University of Cyprus

Department of Education

TEACHING FOR CRITICAL THINKING: ENHANCING INSTRUCTIONAL EFFECTS ON STUDENTS' CRITICAL-THINKING PERFORMANCE THROUGH TEACHERS' EMPOWERMENT AND PROFESSIONAL DEVELOPMENT

DOCTOR OF PHILOSOPHY DISSERTATION

FLORIA N. VALANIDOU

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FLORIA N. VALANIDOU

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VALIDATION PAGE

Floria N. Valanidou

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DECLARATION OF DOCTORAL CANDIDATE

The present doctoral dissertation was submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy of the University of Cyprus. It is a product of original work of my own, unless otherwise mentioned through references, notes, or any other statements.

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ABSTRACT

Although critical thinking is a major educational objective, education has not lived up to the task consistently since critical thinking is ill-defined in curriculum discussions, students' critical thinking is inadequate and teachers are not well-informed or resistant to teaching for critical thinking while focused on delivering content. Therefore, intervention efforts through which teachers are given ongoing developmental opportunities to (re)act and (re)think in how to teach for critical thinking are needed, especially in elementary education where research is lacking.

The study aimed to develop a well-planned teacher professional development programme in teaching for critical thinking and empirically examine its effects on student critical-thinking outcomes as well as to explore the presuppositions, conditions, and difficulties in teaching for critical thinking in the subject area of Language Arts. The programme was developed based on an integrated approach to professional development. Thus, it was explicitly based on a substantive theoretical framework for critical thinking and focused on progressive improvement of instruction through developing teachers' critical thought.

23 teachers and 395 students aged 10-11 from 14 elementary schools participated in the study. 12 teachers and 205 students constituted the experimental group while 11 teachers and 190 students constituted the control. Teachers of the experimental group were engaged in school-based professional development during which they were supported towards teaching for critical thinking for a school year. Teachers of the control group did not receive any kind of training or support.

The study used a mixed-method approach to evaluate the impact of the programme upon the dependent variables of student critical-thinking performance and quality of teaching. Changes in the teaching quality were monitored through 69 classroom observations (23 teachers x 3) using a Critical-Thinking Observation Tool, while teachers' reflections upon their perceived ability to teach for critical thinking were obtained. A Critical-Thinking Questionnaire measuring six core critical-thinking skills was administered to the control and experimental groups at the beginning and end of the programme while interim testing was also used. Scales for the student critical-thinking performance and teaching quality were created through the Rasch Model that was used to evaluate the conceptual structure of the tools (meaning, validity) and test whether they were targeted correctly.

Findings revealed that the intervention had both an impact on the improvement of students' critical thinking and teaching quality. In particular, students in the experimental group outperformed students in the control group, while teachers engaged in the programme had

gradually improved their quality of teaching for critical thinking. Multilevel modelling techniques used to identify the explanatory variables associated with the student critical-thinking performance in the post-test, have shown that the level-one predictors were the student critical-thinking performance in pre-test and interim test, reading books, and the treatment group (experimental or control). The experimental condition had a relatively strong appeal on student critical-thinking outcomes, which relates to certain features of the teacher professional development programme.

Findings provide evidence regarding the impact of teacher professional development on student learning. The study suggests an organic curriculum for empowering teachers in teaching for critical thinking, which is fully contextualized since the programme was monitored and revised while implemented based on the participants' needs. Findings assume that empowering teachers' knowledge of, and commitment to, teaching for critical thinking is worthwhile given that teachers undergo appropriate (multi)treatment through effective professional development. Implications for research into supporting teachers to teach for critical thinking are given.

ABSTRACT [in Greek language]

Παρότι η κριτική σκέψη αποτελεί πρωταρχικό στόχο της εκπαίδευσης, η εκπαιδευτική πραγματικότητα διαφέρει σε τρία επίπεδα. Έρευνες δείχνουν ότι δεν υπάρχει σαφής επεξήγηση της έννοιας της κριτικής σκέψης στο Αναλυτικό Πρόγραμμα ενώ οι μαθητές δεν την αναπτύσσουν ικανοποιητικά. Παράλληλα, οι εκπαιδευτικοί δεν είναι επαρκώς πληροφορημένοι ή/και διστακτικοί στο να διδάσκουν κριτική σκέψη εστιάζοντας σε κάλυψη προδιαγεγραμμένης ύλης. Επομένως, παρεμβατικές προσπάθειες που δίνουν στους εκπαιδευτικούς συνεχείς ευκαιρίες για (αντί)δραση και (ανα)στοχασμό σε σχέση με τη διδασκαλία για την κριτική σκέψη κρίνονται απαραίτητες, ιδιαίτερα στη Δημοτική Εκπαίδευση που η έρευνα είναι περιορισμένη.

Η παρούσα έρευνα στόχο είχε να αναπτύξει ένα καλά δομημένο πρόγραμμα επαγγελματικής ανάπτυξης εκπαιδευτικών σε σχέση με τη διδασκαλία για την κριτική σκέψη και να εξετάσει εμπειρικά την επίδρασή του στα αποτελέσματα της κριτικής σκέψης των μαθητών, διερευνώντας προϋποθέσεις και συνθήκες διδασκαλίας για την κριτική σκέψη. Η ανάπτυξη του προγράμματος βασίστηκε σε μια μικτή ενοποιημένη προσέγγιση επαγγελματικής ανάπτυξης, τα βασικά στοιχεία της οποίας αφορούν σε ένα καλά τεκμηριωμένο θεωρητικό υπόβαθρο και σε προοδευτική βελτίωση της διδασκαλίας μέσω ανάπτυξης δεξιοτήτων αναστοχασμού των εκπαιδευτικών.

Στην έρευνα συμμετείχαν 23 εκπαιδευτικοί και 395 μαθητές ηλικίας 10-11 χρονών από 14 δημοτικά σχολεία. 12 εκπαιδευτικοί και 205 μαθητές αποτέλεσαν την πειραματική ομάδα ενώ 11 εκπαιδευτικοί και 190 μαθητές αποτέλεσαν την ομάδα ελέγχου. Οι εκπαιδευτικοί της πειραματικής ομάδας συμμετείχαν στο πρόγραμμα επαγγελματικής ανάπτυξης σε σχολική βάση όπου έτυχαν ενδυνάμωσης και στήριξης σε σχέση με τη διδασκαλία για την κριτική σκέψη για μια σχολική χρονιά. Ταυτόχρονα, οι εκπαιδευτικοί της ομάδας ελέγχου δεν έτυχαν οποιασδήποτε στήριξης.

