at various levels of everyday life, fuelled by collective processes and nurtured through education (e.g., Craft, 2001; Runco, 2007). "Everyday" or "little c" creativity, as this theoretical approach is called, is viewed as a multi-component process, involving not only cognitive aspects and abilities but also affective, motivational, and personal characteristics mediated through social and cultural interactions. This process leads to the emergence of some *novel* understanding, idea, practical solution, or product that is meaningful at least to the individual – without being necessarily historically new within the broader cultural context (Sawyer, 2006; Kampylis, 2010).

A second, relatively recent, theoretical approach of human creativity emphasizes its "ethical elements" (Cropley, 1999, p. 513) or "moral underpinnings" (Craft et al., 2008, p. 169). Not all forms of creativity are inherently good, benevolent, and constructive; creativity can be potentially dangerous if not accompanied by awareness of its impacts on society and the environment (Craft et al., 2008; Cropley, Kaufman, Cropley & Runco, 2010; Sternberg, 2010). Therefore, the assumption that the sole issue is the identification and fostering of the creative potential of the individual has begun to be questioned, and the focus has equally turned to the individual's intentions, values, and sense of responsibility regarding his/her creative endeavours (Kampylis & Valtanen, 2010). The field has also been enriched by theorizing over new forms of more conscientious creativity (i.e., "ecologically-centred creativity", Bowers, 1995; "wise creativity", Craft, 2006).

However, attributing meaning, recognizing "novelty" and identifying the ethical dimensions of a creative activity are related to the context within which the whole process is embedded. In other words, although creative thinking is inherent in many fields and aspects of life, it is manifested and perceived in different ways with respect to its domain of reference. Thus, according to a third theoretical approach, creative thinking is treated as a "situated" activity, in the sense that it can be better understood in reference to the socio-cultural context and/or the disciplinary area in which it occurs (Amabile, 1983; Csikszentmihalyi, 1996).

The three abovementioned theoretical approaches, on "everyday" creativity, on the ethical dimensions of creativity, and on "creativity as a cultural and social construction", urge us to reconsider the role of formal education in fostering creative thinking. First, by assuming that "creative potential" is widespread among everyone and is manifested in many areas of everyday life, education takes on the role of providing appropriate learning experiences to help students develop this potential. Second, by recognizing that creative thinking is not expressed in a moral vacuum but is embedded in culturally defined value systems, it is the responsibility of education critically to address issues of social and environmental responsibility related to individual creativity and to encourage more conscientious forms of creative thinking. Third, by acknowledging that creativity acquires its meaning within the domain in which it is pursued, the fostering of creativity in schools cannot be an undifferentiated process across curricula. Particularities of both the subject matter and the teaching and learning environments in each educational field of study come to the fore, and with them come the imperative to identify the ways in which creative thinking is conceptualized and developed within each of these fields. However, this endeavour should take into account the perspectives not only of scholars but also those of teachers by examining their conceptions of what creative thinking means within their teaching practice (Kampylis, 2010; Andiliou & Murphy, 2010).

Creative Thinking in Environmental Education: A Literature Review

Having reviewed some of the most recent theoretical approaches in the study of creativity, we wanted to establish whether there is a corresponding interest in the field of Environmental Education (EE). We ascertained that although creative thinking has been variably researched for a long time in relation to teaching and learning in other educational fields (e.g. Kampylis, 2010), it has largely been left unaddressed in EE. Few references can be found in the literature on whether and how EE is related or contributes to creative thinking, compared to a much more extensive discussion of the topic in other domains' literature. Moreover, most of these references are held on the level of rhetoric. We found no substantial empirical study exploring the interrelationship between EE and creativity. It is also worth noting that in none of these references, which we detail later in this section, did we detect any attempt by the authors explicitly to define what they meant by creative thinking or to relate their conceptualization of creativity to any broader theoretical approach. We therefore argue that, by critically reviewing the range of perspectives informing education about creativity in the wider literature, we have taken an essential step toward a more profound study of creativity in EE.

In the EE literature, creative thinking is implicitly considered to be either an essential quality of thinking and learning about the environment and current environmental issues, and coping effectively with them, or a prerequisite for visioning and designing alternative sustainable futures. Its relevance as a particular genre of thought processes, as an ability or as a state of mind that must be applied by people confronted with present and future complex, uncertain and conflicting socio-environmental realities has been emphasized by some prominent scholars (e.g., Disinger & Howe, 1992; Bowers, 1995; Simmons, 2000; Chawla, 2002; Wals, 2010) and organizations in the field (North American Association for Environmental Education [NAAEE], 2002). They consider creativity to be among the "tools" that people need to be empowered with through an EE process in order to gain a richer experience of the environment and environmental realities (Simon, 2006; Boeckel, 2009); to more actively participate in and contribute to the shaping of their environments (Chawla, 2002); to be supported in solving current environmental problems (Disinger & Howe 1992; Pruneau et al., 2006); and to become engaged in the search for a more ecologically-cantered (Bowers, 1995) and sustainable world (Wals, 2010). Creative thinking is also viewed to be among the "lifelong learning skills" that are essential for meaningful learning in EE (Simmons, 2000) and as a concomitant disposition of an "environmentally literate citizenry who are able to participate … in a democratic society" (NAAEE, 2002, p. 3).

One curriculum strand in which creativity in EE is addressed is within the framework of art-based activities. Traditionally, art-making is considered a creative process *per se*, and art education is regarded as a fertile terrain for fostering creativity (e.g. Craft, 2001). However, it is also suggested that nurturing creativity through artistically-oriented EE facilitates learners to open up their senses to nature and bond with it, to increase their receptivity toward environmental reality, and to better understand and deal with complex environmental problems (Simon, 2006; Inwood, 2008; Boeckel, 2009). Art-based creativity is also viewed as being connected with inciting social and environmental change by allowing the expression of multiple perspectives and the imaginative search for solutions to current environmental challenges.

