

What does Critical Thinking mean? A statistical data analysis of pre-service teachers' defining statements

Sofia D. Anastasiadou (Corresponding Author)

University of Western Macedonia
30 km Florinas Nikis, 53100, Florina, Greece
E-mail: sanastasiadou@uowm.gr, Phone: 00302310416056

Aikaterini Dimitriadou

University of Western Macedonia
30 km Florinas Nikis, 53100, Florina, Greece
E-mail: adimitriadou@uowm.gr, Phone: 00302385055015

Abstract

Critical thinking development is an essential part of undergraduate education, but are we certain that pre-service teachers can define the concept of CT in order to pursue it later in the classroom? Based on the conviction that CT can be learned, developed and improved, this paper refers to an empirical research aiming to determine the way in which 88 third semester student teachers of the University of Western Macedonia, Greece, conceive the notion of CT. The participants' defining statements of the term are mainly concerned with metacognition, approach and utilization of knowledge as well as cognitive processes based on logic, thus forming categories in approximate analogy to those of Sternberg's model of human intelligence; however, the implementation of implicative statistical analysis reveals a differentiation from this model. The results of the study have implications for the pedagogy of CT and the pre-service teachers' epistemological development.

Key words: critical thinking, pedagogy of critical thinking, teacher education, implicative statistics

Introduction

The human ability to respond to the needs constantly arising in modern world is an imperative concerning all parts of the universe. These needs follow not only the acceleration of the pace of change but also the intensification of complexity and interdependence, thus resulting to the need for thinking critically as a major agenda in education across the world (Hamers & Overtoom, 1999; Frangoudaki, 2004; Ahmad Assaf, 2009). The critical thinking CT movement was generated in the late 1970s and early 1980s (Lipman, 1991: 101-113) in order to help students improve their reasoning about problems encountered in every day life. Drawing on Aristotle's psychology (Robinson, 1989: 62-111), the movement has been constantly expanded to cover more and more areas of thought in order to correspond to the dramatic technological, economic and social changes of our times (Dimitriadou, 2008). Research driven intervention studies and reforms across the curriculum aiming at the development of CT are usually oriented to the applicability to instruction, which has to include cognitive apprenticeship, powerful learning environments and conditions of transfer (Resnick, 1987; McGuinness & Nisbet, 1991: 182).

Attention focuses on learning, thinking and instruction within subject areas (Csapó, 1999), while metacognition or self regulation seems to be a key factor for the development of teaching CT (McGuinness & Nisbet, 1991; Efklides, 2006). The value of CT is established not only for students, but also for educators, especially when they take initiatives which allow the complexities of their profession to be visible; such a condition exists, for example, in the case of action research, which gives teachers the opportunity to build their capacity for a better understanding of their teaching (Carr & Kemmis, 1986; Dana & Silva, 2003). Detailed definitions of the term CT are of major significance so much for teachers as in the minds of educators, administrative members of education and policy makers.

Aim and structure of the study

Our study aims to the understanding of how pre-service teachers define CT. More precisely, it focuses on the conceptions student teachers of the University of Western Macedonia hold about the term CT. The University of Western Macedonia is a new Institution and its course syllabus is still under development. Within the existing program of practicum towards undergraduate students' degree, they have to be engaged in instructional procedures developed in primary schools of Western Macedonia for a period of six semesters. Given the above framework, the educational outcome of this study seems to be useful towards three directions: to the promotion of student teachers' beliefs about knowledge and teaching processes, to the reform of the structure and content of the syllabus, as well as to the development of the student's internship programme in schools.

Student teachers' expected definitions of the features and the characteristic outcomes of CT can enable us to understand the manner in which they see knowledge and drive us to expectations about possible teaching processes that the participants are likely to practice in their professional career. The importance of understanding the perceptions which student teachers hold about CT can be further pointed out on condition that pedagogical as well as epistemological issues concerning the participants' beliefs about the subject matter are taken into account. In this sense, our research does not aim only to the research conclusions; first of all there is a concern for pedagogy (Moon, 2008: 124-176), since the support of CT development in a student needs to be the responsibility of all staff who works with students. Secondly, provided that higher education is a phase during which there is a potential for the development of epistemological beliefs, our study responds to a need to work out a position for relationship between student learning, specific CT and epistemological development on a continuum related to teaching, pedagogy and academic assertiveness on part of student teachers (Kuhn, 1999; Ikuenobe, 2002; Halx & Reybold, 2006; Moon, 2008: 101-174).

At the beginning of the paper the wide range of interpretations invited by the concept of CT are vaguely delineated. Conceptual definitions of the term CT are given and several of its significant perspectives and features are examined, while emphasis is placed upon the importance of its establishment as a core attainment of instruction. Thereafter, the research data are presented and discussed on the basis of the implicative statistics method. Finally, the outcomes that concern the potential connection between the participants' defining statements about CT and the syllabus of their studies are outlined.

Defining CT

CT cannot be easily defined, while it ranges across all disciplines and can be perceived across a lot of logical, ethical, pedagogical and epistemological issues raised in a specific context (Resnick, 1987; Beyer, 1985; Vandermensbrugghe, 2004: 419-420; Fawkes, O'Meara, Weber, & Flage, 2005; Moon, 2008; Ahmad Assaf, 2009). In addition to that, the terms used in the interdisciplinary field of CT are commonly connected with different references, whereas different terms used with fuzzy indistinct boundaries obfuscate meaning.

The CT Community defined CT as "the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action" (Scriven & Paul, 2007: 1). In literature, definitions of the term of CT refer to various notions, such as logical inferences, reasoning patterns or judgement, thus capturing the idea of a mental activity which is useful for a particular cognitive task (Halpern, 1996: 5). Many theorists attempted to define the term in the past, each time placing emphasis on the different aspects of its operational structure. De Bono (1985: 11), for example, defines CT as "that waste of time between seeing something and knowing what to do about it", while Halpern (1996: 31) approaches CT as "the use of those cognitive skills or strategies that increase the probability of a desirable outcome" and Barak, Ben-Chaim, & Zoller (2007: 355) consider CT as "an operative example of higher order thinking that can be accounted for due to reliable and validated tests".