Η έρευνα χρησιμοποίησε μικτή μεθοδολογική προσέγγιση για να εξετάσει την επίδραση του προγράμματος στις εξαρτημένες μεταβλητές της κριτικής σκέψης του μαθητή και της ποιότητας διδασκαλίας. 69 παρακολουθήσεις (23 εκπαιδευτικοί x 3 παρακολουθήσεις) πραγματοποιήθηκαν για να ελέγξουν ενδεχόμενη βελτίωση στην ποιότητα διδασκαλίας μέσω κλείδας παρατήρησης ενώ γραπτές αναστοχαστικές αναφορές ζητήθηκαν από τους εκπαιδευτικούς σε σχέση με την αποτελεσματικότητά τους στη διδασκαλία για κριτική σκέψη. Ένα εργαλείο μέτρησης βασικών δεξιοτήτων κριτικής σκέψης χορηγήθηκε στους μαθητές των δύο ομάδων στην αρχή και στο τέλος του προγράμματος. Επίσης, πραγματοποιήθηκε ενδιάμεση μέτρηση. Κλίμακες μέτρησης της κριτικής σκέψης του

μαθητή και της ποιότητας διδασκαλίας δημιουργήθηκαν μέσω του στατιστικού μοντέλου Rasch που χρησιμοποιήθηκε για να αξιολογήσει την εννοιολογική δομή των εργαλείων (σημασία, εγκυρότητα) και τον βαθμό ανταπόκρισης των υποκειμένων σε αυτά.

Τα αποτελέσματα έδειξαν ότι το παρεμβατικό πρόγραμμα επαγγελματικής ανάπτυξης εκπαιδευτικών είχε επίδραση τόσο στη βελτίωση της κριτικής σκέψης του μαθητή όσο και της ποιότητας διδασκαλίας. Συγκεκριμένα, οι μαθητές της πειραματικής ομάδας ενίσχυσαν την κριτική τους σκέψη σε σχέση με τους μαθητές της ομάδας ελέγχου ενώ οι εκπαιδευτικοί που συμμετείχαν στο πρόγραμμα είχαν παρουσιάσει σημαντική βελτίωση στη διδασκαλία τους σε σχέση με την προώθηση της κριτικής σκέψης. Πολυεπίπεδες στατιστικές αναλύσεις που χρησιμοποιήθηκαν για να καθορίσουν τις ανεξάρτητες μεταβλητές που εξηγούν ή/και προβλέπουν την απόδοση του μαθητή στο μεταπειραματικό δοκίμιο, έδειξαν ότι αυτές αφορούσαν στην αρχική και ενδιάμεση μέτρηση της κριτικής του σκέψης, στην ανάγνωση βιβλίων αλλά και στη συνθήκη (πειραματική ή ελέγχου). Η πειραματική συνθήκη είχε μια σχετικά δυνατή επίδραση στα αποτελέσματα της κριτικής σκέψης των μαθητών που σχετίζεται με συγκεκριμένα χαρακτηριστικά του προγράμματος.

Τα αποτελέσματα ενισχύουν το ερευνητικό πεδίο που εξετάζει τον βαθμό στον οποίο η επαγγελματική ανάπτυξη εκπαιδευτικών συμβάλλει στη βελτίωση των μαθησιακών αποτελεσμάτων. Η έρευνα προτείνει ένα οργανικό πρόγραμμα επαγγελματικής ανάπτυξης εκπαιδευτικών σε σχέση με τη διδασκαλία για την κριτική σκέψη που αναπτύχθηκε σε συγκεκριμένο συγκείμενο για να εξυπηρετήσει ανάγκες συγκεκριμένων συμμετεχόντων. Βάσει των αποτελεσμάτων προκύπτει ότι η ενδυνάμωση της γνώσης, των δεξιοτήτων και της αφοσίωσης των εκπαιδευτικών σε σχέση με τη διδασκαλία για την κριτική σκέψη αξίζει τον κόπο φτάνει οι εκπαιδευτικοί να τυγχάνουν κατάλληλης επαγγελματικής ανάπτυξης και πολυεπίπεδης στήριξης. Προτάσεις για μελλοντικές έρευνες σε σχέση με την επαγγελματική ανάπτυξη εκπαιδευτικών και την κριτική σκέψη συμπεριλαμβάνονται.

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In loving memory of my dad,

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CHAPTER I

THE PROBLEM

Statement of the Problem

Promoting critical thinking has always been an essential goal of general contemporary education (Abrami, Bernard, Borokhovski, Wade, Surkes, Tamim, & Zhang, 2008; Bailin & Siegel, 2003; Ku, 2009; Marin & Halpern, 2011; Nickerson, 1988; Swartz, 2003; Willingham, 2007) since students are consequently prepared to think well and for themselves (Pithers & Soden, 2000). Recent reform efforts of National Curricula (e.g. Scotland, Cyprus) seem to emphasize the priority of improving student thinking and of developing key competences, such as critical thinking (Swartz, 2003). To further inform their philosophical underpinning, curriculum documents stress that critical thinking is integral to lifelong learning and the ability to deal effectively with a world of accelerating change and complexity where individuals are called to make decisions (Abrami et al., 2008; Brookfield, 2003; Halpern, 1989, 2001; Paul, Elder, & Bartell, 1997; Tsui, 2002). Besides, critical-thinking abilities are essential for a functioning democracy of responsible citizens (Angeli & Valanides, 2009; Bangert-Drowns & Bankert, 1990; Behar-Horenstein & Niu, 2011; Beyer, 1988; Kennedy, Fisher, & Ennis, 1991; ten Dam & Volman, 2004). In that sense, attempting to teach students to think critically is a worthwhile activity in which the school can engage (Beyer, 1988; Heyman, 2008). For, if students are educated to become critical thinkers, they will be able to select, analyze, evaluate, infer, interpret, understand and critically apply the wide range of information they receive (Halpern, 1998, 2002; Marin & Halpern, 2011; Markovits, 2003; McKendree, Small, Stenning, & Conlon, 2002; Yang, 2008) and solve ill-defined problems with which they may be confronted (Angeli & Valanides, 2009; Dwyer, Hogan & Stewart, 2014; Halpern, 1998, 2002; Marin & Halpern, 2011; McKendree et al., 2002; Siegel, 1985; Swartz, 2003).