A second line of thought, although greatly unrefined, is that of relating creative thinking to environmental problem-solving. Disinger and Howe (1992), along with Pruneau et al. (2006), have discussed the contribution of creative thinking to scientific or cross-disciplinary environmental problem-solving processes. Creative thinking is, according to Disinger and Howe, the essential genre of thinking for exploring alternative ways of conceptualizing environmental problems through the use of multiple sources of information and by applying multiple frames of reference. What Pruneau et al. claim is that creative thinking can add to various stages of the envi-

ronmental problem-solving process either by facilitating problem-posing or by fuelling the search for innovative solutions. However, none of these authors go into greater depth in addressing the topic. Although enhancing environmental problem-solving processes is at the core of EE's goals, the exploration of its interrelation with creative thinking remains at a premature level, in both theory and research.

The same applies to the alleged potential of creative thinking to empower people to achieve a more sustainable world. On this issue, while Chawla (2002) asserts that young people already possess the creative potential to participate actively in envisioning and shaping their living environments, other scholars view this potential as something that can and should be learned. "Creating space for alternative thinking and the emergence of new ideas" are, according to Wals (2010, p. 380), prerequisites for the pursuit of a more sustainable world, which can be nurtured under conditions of social learning. Blewitt (2005) also calls for the need to foster systemic thinking that will enable the sharing of "significant insights" and the mobilization of collaborative creative processes among learners for envisioning a more sustainable future. However, whether EE pedagogy is inherently creative or needs to be enriched with new forms of learning to enhance creative potential in learners is a question that remains to be explored.

Finally, we cannot ignore Bowers' (1995) contribution to initiating discourse on the ethical dimensions of creativity. By pointing out that creativity in contemporary western societies is centred on individual needs and values without attention being paid to their impacts on community and the environment, Bowers qualifies it as a dangerous cultural construct. He calls for a creativity that instead focuses on common well-being and contributes to a balanced relationship between societies and their environments. In fact, by proclaiming an ecologically-centered view of creativity, Bowers implicitly acknowledges a reciprocal role between creative thinking and EE: it is not only how creative thinking can more effectively promote EE's goals, such as environmental awareness, literacy, problem-solving, or the fostering of a more sustainable future; it is also how EE can contribute to the moulding of more conscientious views of creativity by promoting the development of socio-environmental responsibility.

The Present Study

The absence of research on creative thinking in EE stood as the main incentive for our involvement with this research endeavour. The overarching research focus is on understanding whether and in which ways creative thinking is enhanced through EE practice. A second focus is on illuminating pedagogies that have a substantive impact on fostering learners' creative thinking. In this paper, we present a part of our research, a small-scale qualitative study that explores Greek secondary-education teachers' conceptions of the potential offered by EE in developing creative thinking in students.

Rationale and Aim

Teachers' conceptions of and implicit theories about creativity moved to the forefront of research interest in the mid 1980s as a particular strand of the rapidly thriving research tradition of teacher thinking and practice (Runco & Bahleda, 1986; Sternberg, 1985, 1988). However, of the large number of studies conducted within the general field of creative thinking, very few actually focused on teachers' frames of mind (see Andiliou & Murphy, 2010). This fact is acknowledged in the literature as a real deficiency since it is well documented that teachers play a vital role in the facilitation (or inhibition) of their students' creative thinking (see Kampylis, Berki & Saariluoma, 2009). What is further supported by the literature is that teachers' implicit theories (i) determine their everyday classroom practice and instructional behaviour for fostering creativity in students

(Beghetto, 2006); (ii) act as prototypes for assessing students' creative performance and products (Runco, Johnson & Bear, 1993); and (iii) contain valuable tacit knowledge about students' creativity in real-classroom settings (e.g. Kampylis et al. ibid). In the words of Plucker and Runco (1998), when people engage in creative activity "…*they do not have explicit theories in mind. Their thoughts and actions are guided by personal definitions of creativity and beliefs about how to foster and evaluate creativity that may be very different from the theories developed by creativity experts*" (p. 37).

In light of a renewed interest in the topic, particularly after the establishment of 2009 as the European Year of Creativity and Innovation (European Commission, 2008), a survey was conducted among European teachers (European Commission, 2010) on how they perceive creativity in their teaching practice. Among the results of the study is that the vast majority of teachers consider creative thinking as a fundamental competence to be developed at the school level and as far as possible to be applied to every domain of knowledge and every school subject, including EE. Another study of interest is that by Kampylis et al. (2009), which investigated Greek school-teachers' conceptions of creativity. According to the teachers involved in this study, EE was identified as among the school subjects highly associated with creative thinking and offering many opportunities for its development, although the teachers considered some other subjects offered greater opportunities for creative thinking. However, more focused research-based evidence of teachers' conceptions about the fostering of creative thinking within the context of EE is absent.

These few contributions aside, it was the general absence of research in this area that led us to conduct the study presented in this paper. Its rationale is based on the theoretical assumptions presented in section 1 that (a) there is no single conceptual definition of creativity or theoretical approach of fostering it through education, (b) creative thinking is a "socio-cultural construct," which means that it is conceptualized in different ways across different contexts, settings, and/or subject domains, and (c) it is important for theory and practice to understand how teachers conceptualize creative thinking within real classroom settings. Thus, the main research questions of the study were (a) how Greek secondary teachers involved in the implementation of EE at their schools conceptualize creative thinking, and (b) whether they identify any potential for fostering it in EE.

The Context: Environmental Education in Greece

EE was formally introduced in the Greek National Curriculum in the early 1990s. In most of the official documents accompanying its introduction, it is described as a pedagogical innovation aiming to encourage students and teachers to become actively involved in the development of interdisciplinary, systemic, and critical knowledge in relation to local and global environmental and sustainability issues and topics; to facilitate schools to engage and collaborate with their local community; and to contribute to the reformation of educational practice through the adoption of constructivist and active learning approaches (Flogaitis, Liarakou & Daskolia, 2005).