Educational theorists from different disciplines have at times tried to illustrate the content of thinking as a human characteristic and the kinds of cognitive skills that can be developed during the course of a life time. While there are disagreements about matters of detail concerning CT, considerable agreement has been achieved so that it can be viewed as a combination of either abilities and dispositions (Hager, Sleet, Logan, & Hooper, 2003) or ability, sensitivity, and inclination (McBride, Xiang, & Wittenburg, 2002). In an effort to identify the basic features of thinking, De Bono (1985: 137-174) refers to humor, imagination, creativity and attention, whereas in the field of education the most relevant skill areas are identified as those relating to inquiry and reasoning processes, information, organizing and translation (Lipman, 1991: 40-46).

As far as researchers are concerned, there has been an agreement about the existence of higher forms of thinking, including problem solving and decision making, that are based on basic forms of thinking such as analysis, inductive and deductive reasoning (Ennis, 1987). These forms of thinking are implemented in a great variety of applications including justification, value statements, reasoning from premises, analysing arguments, testing hypotheses, solving problems, estimating probabilities, making decisions and thinking creatively (Ennis, 1969: 375-422; Ennis, 1987; Halpern, 1996: 30). Moreover, the development of CT is considered as possible to be achieved through instruction within subject areas (Csapó, 1999; Matsagouras, 1997) or completely disconnected from it (Halpern, 1999; Hamers & Overtoom, 1999; Ahmad Assaf, 2009), while it plays an important part in the teachers' and students' opinions formation in the multicultural context of modern education (McLaren, 1994; Egege & Kutieleh, 2004). It is worth mentioning that bibliographical references usually stress the role that personal characteristics of the thinker have for CT, such as emotion, language and intellectual curiosity (Moon 2008: 67-75).

CT and taxonomies

In an effort to organize the vast amount of aspects of CT, so that a structure for comprehension is provided and the study of and instruction in thinking is advanced, different approaches have been formed by cognitive scientists and various classification systems have been suggested, each time based on specific parameters (Moon, 2008). Moreover, specialized foundations and centres have been established aiming at defining, structuring, assessing, improving and advancing the principles and best practices of fair-minded critical thought in education and in society (www.criticalthinking.org). Using the differentiation between lower and higher cognitive skills as a starting point, Bloom and his fellow researchers (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956) initially compiled a taxonomy derived from the vocabulary of educational psychology, which accords with the cognitive aims of teaching. He suggests a pyramid of skills, at the apex of which there are analysis, synthesis and evaluation. These skills in turn correspond to CT, creative thinking and judgement, thus constituting the components of higher order thinking (Lipman, 1991: 49). With respect to the three main qualities of thinking, such as CT, creative thinking and reasoning, as well as the abilities and dispositions linked with CT, Ennis (1969, 1987) combined all cognitive skills and formed his own view about the thinking process.

He refined his lists of CT dispositions and abilities in response to critique from others as well as in the light of his own experience (for a simplified summary see Hager, Sleet, Logan, & Hooper, 2003: 305-307). Following a differentiated approach, Demetriou & Efklides (1988) developed the ‘experiential structuralism theory’, which identifies three levels of organization of the mind (the processing system, the specialized structural systems and the hyper-cognition or metacognition), thus proposing notions able to causally explain the construction of autonomous capacities. A decade later, Halpern (1999) suggested a taxonomy which classifies types of thinking in an organizational structure. According to this, thinking is divided into direct and nondirect thinking, with direct thinking further divided into habitual, wishful, superstitious and CT. The subcategory of CT is divided even further into five specific subtypes, such as: (a) verbal reasoning skills, (b) argument analysis skills, (c) thinking as hypothesis testing, (d) using likelihood and uncertainty and (e) decision making and problem solving. In order to become a critical thinker, the above characteristics have to be accompanied by (i) a disposition to use the skills, (ii) a metacognitive monitoring process in which the individual assesses whether the process is “working”, as well as (iii) the ability to recognize when a particular skill is likely to be useful.

A number of competent writers and educators describe CT in connection with pedagogical issues, thus adopting a less structured view for the notion it represents. In this sense, they demonstrate ‘the influence of emotion and of a nurturing environment, the negative influence of threat and the need for an appropriate challenge to thinking’ as parameters which affect the development of CT (Moon, 2008: 46-47). Bernstein, for example, suggests three complementary models of CT, namely the informal reasoning model, the problem-solving model and the negotiation model (Bernstein, 1995 as cited in Moon, 2008: 46-47). Others emphasise the significance of personal attributes in the process of CT and associate its identity with the notion of ways of being. They maintain that CT extends beyond skills, component activities, arguments and logic and is correlated with a general set of habits and attitudes towards everything, thus recognizing the role of emotion as a significant factor (Moon, 2008: 46-49). Finally, in accordance with a developmental framework in the conceptualization of CT, which is drawn on the intellectual development in children and adolescents, Kuhn (1999) identifies three second-order cognitive operations, namely metacognitive, metastrategic, and epistemological.

Having in mind the aforementioned taxonomies imposed among existing categorizations and terminologies, one might observe that higher order thinking, which encompasses critical, systemic and creative thinking, can be conceptualized as a complex mode of thinking that generates multiple solutions. According to Lipman (1991: 94), it tends toward complexity and display of unity, it is compelled by evidence, it tends to seek intelligibility and to display qualitative intensity and it generally exhibits largeness of scope. Furthermore, it is considered to involve uncertainty, application of multiple criteria, reflection and self-regulation (Resnick, 1987). As it is relatively complex, it requires judgement, analysis and synthesis, and it is not applied in a rote or mechanical manner (Halpern, 1999). Contrary to lower order thinking, which has to do with the recall of information, it overlaps levels above comprehension, thus corresponding with procedures such as analysis, synthesis and evaluation of Bloom’s taxonomy (Barak, Ben-Chaim, & Zoller, 2007). A last but not least global classification of thinking skills has to be mentioned here as presented by Sternberg (1985), in relation with his so called ‘Triarchic Theory of Intelligence’. Using the notion of the component as a structural element –as an elementary information process that operates upon internal representations of objects or symbols– he used the componential subtheory to specify mental mechanisms underlying intelligent performance (Sternberg, 1985: 97).