Research proves that critical thinking can be taught and learned (Angeli & Valanides, 2009; Barnes, 2005; Brookfield, 2003; Halpern, 1989; Lipman, 1988; McMillan, 1987; Paul, 2005; Swartz, 2003). In fact, relating critical thinking with instruction has been a recurrent topic in the research of critical thinking since critical thinking can be developed or can fail to improve depending on the quality of the instruction (Insight Assessment, 2015). Critical thinking is thought to be, after all, the result of teaching and training (e.g. Halpern, 1989; Swartz, 2003; van Gelder, 2005), while teaching for thinking skills and critical thinking has been suggested as a characteristic of an effective teacher by several studies (e.g. Kyriakides, Campbell & Christofidou, 2002; Munro, 1999). What is stressed is that students will not eventually become critical thinkers unless there is a deliberate instruction for teaching critical thinking (e.g. Angeli & Valanides, 2009; Beyer, 1988; Halpern, 1989, 1998, 2001; Kennedy et al., 1991; McMillan, 1987; Paul et al., 1997; Paul, 2005; Prawat, 1991). That kind of instruction is reinforced by certain critical-thinking principles. These mainly concern the integration of critical thinking into content instruction (Plath et al., 1999; Swartz, 2003; Zohar et al., 1994), the setting of a context (i.e. understanding a material, making an evaluative judgment, solving a problem or making a decision) under which one would engage in critical thinking (e.g. Ennis, 1989, 1991; Facione, 2011; Fischer et al., 2009; Shim & Walczak, 2012), the explicit teaching of critical thinking (Ennis, 1989; Marin & Halpern, 2011; McGuinness, 1999; McTighe, 1985; Swartz, 2003; Zohar et al., 1994), the use of strategies enabling students to use the right type of thinking at the right time (Swartz, 2003; Willingham, 2007), the practice of critical thinking through critical-thinking rich tasks and activities (Plath et al., 1999; Swartz, 2003; van Gelder, 2005) and the building of an environment of thoughtfulness and self-reflection (Newmann, 1991; Plath et al., 1999; Swartz, 2003).

Despite mounting research on the teaching of critical thinking, what prevails is that typical school instruction maintains ‘the time-honored tradition of stuffing minds with information’ (Ruggiero, 2003, p. 370). Emphasis is placed on covering content and transmitting knowledge (Dewey, 1933; Kennedy et al., 1991; Koutselini, 2008a, 2008b, 2013; Onosko, 1991; Paul, 1992; Ruggiero, 2003; Tsui, 2002), be it generalizations, facts, events, or beliefs held by people in the past and/or the present (Onosko, 1991). In that vein, students learn the products of others’ thinking (Onosko, 1991) instead of learning how to think for themselves (Tsui, 2002). For most students, believing, and not thinking, equals to knowing (Paul, 1992). In this respect, teachers continually find themselves teaching students, who can read texts but cannot infer ideas, explain and defend their points of view (e.g. Bean, 2011; McTighe, 1987; Philips, 1988), give reasons or draw conclusions.

With the aforementioned in mind, there is an educational need for shifting from teaching content to teaching students how to become critical thinkers (Flores et al., 2012) so as to maximize their learning and improve their academic achievement (Beyer, 1988; Facione & Facione, 1994; Zohar, Weinberger, & Tamir, 1994). Teachers are the ones who can address that need by aiming at higher-order thinking and learning during instruction. Teachers can design their instruction so as to motivate their students’ impulsive initiation in a more self-conscious way, such that good critical-thinking practice is encouraged and poor practice is dropped (Bailin et al., 1999a; Swartz, 2003). Students, for example, can be brought, through instruction, to realize that good reasons must be relevant to the opinion in question and stronger than the opinion in question (Lipman, 1988). Students can also learn how to read closely, for deeper understanding, and write substantively, both of which require critical thinking skills (Paul, 2005). And further, students can be encouraged, for example, 'to develop an aporetic stance to texts, that is, to ask more questions about the main ideas of a text' (Angeli, Valanides & Papastephanou, 2011, p. 313) since the textual authority can potentially influence students' judgment and understanding. Besides, reading is more or less defined as meaning constructed by a reader, who is able to integrate the textual information and background knowledge by applying critical-thinking skills such as predicting, inferring, synthesizing, generalizing, and monitoring (e.g. Bean, 2011; Lipman, 1988; Philips, 1988).

However, research shows that lack in basic critical-thinking skills is attributed to deficient educational experiences (Lai, 2011, Nickerson, 1988) for which teachers and their actions are in large part responsible (Tsui, 2001). Research reveals that teachers seem to worry much more whether they will manage to cover the 'imposed' curriculum (Chatzigeorgiou, 2001; Fisher, 2001; Koutselini, 1997, 2006, 2008a, 2008b, 2013; Papastephanou & Koutselini, 2006; Onosko, 1991; Paul, 1992, 2005; Tsui, 2002). Those teachers, who understand teaching as simply following guidelines in curriculum documents, do not seem to teach thinking well (Pithers & Soden, 2000). In this framework, typical school instruction is designed as though recall, mastering and memorizing content were equivalent to knowledge (Beyer, 1988; Fisher, 2001; Koutselini, 2008a; Lai, 2011; Paul, 1992, 2005). For example, teachers may keep lecturing over the assigned texts frustrated by their students' poor reading comprehension abilities (Bean, 2011), asking them to mechanically complete exercises instead of letting them 'do the thinking' or asking them to think more about an answer while they ask another student to give the answer (Chatzigeorgiou, 2001). Paul (1995, 2005) asserts that the root of the problem is teachers' confidence in didactic teaching, for which there are many uncritically held assumptions, namely that i) students learn how to think when they know what to think, ii) knowledge can be transmitted to students without having to think it through for themselves, or iii) the process of education is the process of storing content/factual knowledge in the head. As a result, 'much classroom activity fails to challenge students to use their minds in any valuable ways' (Newmann, 1991, p. 330) since knowledge acquisition remains a major aim (Barnes, 2005) while there is profound absence of thoughtfulness in classrooms (Newmann, 1991).

Furthermore, teachers at all levels of education may not be well-informed, educated or equipped for the kind of teaching that promotes critical thinking (e.g. Astleitner, 2002; Barak et al., 2007; Paul, 2005; Paul et al., 1997; Ruggiero, 2003; Savage, 1998; Stapleton, 2011). What the research reveals is that the majority of teachers does not understand the concept of critical thinking or may not even realize that they lack a substantive concept of critical thinking (Paul, 2005; Paul et al., 1997). In fact, critical thinking may mean different things to different teachers (Stapleton, 2011). As Stapleton (2011) recently concluded, precise understanding of critical thinking by teachers, as well as the instructional steps required to achieve the aim of critical thinking, remain unclear. Lack of knowledge on how to teach for critical thinking may not be the only reason for that (Ruggiero, 2003); teachers' insufficiency to be critical thinkers themselves so as to teach their students to become critical thinkers may be the case (Paul et al., 1997). Therefore, when teachers have a vague notion of critical thinking, they cannot easily design effective teaching lessons for enhancing students' critical thinking (Paul, 2005).