In the case of secondary schools, the National Curriculum anticipates a teacher (or a group of teachers), irrespective of their subject specialty, will spend two hours per week voluntarily running an EE programme with a team of students who also choose to participate in it on their own will. The topic is selected by the students with the aid of the teacher(s). The duration of the programme is approximately five months within one school year. Specifically, teachers who are interested in designing and implementing an EE programme are required to submit a proposal at the beginning of the school year, first to the school director and then to the EE Officer of the administrative district for their school. In this proposal they must state the suggested topic; name the teacher who will have primary pedagogical responsibility for leading the project and those

who will form the pedagogical team; prove their competency in EE by referring to previous related in-service training programmes they have taken part in and to the EE school programmes they have implemented so far; describe the learning goals and present the pedagogical design they will follow to run the programme; state whether they will collaborate with or be supported by any extra-school agencies (NGOs, etc); and finally identify and analyse concepts and themes that overlap with other curriculum subjects in order to incorporate them in their proposed programme.

The pedagogical team should ideally consist of at least three teachers, each with a different disciplinary background to ensure complementarity and interdisciplinarity. After gaining approval to proceed with the implementation of their programme, the pedagogical team forms a team of students, and both teams then decide on the topic and how they will work together over the school year. Teaching and learning processes in EE programs differ from those followed in typical curricular subjects in that they foster project-type and theme-based approaches and emphasize problem-solving, field study and collaborative learning experiences. The students work in groups throughout this five-month period (ideally starting late November and ending early April) to discern and analyse all possible dimensions of the environmental issue being considered. This is in order to search for relevant information so as to discuss critically and better understand the issue, to summarize the results of their work in a final report, and eventually to share their learning experience with other members of the school or local community in a public event usually organized for the end of the school year. The teachers' role in this process varies from providing concrete and sometimes strict guidance on what the students will do and how they will do it at every stage of the project, to supervising their work discreetly, by standing by either as a source of reference or by regularly encouraging enquiry in the students. The ultimate goal is to prepare and empower their students to investigate, search, discover, and think more holistically and for themselves in relation to their immediate environmental reality and/or to the complex environmental and sustainability issues of current global concern. However, several innate difficulties arising from both the school culture and insufficient teacher training create inconsistencies between the rhetoric and practice of EE in the Greek curriculum (Daskolia, 2005). Unsurprisingly, it is chiefly because of this that EE programmes are kept on the fringes of school practice.

As to whether and how "creative thinking" is related to EE practice, any reference to this in most official educational documents is limited. This is also accompanied by some vagueness in the way "creative thinking" as a term is used in these documents. In fact, the Greek Pedagogical Institute, the national board for designing and implementing educational policy in Greece, relates "students' active participation in their learning" to critical and creative processes and states that, among its goals, EE aims to "familiarize students with creatively approaching environmental issues" and to "cultivate in them a competence of creatively intervening in their everyday life" (http://www.pi-schools.gr/drast/perivalontiki). However, there is no further elaboration on what exactly is meant by all these pleas, which consequently results in an uncertainty about how teachers are to put them into practice in school.

Methodology

The aims and intentions of the study suggested a qualitative approach. Since there are a limited number of studies on the area of teachers' conceptions of creative thinking in general and in EE in particular, the study was of a more open-ended, exploratory nature. Non-structured interviews, with only some key questions to encourage participants to think about and ascribe personal meanings to the issues at stake, were used for the collection of qualitative data.

Twenty secondary EE teachers from schools in the wider Athens area participated in the study (see Table 1). In order to select the sample for the study, we applied for and gained access to the official data catalogues of the Ministry of Education containing the names and contact details of all teachers from this area who were implementing EE projects in the school year in which the study was expected to be conducted. We also contacted the Administrative Officers in charge of EE in the five local districts of Athens to make them aware of the goals of the study and ask for their collaboration in identifying EE teachers with a genuine interest in the subject and who could contribute to the study. As explained in section 3.2, the opportunity to apply for and run EE programmes is open to practically all secondary teachers, and each year several Greek schools engage their students in one or more projects with an environmental or sustainability focus. However, it is the managing EE Officers who tend to have a better overview of who is involved in such programmes and how genuinely concerned, competent, and innovative they are in the work.

Initially, a long list of prospective participants in the interviews was drawn up based on the official data on teachers implementing EE programmes in the wider Athens area in the school year 2007–2008. Subsequently, we asked the EE Officers' help in limiting the list to those teachers who had a primary responsibility in running their programme and who had showed signs of serious engagement with EE practice.

Table 1. Participants' demographics

Gender	Female	10
	Male	10
Age	30–40	3
	41–50	8
	51–60	9
Years of teaching experience in EE	1–5	5
	6–10	8
	11–15	7
Subject expertise	Greek Language	4
	Foreign Language	3
	Arts Education	2
	Physics	2
	Chemistry	2
	Technology	2
	Religious Studies	1
	Music Education	1
	Biology	1
	Computer Science	1
	Economics	1

In order to obtain multiple perspectives, the final selection of participants was made using several characteristics (gender, background, subject expertise, years of overall teaching experience, and teaching experience in EE) (see Table 1) following the principles of maximum variation sampling (Kemper, Stringfield & Teddlie, 2003). Ten male and ten female secondary teachers, most of them in middle age (17 out of 20 were between 41 and 60 years old) and with considerable experience in leading EE projects in their schools (almost one third had been involved for more than ten years in EE school practice) were asked to participate in the interviews. In terms of subject expertise, seven taught languages, eight teachers had a science and technology

background, two of them had a major in social sciences, and three taught arts or music education. It was expected that the diverse backgrounds and subject expertise of the participants would ensure the widest possible range of views (Cantrell, 1993). All interviews were individual and conducted by the same interviewer – the second author of the paper – within a two-month period, in spring 2008. The selection of the spring trimester for conducting the interviews was made so that the teachers were toward the end of the five-month period of implementation of their EE programmes and therefore better able to recall and refer to them during the interview.