According to this, he distinguished three different types of components, which can serve three kinds of action: (a) metacomponents, which are higher order executive processes used in planning, monitoring and decision making in task performance; (b) performance components, which are processes used in the execution of a task; and (c) knowledge acquisition components, which are processes used in learning new information. Sternberg's taxonomy of thinking skills covers all cognitive abilities: (a) the executory processes are used to evaluate one's own thinking, thus having to do with metacognition; (b) the non executory task processes are used to actually carry out that thinking; and (c) the non executory learning processes are used to learn how to think in the first place, that is for the acquisition of knowledge (Sternberg, 1985: 41-128). The Sternberg's model as a hierarchical organization of thinking-related concepts and their definitions has been proved useful to this study, since it provided us with a common language in order to communicate the verbal expressions of the participants and organize them on the basis of logical rules.

The research

As demonstrated above, CT is a concept that invites a wide range of interpretations. At the same time it constitutes a pedagogical aim of high priority in Institutions preparing teachers, since the attainment of CT may restructure the way traditional curriculum methods and materials are used. Based on the conviction that CT can be learned, developed and improved (Halx, & Reybold, 2006; Barak, Ben-Chaim, & Zoller, 2007) our study was directed towards the need to sort out a meaningful response to the question '*What is the meaning of critical thinking?*'. In accordance with that, the following research questions were formed:

- Do the student teachers of the University of Western Macedonia have a clear idea about the content of CT?
- What attributes do they mainly give to the notion of CT?
- Do they correlate CT with specific conceptions/tasks or do they share a broader perspective of it?
- Do they imply a relationship between CT and personal characteristics of the thinker, such as emotion, language and curiosity?
- Do they correlate CT with the curriculum and the pedagogical role of teaching?
- Is there any statistically important difference between male and female student teachers' conceptions about critical thinking?

The answers to the above questions seem to be of great interest, since the student teachers' ability to conceptually approach this complex notion are probably indicative for their competence on how to guide prospective learners into being critical thinkers. More precisely, we expected that the participants' definitions would emerge through the ways in which CT is facilitated, so that the parameters which support CT could be identified. The identification of these conditions is of crucial importance so much on the level of teaching as on the level of different challenges encountered to students' learning (Joyce, Calhoun, & Hopkins, 2002), thus designating the pedagogy of CT (Halx & Reybold, 2006).

The research focuses on the essays of 88 third semester student teachers (69 female and 19 male) of the School of Primary Education, University of Western Macedonia, Greece. The participants composed the essays in order to reply to the open question: "*What is the meaning of the term CT?*" The non-directive wording of the question was expected to allow the participants feel free to thoroughly record their defining statements, so that the researchers could gather rich qualitative data on the participants' conceptions (Cohen & Manion, 1994). The participants' written texts were examined according to the principles of Quantitative Content Analysis, which is suitable for the study of beliefs and opinions of a person or a group (Berelson, 1971). It is worth mentioning that this method is drawn on De Sola Pool (1959), who had expressed the view that Quantitative Content Analysis is ideal for the study of meanings and semiotic relations inherent to oral or written speech, while three decades later Palmquist (1990) used content analysis on students' writings in an illuminative way.

Results

The essays written by the participants were elaborated and transformed into analytical units. More precisely, each of them was broken into conceptual units which fell under four basic categories, so that their particular characteristics were reportable. These categories were in turn further analyzed and reduced the participants' accounts, thus arriving at seven narrower subcategories. The data are analyzed below on the basis of the Implicative Statistical Analysis (Bodin, Coutourier, & Gras, 2000; Gras, Briand, & Peter, 1996; Lerman, 1981), which seems to be the most suitable process for the data analysis in this case. The notions about CT that emerged from the participants' accounts were structurally organized into a conceptual system very close to that of Sternberg's model about intelligence (1985). More particularly, the coding and categorising processes highlighted a total of 289 references of the social subjects of the research, which could be classified into three main categories: *metacognition, approach and utilization of knowledge*, as well as *cognitive processes based on logic*.

The first two categories were subdivided into narrower divisions, so that more subtle distinctions among concepts could be available. References corresponding to the conceptualization of CT as a ‘critical ability’ with no further explanation of the term were classified in a fourth category. Thus, the conceptual structure of the term CT constituted a scheme of seven first class variables and four second class variables. Table 1 shows the categories and subcategories of these references, as well as the percentage of their occurrence.

Table 1: Distribution of subject references about CT

Thematic groups	N	%
1. Metacognition	150	
1.1. Positions-Attitudes	77	51.33%
1.2. Personal opinion elocution	49	32.67%
1.3. Assessment	24	16%
2. Approach and utilization of knowledge	58	
21. Knowledge acquisition	45	77.59%
22. Knowledge application	13	24.41%
3. Cognitive processes based on logic	50	100%
4. Critical ability (conceptual identification of the term)	31	100%
Reference total	289	

Category 1, comprising more than half of the participants’ reference total, corresponds to *metacognition* and includes the following notions:

1.1. Positions and attitudes

The participants’ references which correspond to the meaning of CT as a position conceive this meaning as an attitude that prevents individuals from becoming passive receptors of social happenings. They argue that it makes one distance himself from the masses, develop a personal mentality, cautiously take control of people, facts and circumstances, challenge commonly approved concepts, express his will, develop autonomy and independent thinking and be open to every possibility. According to this aspect, the concept of CT is also linked with an individual able to be cooperative, organized, truthful, conciliatory but not superficial, and devoid of stereotypes and biases. Moreover, a person characterized by this ability is receptive to the presence of any difficulties, thus being able to use overall metacognitive processes.

1.2. Elocution of personal opinions

In this group of references, the concept of CT is linked with an individual’s ability to vocalize and be assertive about his personal opinions, defend his principles and beliefs and think in an individual and not universal way, demonstrating maturity in his decisions. Thus, CT is what leads a person to make personal choices, generally express his personal opinions, take part in discussions, and finally shape his mental personality.