The significance of enhancing students' critical thinking, since they are not learning the critical-thinking skills they need, as well as the fact that teachers are not well-informed and/or resistant to teaching for critical thinking and/or focused on teaching the prescribed curriculum, emphasizes the need for research efforts focusing on examining ways to empower teachers towards teaching for critical thinking. Besides, if we want to transform the way students learn and enhance their critical thinking abilities, we must also help teachers expand their own knowledge, skills and outlook. What the research reveals is that teachers need to receive training, support and empowerment to substantially understand what critical thinking is all about (Paul, 2005), how teaching is related to the development of critical thinking, and how to design learning environments appropriate for teaching and promoting critical thinking (Dewey & Bento, 2009; Ennis, 1987; Flores et al., 2012; Paul et al., 1997; Shim & Walczak, 2012; Stapleton; 2011). Some researchers even reckon that teachers need a detailed analysis of the required skills and desired learning activities for designing effective learning environments to promote critical thinking (Frijhters, ten Dam & Rijlaarsdam, 2008). What is important is that training efforts become more successful when teachers are given ongoing developmental opportunities to (re)act and (re)think in how to teach for critical thinking in actual classrooms (Abrami et al., 2008; Ennis, 1987; Flores et al., 2012; McGuinness, 1999; Paul, 2005; Paul et al., 1997; Stapleton; 2011). As Eisner (2000) would have said, improving teaching performance and enabling the teacher to get better at what he or she does "requires the kind of fine-grained attention and continuity of support that is provided to, for example, athletes, singers and actors" (p. 347).

Very few critical-thinking efforts, which are recorded in different levels of education, namely college, university, high-school or elementary level, aimed at implementing professional development involving teachers' training and empowerment (e.g. Barnes, 2005; Dewey & Bento, 2009; Zohar et al., 1994). Even though these critical-thinking efforts were differently designed and enacted, they indicate a beneficial effect on teachers' conceptual knowledge of critical thinking and ability to integrate critical-thinking skills in class. Despite such positive findings, though, most of these studies involved self-selected samples and self-reported data with no objective measures (i.e. classroom observations) of change in teaching practice. In that sense, the very few instructional interventions in which teacher training was documented did not investigate the extent to which the teacher professional development was effective and/or impacted on teaching quality and student learning. In addition, those studies were not clearly oriented in an integrated approach to professional development (Creemers, Kyriakides, & Antoniou, 2013) based on which teachers receive ongoing training and support on teaching for critical thinking through meaningful learning experiences. Provided that *"the likelihood of learning and the quality of the learning outcome is determined by teachers' activation"* (Munro, 1999, p. 152), it appears that there is a considerable gap in our knowledge about the conditions under which elementary teachers could be activated on, and supported to teaching for critical thinking. And further, it is still unclear how teachers' activation and empowerment towards that kind of teaching could result in better student critical-thinking outcomes, since few researchers evaluate the impact of teacher professional development on student learning (Creemers et al., 2013), especially in elementary education where research is lacking. In fact, critical-thinking research efforts are mostly recorded in college, university or high-school level while very few are recorded in primary education. Given the lack of empirical support for success in fostering students' critical thinking at the elementary level, the value of further (intervention) critical-thinking efforts must be questioned.

In this line of reasoning, the present study aimed to develop a teacher professional development programme in teaching for critical thinking and to empirically examine and evaluate its effects on elementary students' critical-thinking, exploring at the same time the presuppositions, conditions, processes and difficulties in teaching for critical thinking. The study is considered important since such kind of studies aiming at directly strengthening elementary teachers' knowledge of, and commitment to, teaching for critical thinking through interventional participatory professional development processes so as to consequently manage an effect on student critical-thinking outcomes are not frequent in the field of educational research in general (Creemers et al., 2013).

To masterfully reach its aims, the study adopted, among others, the argument of McGuinness (1999), who clarified the presuppositions of successful intervention approaches incorporating teacher professional development, which mainly concern the assurance of: a) a strong theoretical underpinning, b) well-designed and contextualized materials and explicit pedagogy and, c) good teacher support. To further inform the inquiry, the study also drew on the characteristics of an effective professional development programme as pointed out by Creemers et al. (2013): a) a valid theoretical framework linked to daily teaching and positively related to student progress, b) needs' assessment of participants, c) opportunities for teachers' active engagement and feedback on their performance, d) opportunities for collaboration and networking among the teachers of the same school or class, e) sufficient duration of the programme combined with sustained follow-up support, and f) evaluation of the programme's impact on both the teaching quality and students' achievement.

Under this framework, the study lasted for an entire school year. Firstly, the 23 teacher participants from 14 elementary schools, who volunteered to participate in the study, were randomly assigned into two groups, the control and experimental groups, since the 14 schools were randomly allocated evenly to these two groups. Secondly, the critical-thinking performance of their students aged 10-11 was assessed before the intervention (pre-test) using a Student Critical-Thinking Instrument developed within the study. On a third level, the intervention, that is, the teacher professional development programme on teaching for critical thinking, took place. The programme was explicitly based on a substantive concept of critical thinking and focused on progressive improvement of instruction through developing teachers' critical thought (Paul, 2005). Teachers in the experimental group were engaged in a 6-month professional development where situated learning and reflection aimed to support and empower them towards teaching for critical thinking. In particular, teachers participated in 24 80-minute training sessions of initial, interim and ongoing training during which they got continuous support on how to enhance their students' critical thinking in the elementary subject area of Language Arts on a school basis. Neither support on how to teach for critical thinking was imposed nor were teachers given a prescribed set of lessons; they were rather left free to filter and reflect upon the critical-thinking knowledge-base and guidelines presented (Creemers et al., 2013) so as to instructionally refine them and accordingly design their teaching for promoting critical thinking. Besides, in-service teachers are central stakeholders to the improvement of schooling (Eisner, 2000), and professionals whose practice should be informed by theory and critical reflection (e.g. Creemers et al., 2013; Koutselini, 2006, 2015; McNamara, 1990). Meanwhile, the teachers of the control group did not receive any kind of training in teaching for critical thinking. On a fourth level, three classroom observations were carried out for each teacher participant and thus a total of 69 observations (23 teachers x 3 times each) took place using a Critical-Thinking Observation Tool that was developed and pilot-tested within the study. The observations were spread out over the period that the professional development programme in teaching for critical thinking took place (November 2016, February 2016 and April/May 2016). Meanwhile, students' critical-thinking performance was again assessed by using a Reasoning Essay developed and pilot-tested within the study as an interim test. After the participatory intervention study was completed, all student participants (control and experimental) were again administered the Student Critical-Thinking Instrument (post-test). And further, teachers in the experimental group were asked to reflect upon their perceived ability to teach for critical thinking through a Teacher Reflections' Questionnaire after the completion of the programme. During the lifespan of the professional development programme, the principal researcher was taking notes in a reflective journal so that she could address the teacher participants' needs, namely, their misconceptions, deficiencies and difficulties in teaching for critical thinking, as well as to explore the presuppositions under which teaching for critical thinking in elementary classes is facilitated.