All interviews lasted for about 60 to 90 minutes. Participants were first asked to explain what EE means to them. They were then prompted to define in their own words how they conceptualize "creative thinking" as a term. Subsequently, participants were encouraged to express their thoughts on whether EE can facilitate the development of creative thinking in students. Finally, participants were invited to reflect on and discuss particular EE activities through which their students' creative thinking can be fostered. In this paper, we present and discuss only the teachers' conceptions of creative thinking and of the potential of EE for enhancing it.

The interviews were transcribed verbatim and labelled with a code name[1] to avoid identification of individual participants. The transcripts were subjected to thematic analysis (Braun & Clarke, 2006) by two separate analysts/authors of this paper. Recurrent or dominant themes were identified in the data, and the participants' responses were categorized accordingly.

While reading the data, we deliberately tried not to apply any pre-specified definition, personal view, or theoretical perspective of creative thinking. However, we organized our analysis on the basis of a conceptual framework that provides a concise representation of the key components for understanding creativity. These are, according to Kampylis and Valtanen (2010), the four points of intersection of the majority of definitions suggested by researchers and theorists, viewing creativity (a) as a key ability of individual(s) [*person*], (b) as presuming an intentional activity [*process*], (c) as occurring in a specific field [*context*], and (d) as entailing the generation of novel and useful - at least for the creator - tangible or intangible output(s) [*product*].

The results of each analyst's work were discussed and compared against each other, and by this process the criterion of inter-rater reliability was attained (Cantrell, 1993). In order to illustrate the themes representing the participants' conceptions, indicative quotations were selected from the transcripts.

Findings and a Preliminary Discussion

Before presenting the findings, we would first like to stress the exploratory nature of the study. Our aim was to gain an insight into a greatly under-researched topic and to emerge with a set of provisional themes, which we could submit to further investigation in a subsequent phase of the research. There was no intention to draw any generalizations from the data. Second, although the sample was selected in a way that was consistent with the criteria for qualitative methodologies described by Cantrell (1993), the study is a small one. Any conclusions are therefore provisional and limited to the Greek education and socio-cultural context.

Finally, the interviews were conducted, transcribed, and analyzed in Greek, but both the findings and the interview quotations selected to support them are presented in this paper in English. Therefore, some misinterpretation of the collected data may have occurred despite our efforts to reproduce the teachers' responses in English as accurately as possible.

[1] For example, "F5-Physics" refers to the fifth female participant whose main subject is Physics, whereas "M6-Greek Language" refers to the sixth male participant whose main subject is Greek Language.

Research Question One: "What Does Creative Thinking Mean to You?"

All participants faced some difficulty when asked to provide a definition of "creative thinking". Most declared that it was the first time they had been invited to ponder on what "such a difficult-to-define term" meant. However, after overcoming their initial embarrassment they began to express their views in a more eloquent way. After analyzing the interviews we were able to discern all four key components of the creativity construct depicted within the participants' conceptions, with reference to creative thinking as *process*, *person*, *product*, and *context*. Most prevalent among them was the reference to process.

In this regard, more than half of the interviewees (12/20) linked creativity with *the thinking processes of problem-finding and -solving*, as do Runco and Sakamoto (1999). To relate creative thinking not only to devising solutions to a problem but also to the very process of problem-defining is in accordance with the conclusions of current research on creativity (e.g., Treffinger, Selby, & Isaksen, 2008). Pruneau et al. (2006) also made a connection between environmental problem-posing and the development of creative capacity in learners.

> "Creative thinking means to pose a problem and to try to find a solution to it." (F5-Physics)

> "Through creative thinking the student can not only assess the causes and effects of a problem, but also apply a new way of thinking about the problem…" (M9-Physics)

A particular interpretation of creative thinking expressed by one of the participants (quote below) is that of *a process enabling people to grasp reality by applying a holistic and multidisciplinary approach*. Creativity as delving into current environmental reality in a more integrated manner and through multiple frames of reference is consistent with the view of Disinger and Howe (1992). It is also embedded in the approach of *manifold thinking* (Valtanen, Berki, Kampylis & Theodorakopoulou, 2008), which attempts to balance creative thinking with critical, caring, and reflective thinking.

> "Creativity is a kind of thinking that brings forth ideas, that makes you ponder a little bit more, which makes you see things holistically and from different angles… If you realize that things are complex and multifaceted, and if you manage to see them not only from your own point of view, but also from other people's points of view, this is creative too." (F7-Economics)

One third of the interviewees (7/20) tried to define creative thinking by relating it to *the general educational and social context that favours it*. The views held by the teachers showed a remarkable similarity to the conclusions reached by researchers and theorists in the field. Three talked about what Tan (2001) refers to as "a non-conventional learning environment" (p. 50) in which students can approach knowledge through activities that engage them in learning personally and in groups. Three other interviewees (within the same group of seven) focused on the pedagogy that teachers need to follow in the classroom, by making special mention of the teaching techniques that should be employed. Finally, the seventh interviewee referred to the general school climate, which should be characterized by an aura of freedom and safety for students. This is a perspective also present in the literature, highlighting the contextual basis of creativity and arguing about the conditions that facilitate its expression (e.g., Sawyer, 2006).

> "…The students have to act on their own to face a problem… The teacher's role would be to help them, to guide them up to a point, but from there on what they do is called creative thinking." (M5-Music Education)

> "…I can identify creativity whenever things surpass the limits of everyday school routine… When the students are willing to do things beyond the school timetable, when they feel free and safe enough to try and do things on their own…" (F8-Arts Education)

Eight teachers addressed creativity by emphasizing the *personality traits of the creative student*. According to them, students are creative if they pose questions and manifest curiosity, if they undertake initiatives and are able to materialize their ideas, whether encouraged by the teacher or not. All eight of the aforementioned teachers also mentioned strong internal motivation as among a creative student's top characteristics. The same personality traits of the creative person have also been emphasized by several researchers such as Chan and Chan (1999) and Amabile (1983).