1.3. Assessment/evaluation

According to a third group of references, CT is linked to the individual who can make assessments, discern right from wrong, show approval or disapproval, and recognize what is beneficial or not. According to this aspect, CT means that a person can be selective and realize the difference between right and wrong in order to be objective.

2. The second category of recorded references has to do with the *approach and utilization of knowledge*, thus resulting to two subcategories:

2.1. Acquisition of knowledge.

The definition of CT on one the hand concerns the formation of a global point of view, and on the other the ability to consider things from different perspectives based on concrete parameters. CT is linked to the acquisition of an all-round knowledge, the process of becoming informed as well as comprehension instead of memorization, all subjected to the formation and output of knew knowledge, based on wisdom, education, imagination, and a general observation ability.

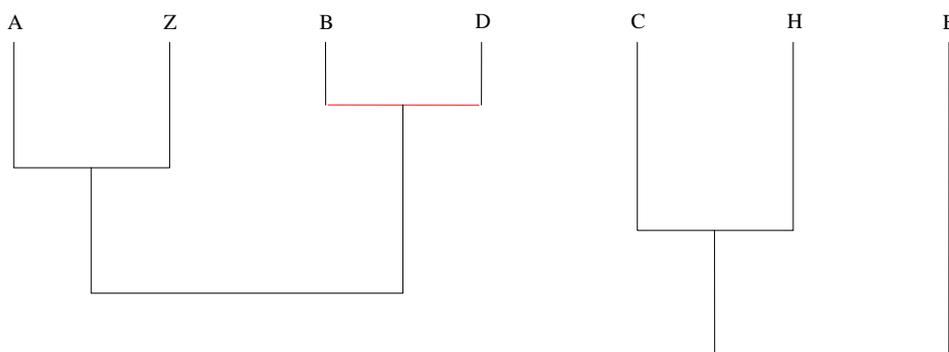
2.2. Implementation of knowledge

According to the references corresponding to this subcategory, CT comprises the combination of theory and practice, problem solving, fact and circumstance interpretation, assimilation and use of new and previous knowledge in various conditions, and finally, a critical implementation of reason.

3. The third category refers to cognitive processes coinciding with *reasoning*. The participants’ references correspond to the concept of CT as a succession of cognitive processes grounded on reasoning: implementation of reason, detection of causes, abstractive ability, ability to analyze, synthesize, compare and thoroughly examine, investigate and detect the essential among details. Moreover, they correspond to the consideration of consequences, implementation of higher thinking processes, orderly placement of thoughts, development and corroboration of thought and, finally, argumentation.

4. In the fourth category the participants' references on CT present a conceptual identification of the term with *critical ability*. In this group of references CT is reported as equivalent to critical ability, with the notion that critical ability means to have and use one's personal judgement, thus resulting to the ability to judge and criticize. Student teachers describe critical ability as the ability to combine on one hand judgment and thought and on the other judgment and action. In this sense, they note that critical ability requires the ability to judge before acting. Statistical processing of the participants' answers has produced three diagrams, which outline the relation between social subjects and their references: a *similarity diagram*, a *hierarchical diagram* and an *implicative diagram*. The conceptual groups that compose the charts, as they are linked in many ways, are as follows: A positions, B elocation of personal opinions, C assessment, D modes of knowledge acquisition, E means of knowledge implementation, Z cognitive processes based on reason, H critical ability. Specifically, the *similarity diagram* represents a classification method which aims to identify in a set V of variables, thicker and thicker partitions of V, established in an ascending manner. (Figure 1: The similarities with a bold dark color are significant in a significance level of 99 %).

Figure 1: Similarity diagram

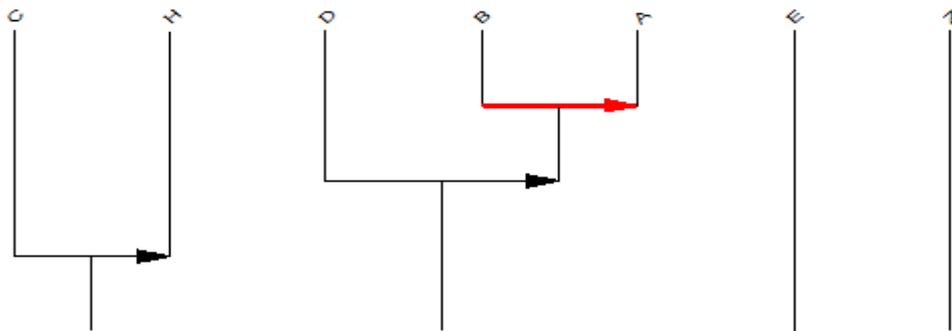


In this chart, conceptual groups about CT are classified into two big groups of similarity. The first one comprises of groups A, Z, B and D. We can observe that the strongest similarity (almost 1) occurs between groups B and D. This means that the student teachers believe that CT is a characteristic of those who can voice and assert their personal opinions. Such individuals can take part in discussions, express their viewpoint, as well as make personal choices and decisions. In addition, CT characterizes those who can form an all-round view, be objective and view the different aspects of a problem, taking seriously into consideration evident or hidden parameters. References included in this category also highlight the belief that CT is an ability which appears in those who, based on established knowledge, process the information they receive, utilizing it in new cognitive contexts supported by imagination. The similarity between variables A and Z is also very important (0,732), as the participants think that those who have CT are not passive recipients of knowledge. In the contrary, they diversify themselves from the masses, raise questions, are cautious, think independently and express their thoughts autonomously, while they rid of any stereotypes and prejudices. Their cognitive processes are thus based on reason. According to this, those who possess CT are able to handle any matter with the use of reason, so as to examine it, analyze it, point out the causes and possible consequences, and support their positions with argumentation.