Under this framework, the study aimed to examine whether, and to what extent, teachers' empowerment on teaching for critical thinking could expand their scientific knowledge base, encourage their critical reflection upon that knowledge (Creemers et al., 2013; McLaughlin & Talbert, 2006), improve and orient their teaching towards the critical-thinking objective and, consequently, have an effect on student critical-thinking outcomes.

Purpose of the Study

The purpose of the study was to develop a well-planned teacher professional development programme in teaching for critical thinking and to empirically examine its effects on elementary students' critical-thinking, as well as to explore the presuppositions, conditions, processes and difficulties in teaching for critical thinking in the subject area of Language Arts. The findings of the study particularly refer to the impact of the intervention, that is, teachers' engagement in professional development in teaching for critical thinking, upon three dependent variables: (a) student critical-thinking outcomes, (b) the quality of teaching for critical thinking, as well as (c) teachers' reflections upon their perceived ability to teach for critical thinking. In particular, the purpose of the present study was achieved by:

a) Designing and implementing the teacher professional development programme in teaching for critical thinking. The programme was explicitly based on a substantive concept of critical thinking (Facione, 1990a), and focused on progressive improvement of instruction through developing teachers' critical thought (Paul, 2005);

b) Examining and comparing the student critical-thinking outcomes within and between the groups (control and experimental) before and after the completion of the intervention – teachers' engagement in professional development;

c) Analyzing the magnitude of the instructional effects on student critical-thinking performance in relation to other teacher background characteristics (e.g. teaching experience) and student background characteristics (e.g. sex, academic achievement);

d) Investigating the contribution of the ongoing teacher professional development in teaching for critical thinking on the quality of teaching and teachers' perceived ability to enhance their students' critical thinking.

Research Questions

1. Whether, and to what extent, did the teacher professional development programme in teaching for critical thinking contribute to student critical-thinking outcomes?

2. What was the contribution of the teacher professional development programme in teaching for critical thinking to student critical-thinking outcomes?

3. Whether, and to what extent, did the teacher professional development programme in teaching for critical thinking improve teachers' quality of teaching with regard to the promotion of critical thinking?

4. What proportion of variance in student critical-thinking outcomes was attributable to the student's background characteristics, the teacher's characteristics, and the professional development programme effects?

5. Did the teacher professional development programme in teaching for critical thinking empower teachers and enhance their perceived ability to promote critical thinking, as well as their meaning-making towards teaching for critical thinking?

Importance of the Study

Critical thinking as an operative example of higher-order thinking (e.g. Astleitner, 2002; Barak et al., 2007; Frijters, ten Dam, & Rijlaarsdam, 2008; Marin & Halpern, 2011; Newmann, 1991; Niu, Behar-Horenstein & Garvan,, 2013; Tsui, 2002) that concerns, among others, the core critical-thinking skills of interpretation, analysis, evaluation, inference, explanation and self-regulation (Facione, 1990a) has always been a major educational ideal (Abrami et al., 2008; Bailin & Siegel, 2003; Ku, 2009; Marin & Halpern, 2011; Swartz, 2003; Willingham, 2007). Critical thinking does not facilitate and enhance higher-order learning for school success only (Bryan, 2000; Ennis, 2011; Facione & Facione, 1994; Paul, 1992; Zohar et al., 1994; Zohar & Nemet, 2002), but also for lifelong learning and the ability to deal effectively with a world of accelerating change and complexity (Abrami et al., 2008; Angeli & Valanides, 2009; Beyer, 1988; Brookfield, 2003; Butler, 2012; Halpern, 1989, 2001; Paul et al., 1997; Tsui, 2002).

Nevertheless, educational reality is different in three levels. Firstly, although critical thinking has been defined as a key competence and an essential goal of many recent reform efforts (e.g. National Curricula in Cyprus and Greece), there is no clear elaboration as to what it means and/or how it can be taught. For, these issues are frequently neglected or ill-defined in curriculum discussions since they are rather controversial when made explicit (Beyer, 1988; Ennis, 1997; Newmann, 1991). Secondly, students' critical thinking, at all levels of education, is inadequate (Flores et al., 2012; Paul, 1992, 2005; Pithers & Soden, 2000; Tsui, 2002; van Gelder, 2005). Students find themselves memorizing, recalling, and mastering content (Fisher, 2001; Koutselini, 2008a; Lai, 2011; Paul, 1992, 2005; Tsui, 2002), performing poor reasoning skills (Nickerson, 1988; Philips, 1988), being 'surface readers' focusing on facts and information instead of being 'deep readers' focusing on meaning (Bean, 2011), and not effectively managing with reading and writing learning situations for which critical thinking skills are required (Bean, 2011; Paul, 2005). In addition, students do not recognize that their assertions, beliefs and statements have implications and that evidence is needed to support them (Lai, 2011; Paul, 1992). National results obtained from recent secondary school leaving examinations (e.g. Pancyprian Examinations 2015) have revealed that the situation is not different in the context of Cyprus, as students have not been doing well on thinking and reasoning in major subjects such as Language Arts (e.g. essay writing).

Student poor critical-thinking outcomes are mostly related to deficient instructional environments (e.g. Lai, 2011; Nickerson, 1988) often comprising inefficient instructional variables (Tiruneh et al., 2014). Therefore, the third level concerns teachers, who are in large part responsible for student inefficiency, since they may not be well-informed or educated on how to foster critical thinking in their students (e.g. Astleitner, 2002; Paul, 2005; Paul et al., 1997; Stapleton, 2011) and/or resistant to teaching for critical thinking (e.g. Ruggiero, 2003; Savage, 1998). And further, teachers seem to place emphasis on teaching the content (Dewey, 1933; Fisher, 2001; Koutselini, 1997; Tsui, 2002), delivering the prescribed curriculum (e.g. Chatzigeorgiou, 2001; Koutselini, 2006, 2008a, 2008b, 2013; Papastephanou & Koutselini, 2006; Paul, 1992), and distantly performing predefined routine activities from which students and teachers are alienated (Koutselini, 1997), aims that do not portray higher-order thinking and learning.