> "Creative is the student who undertakes initiatives with or without any external incentives, either inside or outside the classroom; s/he accepts the challenges placed by the teacher or whoever… Creativity is exemplified in the way the student's thinking leads him/her to observe, to experiment, to test his/her personal hypotheses…" (M6-Greek Language)

> "(The creative student) is one who takes initiatives and, in a way, does not comply with the teacher's instructions… S/he keeps her/himself outside the mainstream; s/he acts for her/himself... S/he finally puts into practice what s/he has in mind ..." (F8-Arts Education)

Five participating teachers (5/20) approached creativity through *the products of creative thinking*. They suggested that students' creative thinking is manifested in the materialization of their imagination either through the production of something novel or in the expression of their ideas in various ways. Novelty, along with appropriateness, is apparent in most researchers' definitions of creativity (Kampylis & Valtanen, 2010). However, both researchers and teachers use novelty in an indefinite way because it is not clear for whom and to what extent the creative "product" is novel.

> "At the end of the school year the students have to think of original ways to present what they have done and learned… They have to figure out how to most appropriately and imaginatively organize an event to share their work… [they may have] to write a column or an article about the studied issue in their school journal …[or] to stage a dance performance or a play… I believe that all these instances show creative thinking..." (F1-Greek Language)

Finally, of particular interest are the views of four interviewees (quotes below) who attempted to define creative thinking in a way that does not refer to any of the above four approaches. These views are congruent with the theoretical perspective that emphasizes the ethical dimensions of human creativity by arguing that its fostering should have as a goal the promotion of the common good (Bowers, 1995; Craft, 2006; Cropley et al, 2010). In the words of these teachers:

> "Creative thinking goes hand in hand with the determination to be useful, a sort of participation in some common effort…" (M1-Greek Language)

> "…Creative thinking is related to the degree to which I am responsible toward society, nature, the whole world." (M10-Arts Education)

> "…Creative thinking should be always in the interest of mankind; it has both a positive and a negative aspect, depending on the orientation given by education." (M7-Technology)

Research Question Two: "Does EE Enhance the Student's Creative Thinking, and if Yes, How?"

When teachers were invited to discuss the relationship between EE and creative thinking, almost all (18/20) agreed that EE offers many opportunities for enhancing creative thinking in students. This finding agrees with the results of a recent study (Kampylis et al., 2009) in which EE was identified by the participated Greek primary teachers as among the school subjects offering many opportunities for the development of students' creative thinking. Moreover, what is of note is that the ways they described and justified their views were related to their personal ways of approaching creative thinking.

A majority of participants (12/20) indicated the potential offered by EE for the development of students' creative thinking with reference to *the innovative characteristics that EE brings to educational practice*. They mainly highlighted the advantageous educational and learning atmosphere in EE that offers a suitable context for the development of creative thinking in students.

> "…Creative thinking in EE is found in the breaking through of the barriers of conventional teaching and learning…" (F6-Greek Language).

Among the factors suggested by teachers as having a positive impact on students' creative thinking are the opportunities that students have (a) to participate actively in the process of learning, a process that starts with their autonomous decision to become members of an environmental learning group in their schools and goes on to them having the chance to select their preferred topics for study; (b) to promote their personal interests and inclinations; (c) to "learn by doing" through collaborative learning, group work, and the active pursuit of knowledge; and (d) to come across real-life problems and deal with them through environmental problem-solving procedures.

> "…Yes, creative thinking can be fostered through EE school programs …because [the students] work on their own on something they are interested in … By doing this, I believe their creative thinking is enhanced." (F3-Greek Language)

> "…It [EE] certainly develops it [creative thinking]… Students learn and act on their own … The aim is to get away from the knowledge-centred educational practice that applies to many of the other subjects and to foster a collaborative way of thinking in the students…" (F8-Arts Education)

> "…Of course, EE develops creative thinking much more than any other subject… the students work in teams, they help each other, they see the teacher as an associate, they all get much closer and therefore it is much more convenient for them to ask questions, to seek information, to think in unconventional ways." (M9-Physics)

Another view that was put forward by many participants (10/20) in favour of the potential of EE for fostering creative thinking is that *student participation in project-type problem-solving learning processes* contributes greatly to this end. The students are called on to identify an environmental problem in which they are interested, to analyze it through various frames of reference, and to discuss various solutions to it. This is precisely how creative-thinking processes develop: "Without a good dose of curiosity, wonder, and interest in what things are like and in how they work, it is difficult to recognize an interesting problem" (Csikszentmihalyi, 1996, p. 53). According to the participants, EE is by nature a problem-oriented and problem-solving educational practice, and so it is naturally connected with the fostering of creative thinking.

> "…The students try to find solutions to the environmental problems they get involved with…" (M8-Religious Studies)

> "…The students reflect on the issue they study and how to deal with it…" (F1-Chemistry)

> "EE certainly develops creative thinking! From the moment the student develops a critical view toward environmental reality, s/he has to think about alternatives that may improve it." (F9-Computer Science).

Those teachers who related creativity to the personality of the students also held a positive attitude toward the potential of EE for enhancing creative thinking. They argued that EE supports the development of creative thinking in students by providing them with learning opportunities and the time to freely express and develop themselves, make full use of their talents, develop their capabilities and pursue their interests. In other words, *EE acts as a catalyst for their inner creative potential to be expressed*.

> "[The teacher] may find out that some children who looked indifferent in the classroom actually have tremendous abilities and a potential to be creative… Yes, EE develops creative thinking, by giving them the space and time to do what they like, without this being imposed on them…" (F2-Biology)

> "In EE the student has more opportunities to actively express his/her inner creativity instead of just consuming knowledge passively." (M2-Foreign Language)

Among the interviewees who associated creativity with tangible results (4/20) the idea proposed was that *EE provides a suitable variety of opportunities for students to be creative in multiple ways*, i.e., by contributing to a school newspaper or by making a poster or other artworks. According to these participants, these artefacts embody the concepts of "new" and "useful" and are therefore manifestations of the students' creative thinking. This view is in accordance with the literature on "everyday" creativity (e.g., Craft, 2001), which argues that creativity should not be connected to great works only. On the contrary, when found in a facilitating context and with application of the appropriate teaching methodology, students can express their creative potential and produce some original and useful works (whether simple or complex).