The second similarity group consists of groups C, H, and E. According to the participants' references, those who can formulate appreciative evaluations possess critical ability –the features of which are not defined–, while they simultaneously can devise methods for the implementation of knowledge. It is worth noting that in the tree-chart of similarities the three groups of notions corresponding to variables A, B and C do not appear together; that means that they do not seem to form a similarity group which could constitute the first of the four second class variables (metacognition), according to Sternberg's model. The same situation can be observed in the case of variables D and E, which together could form a group of similarity, thus becoming the second order factor 'approach and implementation of knowledge'. The *hierarchal diagram* (Figure 2) presents the implicative relationships between the variables in order of significance, as well as the direction of these relationships (the implications shown in bold dark color are significant in a significance of 99%). We can detect that the participants who believe that CT means the ability to assess are those who express a definite discrimination between right and wrong, the beneficial from the futile, the just from the unjust, and who are ready to answer what is to be approved of and what is not (C: assessment). These participants also attribute the perception of CT as critical ability (H). The above characteristics seem to imply a person's ability to implement his personal judgement in order to stand critically opposite people, facts, and circumstances, combine judgement with action and in any case never act without first thinking.

We should note here that the participants interpret the term CT as critical ability, resulting in a tautology which does not seem to illuminate their conceptions.

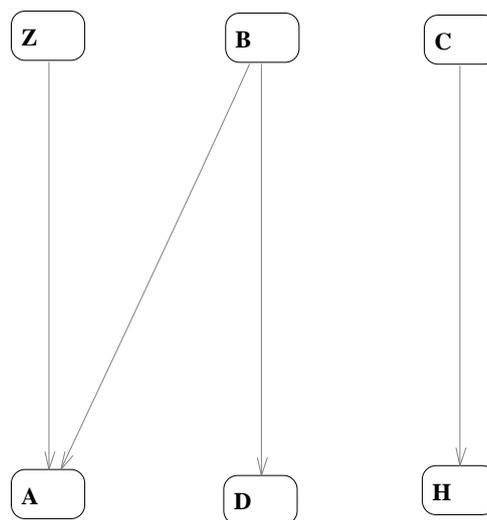
Figure 2: Hierarchical diagram



The next and final implication (D: Modes of knowledge acquisition, B: Elocution of personal opinions, A: Positions) indicates the participants belief that the ability to acquire knowledge implies the ability to voice one’s personal opinions. This conclusion makes sense since the acquisition of knowledge, which is the foundation of a person’s formation of an all-round view and his ability to consider different aspects, is what makes him capable of boldly expressing himself, on both personal and social level, support his personal beliefs, as well as make wise choices and successful decisions. Besides, the possession of knowledge with the simultaneous ability to voice one’s personal opinions results in forming specific positions that will differentiate them from the masses. Furthermore, it assists him in making independent, autonomous and detached judgments using high level strategies in his approach to reality. It should be noted at this point, as is evident by the parallel and non-concurrent concept groups E and Z, that the participants’ conception of CT as a means of knowledge implementation seem to be far different from the notion of cognitive processes based on reason.

Finally, the *implicative diagram* (Figure 3) reveals the variables Z, B and C as being the dominant ones.

Figure 3: Implicative diagram



More precisely, the dominant group-variables Z and B are linked with an implicative relation with the group-variable A, thus the implicative diagram falling in line with the similarity diagram. Moreover, the dominant variable B (elocution of personal opinions) implies the conception of CT as the ability to acquire knowledge. The dominant variable C (assessment) is linked by implication only with variable H (critical ability), and shows that the development of evaluation processes points to what the participants connote with the term ‘critical ability’. Taking the three diagrams of statistical analysis into consideration, it seems that although the student teachers mark several conceptual aspects of the term CT, they are incapable of clearly specifying the structural and functional features of the term, in order to logically describe a pattern drawn on the relationship between them.

More specifically, they refer to structural elements of CT which appear to be functionally linked to each other. This connection, however, does not concern related concepts, and is thus devoid of logical consistency. Besides, as established by the study of the complementary variable of “sex” during the statistical analysis of the data, male and female student teachers do not present any differences as far as the definition of the term CT is concerned.

Conclusions

Based on the assumption that definitions related to the term of CT can facilitate pre-service teachers to conceive knowledge produced in school in order to fully engage learners with the process of CT, a group of student teachers of the University of Western Macedonia were asked to write essays in order to interpret the term. Their statements convey definitions that reveal their views about different attributes of this complex notion and are open to interpretations which widely vary in terms of their meaning. Although distributed and not able to be included under well constructed conceptual systems, the participants’ views can be reduced to a series of seven structural elements constituting the notion of CT: positions, elocution of personal opinions, assessment, acquisition of knowledge, implementation of knowledge, cognitive processes based on reason and critical ability. The participants’ definitions fall under categories which imply notions in approximate analogy to Sternberg’s (1985) *components of thinking* in his ‘Triarchic Theory of Intelligence’. More particularly, the first three of the elements comprise the category of *metacognition* and the following two the category of *approach and utilization of knowledge*. A third group of participants’ defining references belong to the category of *reasoning*. However, a further organization of these categories into a structural system is not equivalent to the categorisation inherent in the taxonomical system of Sternberg’s model.

The participants’ conceptions about the notion of CT and the relationships between their characteristics, as were highlighted by the implicative statistical analysis, allow us to consider them as structural elements which form further cognitive patterns on CT born by the participants. First of all, the interpretations of the term are mainly concerned with the notion of metacognition, emphasizing on the category of attitudes (Efklides, 2006). The main interrelated concepts are the cognitive processes based on reason and the expression of personal opinions which are related to attitudes. The expression of personal opinions leads to the perception of critical ability as an ability to form attitudes, to examine different aspects, to make judgments and to be ‘objective’ in evaluation. On the other hand, the participants’ conception of CT as a cognitive process mainly based on reason seems to differ from their conception related to the implementation of knowledge, while their defining statement “critical ability” corresponds to assessment procedures (Ikuenobe, 2002). All in all, the participants’ reports on the meaning of CT incorporate statements which convey elusive conceptions of the notion; this finding gives an answer to a probable question emerging from the data: why the participants so often ascribe tautological interpretations of the type “CT = critical ability”?