Under this framework, intervention is needed. Meta-analytic studies actually confirm that critical-thinking teaching interventions can gradually improve students' critical-thinking skills although they present a small average effect size (e.g. Abrami et al., 2008; Bangert-Drowns & Bankert, 1990; Niu et al., 2013). And even if strong effect sizes prove unattainable, instructional interventions focusing on teaching for critical thinking ensure that something worthwhile will have been taught. Nevertheless, discussion still continues about how this kind of intervention can be realized more effectively and how teaching can be improved so as to obtain more satisfying results (Niu et al., 2013; Wolcott et al., 2002). Research shows that intervention efforts become more successful when teachers receive training and support in preparation for teaching for critical thinking (e.g. Abrami et al., 2008; Ennis, 1987; Flores et al., 2012; McGuinness, 1999; Paul, 2005; Paul et al., 1997; Shim & Walczak, 2012; Stapleton; 2011), especially if they are expected to enhance their students' critical thinking (e.g. Ennis, 1987; Flores et al., 2012; Paul et al., 1997; Shim & Walczak, 2012; Stapleton; 2011). Although several studies have revealed 'what teachers (could) do', through exploring various instructional effects on the critical-thinking outcomes of students mostly through intervention designs (e.g. Angeli & Valanides, 2009; Daniel et al., 2005; Frijters et al., 2008; Lee et al., 2014; Malamitsa et al., 2009; Marin & Halpern, 2011; Luckey, 2003; Yang, 2008), in the majority of them teachers were not given ongoing training, feedback and support on teaching for critical thinking. Instead, the instructional interventions were mostly carried out by the researchers. However, enhancing students' critical thinking does not depend only on carefully designed intervention studies providing systematic opportunities to students to think but also on teachers, who should be given ongoing developmental opportunities to (re)act and (re)think how to teach for critical thinking (Barnes, 2005; Flores et al., 2012; McGuinness, 1999; Paul 2005).

In fact, research has proven that teacher professional development programmes with an emphasis on teachers' training and empowerment have a positive impact on strengthening teachers' knowledge of the concept under study, be it thinking skills, critical thinking or learning in general, and the application of this knowledge to practice (e.g. Barnes, 2005; Dewey & Bento, 2009; Kyriakides et al., 2017a; Munro, 1999; Supovitz & Turner, 2000; Zohar et al., 1994). In proof of that, there are teacher professional development programmes aiming at developing teachers' skills in order to enhance the quality of teaching (e.g. Antoniou & Kyriakides, 2011; Creemers et al., 2013; Kyriakides et al., 2017a; Munro, 1999) as well as several others aiming particularly at implementing critical-thinking efforts (e.g. Dewey & Bento, 2009; Zohar et al., 1994, Barnes, 2005), that are recorded. Some of them, even though differently designed and enacted, concern 'the Integrated Thinking Skills Project' in the early 1990s at the Community College of Aurora, Colorado (Barnes, 2005), the 'Biology Critical Thinking Project' at Israel (Zohar et al., 1994) or the ACTS infusion intervention that dealt with activating children's thinking skills (Dewey & Bento, 2009). However, these are mostly recorded in college, university or high-school level since most of the research on critical thinking has been confined to secondary and post-secondary education, while some of them, even if recorded in primary education, do not avoid falling into limitations (e.g. non including a control group by which to compare findings) or being inadequately documented (e.g. Malamitsa, Kasoutas, & Kokkotas, 2009). Under this framework, teaching critical thinking to kindergarten through age-12 students is ripe for investigation (e.g. Flores et al., 2012), an argument that partly proves the necessity of the present study, which addresses elementary students' and teachers' needs with regard to the critical-thinking objective.

Another argument adopted in the present study that reveals its importance is that *"educational change depends on what teachers do and think"* (Koutselini, 2008b, p. 31). Although in the field of critical thinking there are studies dealing with 'what teachers think', namely, dealing with teachers' conceptions of critical thinking (e.g. Barak et al., 2007, Paul et al., 1997; Stapleton, 2011), direct observation of actual teaching practices or classroom observations during teachers' empowerment and training on teaching for critical thinking were not included in those studies, issues that the present study aims to address. In addition, a lot of studies that examine classroom practice (e.g. Dewey & Bento, 2009; Shim & Walczak, 2012; Zohar et al., 1994) tend to rely on self-reported data (either by teachers or students) rather than observational data, as Tsui (2002) reckons. A relevant study was that of Shim and Walczak (2012) that used college students' self-reported gains in critical thinking so as to examine the impact of certain instructional practices to the development of students' critical-thinking skills without any class observations. Even if their results from multinomial logistic regression analyses showed that certain instructional practices (e.g. asking challenging questions) increased students' self-reported critical thinking abilities, the concern of whether self-report measures are valid or not remains (Halpern, 2001). And that is because, as Shim and Walczak (2012) admit, students' self-reports may reflect students' satisfaction with teaching experiences or their own perception of their developmental levels and not an accurate standardized measurement of their actual critical-thinking ability level. For minimizing the risk, Shim and Walczak (2012) used direct measures of critical thinking (i.e. the Collegiate Assessment of Academic Proficiency) as well, but again actual teaching was not recorded, nor was empowerment of faculty's instructional practices attempted. In a similar vein, while Zohar et al. (1994) found that students who participated in the Biology Critical Thinking Project improved their critical-thinking skills compared to their initial level and compared to their counterparts in the control group, classroom observations were not reported. Instead, Zohar et al. (1994) asked teachers of the experimental and control group to report one lesson per week so as to examine whether the teaching strategies used in the Biology Critical Thinking Project influence the learning environment. But again, only self-reported data are recorded, which could have been more valid if classroom observations had taken place.

Taking into account all the argumentative discourse put forth, the present study is considered important since it aimed to empirically examine whether (and to what extent) the teacher professional development programme in teaching for critical thinking developed within the study could contribute to the student critical-thinking outcomes on the one hand, and teacher effectiveness in teaching for critical thinking, on the other. In this respect, the major premise that the present study adopts is that any teacher professional development programme aiming at supporting teachers to address the issue of enhancing students' critical thinking should be able to empirically examine whether the effort is achieving the desired effects (Barnes, 2005). Moreover, in the field of educational research in general, very few researchers evaluate the impact of teacher professional development on student learning (Creemers et al., 2013). The present study aims to evaluate the impact of the teacher professional development programme mainly through: i) pre- and post-assessment of student critical thinking performance, ii) classroom observations, and iii) teachers' reflections upon their perceived ability to promote critical thinking.