> "Students invent incredible things, things we cannot imagine... We give them a piece of something, a cloth, an empty bottle, something considered useless by others, and all of a sudden they make something nice, something we would not imagine… They take us by surprise every day." (M1-Greek Language)

> "Creative thinking is exactly what we are doing in EE! ... The students think of various ways to express what they wish to say, each in a different way: through maps, drawings, drama games… the students even write plays by themselves… In general, everything taking place in EE originates from creative thinking on the part of the students …" (M2-Foreign Language)

Regarding those teachers (4/20) who attach an ethical dimension to creative thinking, they argue that students become more socially and environmentally aware and responsible through EE and that these are qualities that are or should be connected to creative thinking. In other words, EE plays a decisive role in orientating creativity toward more socially and environmentally constructive ends. This is a view that gives creativity a new perspective by ascribing it

to the wider context of a socio-ecological frame of thinking and living in the world (e.g. Mueller, 2009) and by bringing forth its moral underpinnings (e.g., Craft et al., 2008).

> "Yes, creativity! But in order for creativity to take place, a sense of responsibility and real concern for the environment is needed." (M2-Foreign Language)

> "Creativity stems from the process of getting personally involved with and feeling responsible toward the environment, not just blaming others." (F7-Economics)

> "EE helps the students to become environmentally responsible and active citizens… Unless creativity goes hand in hand with responsible citizenship, there is no point in promoting creativity in any form." (M7-Technology)

Theoretical Relevance of the Findings and Implications for Educational Practice and Research

It is widely acknowledged that teachers play a key role, whether positively or negatively, in fostering students' creative thinking. It is also broadly accepted that more research is needed to highlight opportunities already existing in the school context and explore how to improve support for teachers to boost creativity more effectively. The present study is among the few that provide a platform for secondary teachers involved in the implementation of EE to express and reflect on their personal frames of thinking regarding what creativity means to them and their thoughts about opportunities in EE for enhancing students' creative thinking. Our aim was to explore how creativity is conceptualized by teachers within a particular knowledge domain and educational field, that of EE, by taking into consideration how this field is embedded in a specific educational and socio-cultural context (the Greek secondary-education context of EE practice and implementation). This focus aligns with the theoretical view of creativity as a "situated" activity that is operationalized and interpreted with respect to its domain of reference (Amabile, 1983; Csikszentmihalyi, 1996). It also takes into account the conclusion of Andiliou and Murphy (2010) in their literature review that there is a huge lack of research on teachers' conceptions of creativity and on how creativity is moulded and manifested in various disciplinary and curricular areas and in diverse cultural contexts.

We argue that the focus of our research is highly important as it is widely documented in the literature that teachers' thinking plays a decisive role not only in moulding their judgements and interpretations in relation to the environment and environment-related issues, but also in shaping the ways in which they view, design, and implement EE practice (Hart, 2003). We also argue that the situated knowledge and experiences of teachers regarding the nurturing of creative thinking within the context of EE may offer valuable insights and information not only for researchers but also for policymakers and curriculum designers who aspire to put into action educational programmes and initiatives with similar aims. Moreover, delving into a more profound understanding of teachers' personal theories of creativity provides practitioners with valuable insights into their own thinking and practice. It is not by chance that several participants commented that their involvement in this study was a rare opportunity for them to reflect on their conceptualizations and daily practices regarding the fostering of creative thinking in students. It is nevertheless only through this path that a teacher becomes "…a reflective practitioner – one who considers actions and intentions by reflecting both in and on practice" (Craft, Gardner & Claxton, 2008, p. 11).

A welcoming finding of the present study for both EE theory and practice is that, on the question of whether EE enhances creative thinking, the participants unanimously replied affirma-

tively. As discussed in the literature review, a broadly argued assertion is that creative thinking should be included in EE goals and that it is inherently promoted in EE practice. The present study's findings provide information on how teachers view this issue, and it is promising that their thoughts are along the same lines as EE theory. The fact that the teachers acknowledge the affinity between EE and creativity also paves the way for educational policies to promote this relationship in school practice.

However, more than anything else the above finding highlights the need for further research that is more thorough, more considered, and broader. With the exception of a study of Greek primary teachers (Kampylis, et al., 2009), who also described EE as a curricular subject offering considerable opportunities for facilitating creativity, no other empirical study has as yet built on or compared findings. There is thus a considerable gap in the research not only in addressing and disentangling the topic's various unknown dimensions but in clarifying the roots of teachers' favourable views. Taking into consideration that some of them admit that it was the first time they had been asked to reflect on the issue, to what degree is their response not the result of social desirability? Would their spontaneously positive stance have been the same if the sample were bigger and/or approached through a different research design? Do Greek secondary teachers relate this creativity potential only to EE, or would they identify it within any other subject domain? Or is it possible that the augmented "teaching experience" of the participants allowed them to see an equivalent potential in any curricular subject, as research by Tan (2001) suggests? These are questions that by no means undermine the methodological rigour of our study. Instead, they suggest promising new routes for research in the field.

Overall, our findings indicate three distinctive trends in the participants' conceptualizations. The first is an acknowledgement that creative thinking is capable of being developed within the context of EE through the facilitating pedagogy that is applied and the encouraging learning environment that is created in implementing such project-type EE programmes. The second trend identifies the basic practice of creative thinking offered by EE in environmental problem-solving teaching and learning processes. Finally, the third trend is an assertion that the ethical base upon which environmental issues are approached and studied within the frame of EE can actually shape the way creativity is conceived.