The participants’ implied views accord both to highly detailed approaches and to more general descriptions of CT at the same time. In the first case, they refer to mechanical processes, each part of which can be operated separately. These processes could be related to Socratic questioning as an art of stimulating students to think critically (Paul & Elder, 2008). In the second case there is a sense of a more holistic approach with ‘deeper’ conceptions concerning CT as a way of being (Moon, 2008: 55-56, 113-120). They tend to treat the term as covering both the mental activities and the various representations of the thinking procedures (including action, speech and writing) (Moon, 2008: 27-33), without making a discrimination between them. Besides, they seem to give an emphasis on specific kinds of mental activity, such as evaluation, critical appraisal, reflection and understanding. They point out, for example, that CT prevents people from being passive recipients of knowledge, diversify them from the masses and rid them from stereotypes and prejudices. As a result, it assists them in making independent judgments supported by high level strategies for the approach to reality.

Most participants conceive critical thinking in the full sense as the making of a judgment, thus involving recognition that knowledge is contestable and a tendency for progress in epistemological terms (Moon, 2008: 101-112). However, there are a number of participants whose descriptive statements about critical thinking have an absolutist or a dualistic character: knowledge is right or wrong. This implies a disposition which does not accord with relativistic or contextual knowing and could be related to their inadequately developed epistemological beliefs, as observed in students of early stages of their higher education. As a result, they seem to have a need for a transition from dualist to multiplist and to relativist thinking, that is from absolute thinking to the notion that knowledge is a matter of opinion; to the recognition that there can be different views of knowledge because knowledge is constructed (Murphy, 1997); moreover, to the consideration that due to human fallibilism, knowledge is only highly probable and deprive us from the possibility to get at the true nature of metaphysical reality (Ikuenobe, 2002).

Having this in mind, teachers should deliberately select material that challenges the rationality (Schrag, 2003), displays ambiguity and introduces the possibility of multiple perspectives in order to stimulate students to think critically. Among the participants' defining statements there does not seem to be any references to emotion, language and curiosity as personal characteristics of the thinker affecting cognitive processes (Moon, 2008: 67-75). Besides, the participants did not relate CT with the classroom, since they added no connotative references to any parameters of the educational process, such as the curriculum subjects (science, history etc) or the multicultural context of contemporary schools (e.g. issues about facing stereotypes) (Gundara, 2000; Banks, 2001). We assume that this absence of reference is due to the open wording of the essay-type question posed. The study did not seem to aim at the detection of characteristics that a critical thinker should entail in regard of teaching. There is a need, however, for creating a concern for the *pedagogy* of CT and putting a framework which could enable us to understand better the manner in which student teachers see knowledge. Such a framework can both highlight the way in which teachers methodologically mediate the curriculum and provide with 'language' describing aspects of the quality of CT. Thus, apart from guiding learners to effective pursuit of knowledge, this language can give good feedback to teachers on how to improve their work. Moreover, it would be useful to work out a position for the relationship between student learning, CT and epistemological development (Kuhn, 1999).

Discussion

Based on the above discussion, interventions could be made in the course syllabus of School of Education of the University of Western Macedonia aiming to a discourse on the conceptual clarification of the term of CT, with or without respect to the student teachers' practicum. Such a discourse can dwell on further perceptions about the defining features, the characteristic outcomes, and the underlying conditions that make CT possible, connecting faculty perceptions of critical thinking with pedagogical applications (Halx & Reybold, 2006). Our findings are expected to function in terms of higher education policy and faculty preparation for critical thinking pedagogy, thus creating a bridge between theory and practice and promoting the passing from scientific understanding ("episteme") to practical knowledge ("phronesis") (Kessels & Korthagen, 1996). This knowledge has to do with a competency of a holistic and organic character –namely the achievement of *depth* in CT– underpinning the particular pre-service teachers' studies stage, which is related to their state as individuals of epistemological understanding.

The development of CT as a feature in parallel with the epistemological development can display the cognitive growth which can be perceived as a productive approach to pedagogy. Students in higher education can be helped to shift towards this ability depending on the nature of supporting activities for CT and the change of their views on the nature of knowledge. More particularly, the pedagogy of CT can introduce learners to contextual knowing, shift their responses to critical issues from description to depth, display flexible and metacognitive thinking, use creativity and face objectivity and subjectivity with respect to their thinking processes (Lubart, 1994; Halx & Reybold, 2006). Among the major strategies for encouraging CT, Moon (2008) discriminates the following: challenging learners beyond their zone of proximal development (Vygotsky, 1978), encouraging interaction and risk taking in the classroom, engaging students in thinking and writing procedures, giving examples and "local" definitions of CT, using assessment as quality measurement and feedback, adopting interactive teaching instead of presentations, clarifying the idea of CT in student teachers' own disciplines, and fostering their epistemological development (Moon, 2008: 130-161, 219-224). Reviewing objects, evaluating or developing arguments, engaging in CT about self, reviewing incidents, constructively responding to other's arguments and displaying "a critical habit of engagement with the world" are some of the learners' capacities which need to be deployed if student teachers are to be promoted in their 'academic assertiveness' (Moon 2008: 77-89).

On a second level, the conclusions could be linked to important issues of teaching and learning, such as the implementation of knowledge, the courses included in the curriculum and the creation of conditions which promote the contextualization of CT (Vandermensbugghe, 2004). Particularly the teaching *for* critical thinking could have useful implications for diversity in learners' performances: student teachers can have a progress in their epistemological development toward promoting inclusive education and using teaching practices which respond to the needs of cognitively or culturally differentiated classrooms (Tomlinson, 1999; Gundara, 2000; Banks, 2001; Egege & Kutieleh, 2004; Banks et al., 2005; Keller, 2008). The clarification of the student teachers' concepts for CT could possibly assist them not only in attaining the promotion of their students' critical abilities, but also in the development of rethinking their own capabilities. This means that they should be able to think critically about their own practice in an ongoing developmental manner (Kroll, 2004) and introduce critical processes into their teaching as professional practitioners –decisions about the content, aims and objectives of instruction, sequencing and pacing of content, pupil interactions with subject matter and evaluation of mastery– thus making steps in tracing a route to the epistemology of practice (Schön, 1983).