Furthermore, the present study is considered important in that it aimed to explore the presuppositions, conditions, processes and difficulties in teaching for critical thinking in the elementary subject area of Language Arts that was purposefully chosen. Besides, little is known about whether the elementary Language Arts course, that might be expected to promote student critical-thinking, actually improves critical thinking. In this line of reasoning, the present study extends previous work, which has mainly focused on solely identifying instructional factors that have an impact on students' critical thinking, and/or fragmented training programmes focusing on mastery of knowledge and certain teaching skills identified as effective for "delivery" in order to promote critical thinking (e.g. Dewey & Bento, 2009; Zohar et al., 1994). Conversely, it placed emphasis on providing elementary teachers with ongoing developmental opportunities to (re)act and (re)think in actual classroom environments where they could refine the critical-thinking principles of the programme into practice. The ultimate goal was to evaluate the effects of that kind of professional development on the quality of teaching and consequently on the student critical-thinking outcomes. Besides, research shows that when teachers are given ongoing developmental opportunities to (re)act and (re)think in actual classrooms, instructional effects become even stronger (Barnes, 2005; Flores et al., 2012; McGuinness, 1999; Paul 2005).

From another perspective the present study is considered important since it took into account that both teachers' willingness to incorporate critical-thinking based instruction as well as explicit strategies to do it effectively, are needed to maximize the instructional effects (Abrami et al., 2008). With regard to the latter, "it appears that critical thinking skills do not develop unless explicit and deliberate efforts are invested in developing them" (Zohar et al., 1994, p. 184), something the present study takes into account. And more importantly, something that the study also considers is that, if critical thinking is to be taught, you need to find available (given the political, economical, educational conditions), and ones who are sympathetic to teaching for critical thinking and willing teachers to (learn how to) do so (Barnes, 2005; Ennis, 1997). Despite the fact that engaging teacher participants, who are actually interested in the concept under study, might be considered as a research limitation, since research results cannot be generalized, the study is enacted in this way for two reasons. Firstly, teacher participants' positive disposition towards self-direction of change in practice provides an impetus for their involvement in the programme (Barnes, 2005; Munro, 1999). In accordance to that, the study of Karagiorgi and Symeou (2007), which examined, among others, the motives of teachers in Cyprus for participating in in-service training, revealed that teachers' personal need for development and the need to become better qualified influence their decision to get involved in professional development programmes the most. Besides, "to learn from others implies that one expresses a willingness to listen to what others have to say and, in turn, that others would listen to what one has to say – that is learning in itself is an intersubjective activity" (Waghid & Davids, 2013, p. 9). Secondly, the study pursued teachers' empowerment on teaching for critical thinking so that insights for new action and reflection can be provided, while both the teacher participants and the principal researcher were encouraged to actively build up new knowledge (Koutselini, 2008b) with regard to teaching for critical thinking. In that vein, in an effort to fill the void in the literature, the present research study is important since it seeks to develop an awareness of how to prepare teachers towards teaching for critical thinking in elementary classroom environments. From another point of view, the study seeks to understand how teacher participants engaged in professional development explore their conceptions about critical thinking and teaching for critical thinking and refine the critical-thinking principles into practice.

Significance of the Study

Considering that critical thinking is a major purpose of education (e.g. Abrami et al., 2008; Bailin & Siegel, 2003; Ku, 2009; Marin & Halpern, 2011; Swartz, 2003; Willingham, 2007), which is thought to be the result of teaching and training (e.g. Halpern, 1989; Swartz, 2003; van Gelder, 2005), the quality of teaching should be assessed based on the extent to which students' critical thinking is enhanced. Besides, teaching is effective (or not) for helping students achieve particular kinds of learning objectives that should be described and measured as precisely as possible (Hiebert & Grouws, 2007). To this end, if instruction and teachers' teaching skills on teaching for critical thinking are progressively improved, then student critical-thinking outcomes will be progressively improved as well. Thus, the main aim of the study focused on i) developing a teacher professional development programme in teaching for critical thinking, ii) empirically examining its effects on student critical-thinking outcomes, and iii) exploring the presuppositions, conditions, processes and difficulties in teaching for critical thinking in the subject area of Language Arts. In that vein, the significance of the study rests on three levels.

On a first level, there is a ***theoretical contribution*** since the study reinforces our knowledge with regard to the concept of critical thinking and student critical-thinking performance on the one hand, and the principles of a critical-thinking based instruction, on the other. In addition, the study provides support for the conditions under which elementary teachers' knowledge of, and commitment to, teaching for critical thinking can be empowered. With regard to the first point, the present study complies with the need stressed by meta-analytic studies for adopting a clear operational definition for critical thinking in an intervention effort (e.g. Abrami et al., 2008; Bangert-Drowns & Bankert, 1990; Behar-Horenstein & Niu, 2011; McMillan, 1987; Niu et al., 2013). For, critical thinking is ill-defined (Kennedy et al., 1991) in many ways based on different theoretical paradigms (e.g. Ennis, 1987, 1989; Facione, 1990a; Halpern, 1998, 2002; Kurfiss, 1988; Lipman, 1988; Paul, 1981, 1992; Siegel, 1985; Sternberg, 1986). Based on the critical thinking definition adopted, the one derived from a two-year Delphi research project, which took place back in the 90s under the sponsorship of the Committee on Pre-College Philosophy of the American, Philosophical Association (Facione, 1990a), the study sheds light on how that definition of critical thinking was used to define the student critical-thinking performance. In that sense, the student critical-thinking performance is determined by the competence of the student to use the critical-thinking skills of analysis, interpretation, evaluation, inference, explanation and self-regulation (Facione, 1990a) for deriving from what he/she reads and perceives and expressing in what he/she writes and says quantity and quality of meaning (Bean, 2011; Lipman, 1988; Paul, 2005). Furthermore, the study sheds light on the ways the particular definition of critical thinking was filtered to guide the design, the content and the tasks included in the main Student Critical-Thinking Instrument developed within the study for assessing student gains in critical thinking. And further, the present study sheds light on how the particular definition of critical thinking was substantively used to assure the strong theoretical underpinning of the teacher professional development programme. With regard to the latter, the present study also sheds light on effective processes and participative procedures for teacher professional development. Based on the integrated approach incorporating direct instruction on solid scientific knowledge, peer coaching, and reflection (Creemers et al., 2013; Munro, 1999), that was used for its development, the programme aimed to involve procedures that diminish external control and ready-made knowledge and, rather, promote collaborative participation and meaning making (Creemers et al. 2013; Koutselini, 2008b). Besides, good practice has long pointed to the need for changing the in-service teacher education by including networks of teachers, peer coaching and a thorough exploration of evidence in relation to children's learning (McGuinness, 1999). Provided that the study addressed the need for change in the teachers' training culture emphasized during the last few years (e.g. Karagiorgi & Symeou, 2007; Koutselini, 2008b, 2015), the design, content and activities incorporated in the programme provide a scientific theoretical background on effective professional development in teaching for critical thinking that can be used for the development of similar training schemes and/or modules in the future. Lastly, the study sheds light on how a critical-thinking based instruction is defined. In particular, the study reveals the minimum requirements or principles of teaching for critical thinking that were used as content principles in the professional development programme, while filtered as teaching criteria included in the Critical-Thinking Observation Tool (CTOT). The CTOT is thoroughly discussed in Chapter III.