Even in the early days of EE, theorists and practitioners emphasized the need to fully dissociate EE practice from traditional pedagogical practices, which were centred on transmissive models of teaching and on learner-as-a-passive-recipient-of-knowledge models of learning (Unesco, 1978). They vigorously promoted the adoption of experiential, constructionist, and socially critical approaches that promote student-centred pedagogies, encourage first-hand experience, active learning, and collaborative interaction among learners, and support the development of critical thinking and enquiry-based problem-solving (see, among others, Fien, 1993; Kyburz-Graber, 1999). This ongoing discourse on the innovative character of EE pedagogy has created many high expectations with regard to the transformative pedagogical role EE can play for the individual, school, or society.

Despite the disparity that is frequently witnessed between the rhetoric and daily EE school practice (Stevenson, 2007), it is interesting that the participants resorted to this same discourse in order to seek arguments in favour of EE's potential in developing creativity. However, it is not completely surprising as a research finding. As studies of teachers of various subjects and from a variety of cultures reveal (Cheung et al., 2003; Fleith, 2000; Fryer & Collings, 1991; Kampylis et al., 2009; Park et al., 2006), it appears to be a common thread in the opinions of most teachers that creative thinking can be developed or facilitated in an appropriate pedagogical context. It could be argued that the almost axiomatic tenet in EE teachers' minds about EE peda-

gogical innovation opens the way for more-extensive theorizing on creativity in the field and for better integrating the pursuit of creativity as a goal in EE practice.

Environmental problem-solving in particular has been thought by many EE theorists as the central process supporting EE activities and programmes, with the ultimate aim of developing independent and critically reflective thinkers capable of identifying environmental problems, investigating hidden dimensions to these problems, seeking out alternative solutions, and developing appropriate action plans for implementing these solutions (see among others Bardwell, Monroe & Tudor, 1994; Gauthier, Guilbert, Pelletier, 1997; Unesco, 1985). The participants in our study also referred to enquiry-based environmental problem-solving as a supportive frame for fostering students' creative potential. This finding adds to the theory as it is in line with an already identified strand of thought in the literature on creativity and in EE literature (Disinger and Howe, 1992; Pruneau et al., 2006). In addition, research in other subject areas such as science education suggests that teachers view problem-based learning and project-based enquiry as a context that facilitates creativity in their disciplinary field (Haigh, 2007; Kind & Kind, 2007; Park et al., 2006). The fact that EE teachers acknowledge that environmental problem-solving processes foster students' creativity can also aid educational policy and practice by incorporating creativity more easily into EE in-service programmes that traditionally focus on enquiry-based environmental problem-solving.

Finally, a promising point worthy of further research is related to the third trend in teachers' views on creativity that arose from the present study: the recognition that no creative act or creative product is value-free or culturally unsubscribed, and that creativity acquires an ethical qualification by the aspiration through teaching and learning to develop it. This conceptualization of creative thinking is embedded in a distinctive theoretical approach in current creativity research that discusses the ethical underpinnings of creativity. Along this line of thought, the participating teachers asserted that EE can play a role in attributing a socially and environmentally constructive ethical meaning to creativity. Although they did not elaborate further or build on this view, the seeds for original theorizing are present in their raw reflection. However, the implication of this finding concerns not only educational theory and future research. Empowering teacher educators and school teachers and, through them, students to expose the cultural layers that attribute the construct of creativity to its "myth" is a true educational process in itself (Mueller, 2009). On the other hand, to qualify creativity with new ethical meanings, better attuned to an ecologically sound (Bowers, 1995) or an authentic ecojustice perspective (Mueller, 2009), is a genuine act of social enculturation.

What is arguably an issue of particular theoretical and practical significance in research on teachers' conceptualizations of creativity is the ability to identify alignments between teachers' and researchers' methods of ascribing meaning to the concept (Andiliou & Murphy, 2010). The present study confirmed that participants' conceptions correspond to the four key components identified in definitions of creativity from the literature: process, person, product, and context (Kampylis & Valtanen, 2010). In fact, these components are not only simply depicted in teachers' conceptions but are interwoven within them. It should be noted that these views emerge from the teachers collectively and are not present in the opinions of all the teachers individually.

The present study also revealed that participants' frames of thinking about creative thinking are embedded in all three theoretical approaches that currently dominate creativity research, namely "everyday" or "little c" creativity, creativity as a "situated" activity, and creativity as an ethically based construct.

In particular, participants did not connect creativity to any particular talent or the exceptional performance of some genius. Instead, their conceptions describe creative thinking mainly as a thinking process that is inherent in everyone and apt to be further developed though educa-

tion. By relating creativity to everyday processes of either defining or resolving a problem, teachers attached particular importance to the pedagogical context created by them in the classroom and to the general social climate of the school. Furthermore, by making reference to manifestations of creative thinking, the participating teachers made no connections between creativity and dramatically striking artworks or exceptionally original products, only "simple" products expressing students' imagination and their ideas in a novel and appropriate way.

By asserting that creative thinking can be fostered within an appropriate educational context, the participants in effect recognize the "situatedness" of creativity. They claim that even a genuinely creative personality needs a facilitative environment to identify and develop this potential. In other words, creativity is inherent in everyone to a greater or lesser extent, but it needs the right context for it to blossom. This view is further supported by the participants' explicit pronouncement that EE can foster creative thinking in their students. Their main argument is that the teaching and learning processes promoted within the context of EE school practice constitute an educational environment that favours the development or facilitation of creative thinking.

Finally, some of the participants acknowledged the opportunities offered by EE to pose and discuss critically issues of social and environmental responsibility in relation to creativity and to encourage students to endorse more conscientious forms of creative thinking. This approach implicitly assigns a steering role to EE to reveal and problematize the ethical underpinnings of creativity with regard to its impacts on society and the environment (Craft et al., 2008; Cropley, Kaufman, Cropley & Runco, 2010).