Research efforts towards clarification of the concept of CT, as was presented in this paper, seems to be identified as an educational attainment of great significance. Not only does the literature cited and concepts discussed provide a starting point for student teachers to integrate critical thinking skills into instruction, but also research findings can form a basis for restructuring the way traditional curriculum methods and models are used (Joyce, Calhoun, & Hopkins, 2002). Moreover, the interaction of students with their environments in order to construct knowledge (Murphy, 1997; Kroll, 2004) link the notion of CT with social intelligence and the discourse of democracy and freedom: fostering the mind to be free from manipulation, a discourse on CT provides 'a language of possibility' as a philosophical construct that has been of foremost significance to the evolution of critical pedagogy (Giroux, 2003; McLaren, 2003).

The limited research sample does not allow generalization and drawing of conclusions. However, we believe that our study could serve as one more discourse on the precise conceptual definition of the term CT among pre-service teachers of Primary Education and for infusing teaching for CT into regular classroom instruction. Further research on the student teachers' ideas on the topic could create challenges for modeling effective thinking strategies (e.g. on how to attack problems, analyze texts or construct arguments) and support particular methods of working with learners in primary school (e.g. dealing with real-world problems, encouraging open-ended discussions, and fostering inquiry-oriented experiments). Empirical evidence shows that persistent and purposeful teaching for promoting higher order thinking among students cultivates CT dispositions and has a beneficial influence on school performance (Ennis, 1987; Resnick, 1987; Halpern, 1999; McBride, Xiang, & Wittenburg, 2002; Ikuenobe, 2002; Barak, Ben-Chaim, & Zoller, 2007). Pre-service teachers' willingness to sharpen their own critical thinking capacity could operationalize their definitions of critical thinking, thus justifying their critical reflection as a common characteristic of successful teaching.

References

- Ahmad Assaf, M. (2009). *Teaching and Thinking. A literature review of the teaching of thinking skills*. Abu Dhabi Education Council
- Banks, J. A. (2001). *Cultural Diversity and Education. Foundations, Curriculum and Teaching* (4th ed.). London: Allyn and Bacon.
- Banks, J., Cohran-Smith, M., Moll, L., Richert, A., Zeichner, K., LePage, P., Darling-Hammond, L., Duffy, H. & McDonald, M. (2005). Teaching Diverse Learners. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing Teachers for a Changing World. What Teachers Should Learn and Be Able to Do* (pp. 232-274). San Francisco: Jossey-Bass
- Barak, M., Ben-Chaim, D. & Zoller, U. (2007). Purposely Teaching for the Promotion of Higher-order Thinking Skills: A Case of CT. *Research in Science Education*, 37 (4), 353-369.
- Berelson, B. (1971). *Content Analysis in Communication Research* (2nd ed). New York: The Free Press.
- Beyer, B. (1985). CT. What is it? *Social Education*, 22, 270-276.
- Bloom, B.S., Englehart, M. D., Furst, E. J., Hill, W. H. & Krathwohl, D. R. (1956). *Taxonomy educational objectives. Handbook 1 – Cognitive Domain*. New York: David McKay.
- Bodin, A., Coutourier, R. & Gras, R. (2000). *CHIC : Classification Hierarchique Implicative et Cohésitive-Version sous Windows – CHIC 1.2*. Rennes: Association pour le Recherche en Didactique des Mathématiques.
- Carr, W. & Kemmis, S. (1986). *Becoming Critical: Education, Knowledge and Action Research*. Lewes: Falmer Press.
- Cohen, L. & Manion, L. (1994). *Research Methods in Education*. London: Routledge
- Csapó, B. (1999). Improving thinking through the content of teaching. In J. H. M. Hamers, J. E. H. Van Luit & B. Csapó (Eds.), *Teaching and Learning Thinking Skills* (pp. 37 – 62). Lisse: Swets and Zeitlinger.
- Dana, N. F. & Silva, D. Y. (2003). *The Reflective Educator's Guide to Classroom Research. Learning to Teach and Teaching to Learn Through Practitioner Inquiry*. Thousand Oaks: Corwin Press.
- De Bono, E. (1985). *Practical Thinking. 4 ways to be right. 5 ways to be wrong. 5 ways to understand*. Harmondsworth: Penguin Books.
- De Sola Pool, I. (1959). *Trends in Content Analysis*. Urbana: University of Illinois Press.
- Demetriou, A. & Efklides, A. (1988). Experiential structuralism and neo-Piagetian theories: Toward an integrated model. In A. Demetriou (Ed.), *Neo-Piagetian theories of cognitive development: Towards an integration* (pp. 173 – 222). Amsterdam: North-Holland.
- Dimitriadou, C. (2008). Changing Times, Changing Literacies: Responding to the Needs of Social Practice in the New European Context. In N. P. Terzis (Ed.), *European unification and educational challenges in the Balkans. Education and Pedagogy in Balkan Countries 8, Balkan Society for Pedagogy and Education* (pp. 423 – 428). Thessaloniki: Kyriakidis Brothers.
- Efklides, A. (2006). Metacognition and affect: What can metacognitive experiences tell us about the learning process? *Educational Research Review*, 1, 3 – 14.
- Egege, S. & Kutieleh, S. (2004). CT: Teaching Foreign Notions to Foreign Students, *International Education Journal* 4 (4), 75 – 80.
- Ennis, R. (1969), *Logic in Teaching*. London: Prentice-Hall.
- Ennis, R. H. (1987). A Taxonomy of Critical Thinking Dispositions and Abilities. In J. B. Baron & R. J. Sternberg (Eds.), *Teaching Thinking Skills. Theory and Practice* (pp. 9 – 26). N. York: W. H. Freeman and Company.
- Fawkes, D., O'Meara, B., Weber, D. & Flage, D. (2005). Examining the Exam: A Critical Look at The California CT Skills Test. *Science & Education* 14, 117–135.

- Frangoudaki, A. (2004). Educational challenges in the rapidly changing societies of today's Europe: the case of Greece. In V. Koulaïdis (Ed.), *Quality of Education. Teachers Professional Training and Development. The European Union and the SE European Countries. Conference Proceedings* (pp. 49 – 53). Athens: The Ministry of Education and Religious Affairs of Greece.
- Giroux, H. A. (2003). Critical Theory and Educational Practice. In A. Darder, M. Baltodano & R. D. Torres (Eds.), *The Critical Pedagogy Reader* (pp. 27 – 56). New York: RoutledgeFalmer.
- Gras, R., Briand, H., & Peter, P. (1996). Structuration sets with implication intensity. In E. Diday, Y. Lechevallier, & O. Opitz (Eds.), *Proceedings of the International Conference on Ordinal and Symbolic Data Analysis - OSDA 95, pp 147-156*,. Paris: Springer.
- Gundara, J.S. (2000). *Intercultural Education and Inclusion*. London: Paul Chapman Publishing.
- Hager, P., Sleet, R., Logan, P. & Hooper, M. (2003). Teaching Critical Thinking in Undergraduate Science Courses. *Science & Education, 12*, 303–313.
- Halpern, D. F. (1996). *Thought and Knowledge. An Introduction to Critical Thinking*. New Jersey: Lawrence Erlbaum Associates.
- Halpern, D. F. (1999). Esperanto and the tower of Babel: A taxonomy of thinking. *Psychology, 6* (3), 255-264.
- Halx, M. D. & Reybold, L. E. (2006). A Pedagogy of Force: Faculty Perspectives of Critical Thinking Capacity in Undergraduate Students. *The Journal of General Education, 54*, 4, 293-315.
- Hamers, J. H. M. & Overtom, M. Th. (1999). Teaching thinking: Programmes and evaluation. *Psychology, 6* (3), 265-277.
- Ikenobe, P. (2002). Epistemic foundation for Teaching Critical Thinking in Group Discussion. *Interchange, 33/34*, 371-393.
- Joyce, B., Calhoun, E. & Hopkins, D. (2002). *Models of learning – tools for teaching*(2nd ed.). Buckingham: Open University Press.
- Keller, J. G. (2008). Questions first: Introducing critical thinking using the Text Analysis Matrix (TAM). *Journal of the Scholarship of Teaching and Learning, 8* (2), 11-24.
- Kessels, J. P. A. M. & Korthagen, F. A. J. (1996). The Relationship Between Theory and Practice: Back to the Classics. *Educational Researcher, 25* (3), 17-22.
- Kroll, L. R. (2004). Constructing constructivism: how student-teachers construct ideas of development, knowledge, learning, and teaching. *Teachers and Teaching: theory and practice, 10* (2), 199-221.
- Kuhn, D. (1999). A developmental model of CT. *Educational Researcher, 28* (2), 16-46.
- Lerman, I. C. (1981). *Classification et analyse ordinale des données*. Paris: Dunod.
- Lipman, M. (1991). *Thinking in Education*. Cambridge: Cambridge University Press
- Lubart, T. I. (1994). Creativity. In: R. J. Sternberg (Ed.), *Thinking and Problem Solving* (pp. 289 – 332). New York: Academic Press
- Matsagouras, E. (1997). Teaching Thinking through the Curriculum. In J. H. M. Hamers & M. Th. Overtom (Eds.), *Teaching Thinking in Europe. Inventory of European programmes* (pp. 249-254). Utrecht: SARDES.
- McBride, R. E., Xiang, P. & Wittenburg, D. (2002). Dispositions Toward Critical Thinking: the preservice teacher's perspective. *Teachers and Teaching: theory and practice, 8* (1), 1-40.
- McGuinness, C. & Nisbet, J. (1991). "Teaching Thinking in Europe". *British Journal of Educational Psychology, 61*, 174-186.
- McLaren, P. (1994). Multiculturalism and the Post-modern Critique: Toward a Pedagogy of Resistance and Transformation. In H. A. Giroux & P. McLaren (Eds), *Between Borders. Pedagogy and the Politics of Cultural Studies* (pp. 192 – 222). New York: Routledge.
- McLaren, P. (2003). Critical Pedagogy: A Look at the Major Concepts. In A. Darder, M. Baltodano & R. D. Torres (Eds.), *The Critical Pedagogy Reader* (pp. 69 – 96). New York: RoutledgeFalmer.
- Moon, J. (2008). *Critical Thinking. An exploration of theory and practice*. Routledge: London.
- Murphy, E. (1997). Characteristics of Constructivist Learning & Teaching. In <<http://www.stemnet.nf.ca/~elmurphy/emurphy/cle3.html>> (available at Febr. 2, 2010).
- Palmquist, M. (1990). *The lexicon of the classroom: language and learning in writing classrooms*. Doctoral Dissertation, Carnegie Mellon University.
- Paul, R. & Elder, L. (2008). Critical Thinking: The Art of Socratic Questioning, Part III. *Journal of Developmental Education 31* (3), 34-35.
- Resnick, L. B. (1987). *Education and learning to think*. Washington: National Academic Press.
- Robinson, D. N. (1989). *Aristotle's Psychology*. New York: Columbia University Press.
- Schön, D. (1983) *The reflective practitioner: how professionals think in action*. New York: Basic Books.
- Schrag, F. (2003). Response: Challenges to Rationality. In K. Alston (Ed.), *Philosophy of Education* (pp. 179 – 181). <<http://ojs.ed.uiuc.edu/index.php/pes/issue/view/15>> (available at Febr. 2, 2010).
- Scriven, M. & Paul, P. (2007). Defining Critical Thinking. The Critical Thinking Community <<http://www.criticalthinking.org/aboutCT/definingCT.cfm>> (available at Febr. 2, 2010).
- Sternberg, R. J. (1985). *Beyond IQ. A triarchic theory of human intelligence*. Cambridge: Cambridge University Press.
- Tomlinson, C.A. (1999). *The differentiated classroom: responding to the needs of all learners*. Alexandria: Association for Supervision and Curriculum Development.
- Vandermensbrughe, J. (2004). The Unbearable Vagueness of CT in the Context of the Anglo-Saxonization of Education. *International Education Journal 5*(3), 417-422.
- Vygotsky, L. (1978). *Mind in Society: the development of higher psychological processes*. Cambridge: Harvard University Press