However, teachers' conceptualizations of creativity as revealed in the present study – as elsewhere – are fragmented and appear to resemble the Indian parable of the elephant and the six blind men who approach parts of the elephant as the whole. The same may be said to be true of creativity researchers who very often study one part of creativity as the whole of this complex construct (see also Kampylis & Valtanen, 2010). We therefore argue that, in order to obtain a wider and deeper understanding of the fostering of creative thinking within the framework of EE, a holistic approach is needed that takes into consideration the viewpoints, experiences, and knowledge of teachers and researchers alike. In order to make this feasible, more research is required with a focus on the theories and practices of teachers concerning creativity in EE, and more EE learning experiences should be designed and implemented in schools that take into consideration the fostering of creativity.

Conclusions and Further Work

The present study aimed to explore how Greek secondary teachers who practice EE conceptualize creative thinking and the potential of EE for fostering it. Our intention was to obtain an initial insight into the topic; a bigger and more detailed study, both qualitative and quantitative, would carry more weight and overcome the inevitable reliability issues found in small scale research. In addition, the way the study was designed methodologically allowed us to make only provisional assertions and restricted us to the particular educational and socio-cultural context. However, it is our view that the present study contributes to theory by addressing questions that have not been dealt with before and by opening up this field to further and more detailed study. We consider it both critical and timely that this under-researched topic in EE should receive greater research attention.

Among the main conclusions of the study is that it is a widely held view among teachers that creative thinking is a type of thinking process that is, can, or should be enhanced within the context of EE. It is the very nature of EE, in terms of both the issues covered and the pedagogical approaches taken, to favour the development of creative thinking in students. Teachers' views are

therefore very much in accordance with scholar assertions in the EE literature emphasizing the close links between EE and creative thinking.

It is also clear that all four key components identified in definitions of creativity in the literature (Kampylis and Valtanen, 2010) – those referring to process, person, product, and context – are not only depicted by but also interwoven within the conceptions of participants in this study, with the most prevalent being that of process. Teachers conceptualize creative thinking as an inherent component of environmental problem-solving, with special reference to the problem-finding stage. In addition, creative thinking is viewed by teachers as a personality trait that can find freedom of expression within the appropriate pedagogical context provided by EE. Another interesting approach identified in the data is that which relates creativity not necessarily only with the production of "fine arts" but also with the creation of simple and everyday objects. Finally, of particular interest is the attribution of ethical dimensions to creative thinking and its pairing with social and ecological responsibility. All these views, identified in the study, are supported by related literature in the fields of both EE and creativity.

What is also acknowledged by participants is that creative thinking is enabled not in a vacuum but with the aid of a specific pedagogy. This is also a view that is supported in the literature. In fact, Reid and Petocz (2006) underline the need for a "creative pedagogy" as among the aims of teacher training in EE. In keeping with the work of these authors, we also suggest that the study's conclusions could be treated as preliminary indicators in the design of teacher education programs in EE with an orientation on enhancing the creative potential of teachers and students (see, e.g., Daskolia, Lambropoulos, & Kampylis, 2009).

Having reviewed the literature, we conclude that, although the seeds already exist for identifying a notable relationship between creative thinking and EE, there needs to be a more thorough and in-depth theoretical exploration of the topic. Moreover, although it may be described as an uncharted area in terms of research, both fields could greatly benefit from empirically addressing many of the interesting questions it raises.

Regarding future research, it is clear that there is much to be gained from continuing exploring teachers' conceptions of creativity within the context of EE in a more elaborate way in terms of teachers' implicit theories and teaching practices (Daskolia, 2005) both on a national and on a cross-cultural level (Andiliou & Murphy, 2010). Continuing and extending the scope of research on creative thinking would thus add considerably to the theory, educational practice, and professional development of teachers in EE.

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Fen Bilgisi Öğretmenleirnin Çevre Eğitim Bağlamındaki Yaratıcı Düşünme Kavramları

Çevre eğitiminde (ÇE) yaratıcı düşünme büyük bir araştırma konusu olarak durmaktadır. Öğrencilerin yaratıcı düşünmelerini kolaylaştırmadaki rolü iyice belgelenmesine rağmen öğretmenlerin ÇE bağlamındaki yaratıcı düşünme kavramları üzerine yapılan araştırma sınırlıdır. Yunanistan ortaöğretim öğretmenlerinin ÇE'de yaratıcı düşünme kavramları üzerine yapılan küçük ölçekli nitel bir araştırma burada sunulmaktadır. Farklı alt yapılara ve konu uzmanlığa sahip 20 ortaöğretim öğretmeniyle yapılandırılmamış mülakatlara dayalı olarak deneysel veri toplanmıştır. Araştırmanın bulguları arasında, katılımcıların yaratıcı düşünmeyi ÇE bağlamında zenginleştirilebilen ve zenginleştirilmesi gereken bir düşünme süreci olarak görmeleri yer almaktadır. Süreç, kişi, ürün ve bağlam gibi literatürde yaratıcılığı tanımlayan dört anahtar bileşen en belirgin süreç olarak katılımcıların kavramsallaştırmaları arasında yer almaktadır. Öğretmenler yaratıcı düşünmeyi, en temel çevresel problem çözme bileşeni olarak kavramsallaştırmaktadırlar. Öğretmenlerin ÇE pedagojisinin kendisiyle olgunlaşılabilecek elverişli bir çevre sunduğunu iddia etmektedirler. Ayrıca etik hususları, yaratıcılıkla sosyal ve ekolojik sorumluluğu eşleştirerek birlikte düşünmektedirler. Katılımcıların yaratıcı düşünme bakış açıları, ÇE ve yaratıcı düşünme arasındaki ilişkiyi ve yaratıcı düşünme üzerine yapılan araştırmalarda öne çıkan geniş kuramsal yaklaşımlarla arasındaki bağlantıyı vurgulayan bilim insanlarının görüşlerini desteklemektedir. Araştırma, ÇE bağlamındaki yaratıcı düşünme üzerine yapılabilecek daha fazla araştırma için bir başlangıç noktası sunmaktadır.

Anahtar Kelimeler: Öğretmenlerin kavramları, yaratıcı düşünme, çevre eğitim, ortaöğretim