On a second level, there is a ***methodological contribution*** since the study reinforces existing knowledge with regard to the assessment of student critical-thinking performance and the evaluation of a critical-thinking based instruction. The study's contribution to the latter concerns the development of the observation tool (CTOT) designed within the study and used as a measure of teacher effectiveness in teaching for critical-thinking on the one hand, and as a measure of the impact of that teaching practice on students, on the other. The conceptual structure (meaning and validity) of the observation tool (CTOT) was evaluated while it was tested whether it was targeted correctly. Along this line of reasoning, the observation tool can be useful for researchers and practitioners interested in the assessment of the instructional quality determined by certain instructional factors, which are consistent with a critical-thinking based instruction and may predict or have an effect on student critical-thinking outcomes. The second methodological contribution of the study concerns the development of the Student Critical-Thinking Instrument. For the development of the instrument, the study particularly adopted two arguments: McMillan's (1987) argument, that it is necessary the measurement of critical thinking to coincide closely with what the intervention seeks to improve (McMillan, 1987), as well as Ennis' (1993) argument that open-ended assessment is better adapted to do-it-yourself test makers that are usually more comprehensive. The Student Critical-Thinking Instrument (SCTI) asked students to incorporate source material and background knowledge so as to apply core critical-thinking skills. In addition, its conceptual structure (meaning and validity) was evaluated while it was tested whether it was targeted correctly. The SCTI was used along with an additional open-ended argumentative in nature critical-thinking measure, a Reasoning Essay, also developed within the study, which served as an interim testing. In that sense, both critical-thinking instrument(s) developed within the study can be used by teachers, researchers and/or practitioners for diagnosing strengths and weaknesses of students' critical-thinking abilities. Besides, lack of knowledge about the critical-thinking skills elementary students can apply if directed by their teachers could be largely attributed to the absence of suitable assessment tools for these elementary-student populations (Ennis & Weir, 1985). In addition, such kind of tools and instruments, once developed, can also become instructional and be used as teaching materials, such as other widely known instruments (e.g. Ennis-Weir Critical Thinking Essay, Ennis & Weir, 1985). From another point of view, another methodological contribution of the present study concerns the combination of data analysis techniques used. Provided that there was a deliberate data collection from two levels, namely, from the teacher and the student, the study employed both quantitative and qualitative methods to tap multiple sources of data. In particular, Rach Analysis Psychometric Techniques were used to create two scales, namely the student critical-thinking performance (pre-test and post-test scale) and the teaching quality scale. The Rasch model was considered appropriate for determining these two scales since it enables researchers to test the extent to which the data meet the requirement that both the performances on each item of an instrument and the difficulties of the relevant items, form a stable sequence (within probabilistic constraints) along a single continuum (that is, if the students' measures and the item difficulties could be represented on the same scale) (Kyriakides, Crreemers, Papastylianou & Pastou, 2014). Provided that contemporary research in the field of teacher effectiveness encourages multilevel multidimensional statistical analyses (e.g. Creemers & Kyriakides, 2006; Kyriakides et al., 2017a; Kyriakides et al., 2017b), multilevel modeling techniques were also used to disentangle the student, class (teacher), and school variance components, since the study's data were nested; namely, students within classes/teachers. The main aim was to explore the extent to which the differences in student critical-thinking performance between the experimental and control groups were accountable for by factors related either to the school, class/teacher or student characteristics, since multilevel analysis allows the use of covariates measured at any of the levels of a hierarchy (Huang & Moon, 2009; Kyriakides & Charalambous, 2004). In that sense, multilevel analyses leaded the study to rich contextual evidence of the types of instructional factors that were associated with the reported gains in student critical-thinking outcomes.

On a third level, there is a *practical contribution* since the results and findings of the study benefit both the teacher and the student. Eventually, the aim of the professional development programme was to stimulate teachers to teach purposefully for critical thinking (sometimes differently from what they have been used to) so as to achieve gains in students' critical thinking. In this respect, the findings of the study reveal teaching experiences resulting in improved critical thinking and provide empirical background for reflection and reform on the praxis of teaching for critical thinking. In particular, the findings of the study reveal how teaching is related to the development of students' critical thinking, how students come to master certain critical-thinking skills and/or how these can be combined, as well as the roles teachers should take during teaching. In addition, certain instructional factors related to gains in critical thinking, as well as effective teaching methods, strategies, and/or teacher behaviors that positively enhance student critical-thinking outcomes, come to light, which is very important especially in elementary education, where research on critical thinking is lacking. Even more, the new contextualized knowledge about teaching for critical thinking that emerges from the present study is generated through praxis, something that is missing from the non-reflective paradigm of teacher education and teacher professional development (Creemers et al., 2013; Koutselini, 2008b). In that vein, information of this sort would allow teachers and educators to make informed decisions about how to teach for critical thinking in their classrooms in the subject area of Language Arts, in particular, and in a variety of other contexts and subjects in general.

Originality of the Study

No other research, to my knowledge, has set out in Cyprus elementary education to i) develop a teacher professional development programme in teaching for critical thinking based on a substantive concept of critical thinking and focused on progressive improvement of instruction (Paul, 2005), ii) engage teachers in this kind of professional development on a school basis to strengthen their knowledge of, and commitment to, teaching for critical thinking during a school year, iii) empirically examine its effects on student critical-thinking outcomes and teacher effectiveness in teaching for critical thinking, and iv) explore the presuppositions, conditions, processes and difficulties in teaching for critical thinking in the subject area of Language Arts. In that vein, the study produces new knowledge and its originality lies in three levels.

Firstly, the study develops a well-planned teacher professional development programme in teaching for critical thinking by adopting ideas, that is, theoretical and methodological orientations, implications and perspectives from the fields of curriculum studies (e.g. Hargreaves, 1991; Tyler, 1949) and teacher professional development (e.g. Creemers et al., 2013; Day, 1999; Desimone, 2009; Guskey, 2003; Koutselini, 2008b; Kyriakides, Christoforidou, Panayiotou & Creemers, 2017a). In particular, from the field of curriculum studies basic information with regard to the development and the design of the intervention programme in terms of the steps or phases followed, as well as the core elements that need to be taken into account for its development, is drawn. These elements briefly concern the programme's purpose (goals and objectives), content, methods or learning experiences and evaluation (Tyler, 1949), which are put in constant interaction. And further, the study accommodates for the programme's manageability and coherence (Hargreaves, 1991). From the research field of teacher professional development, information with regard to the integrated approach, the main elements of which concern providing teachers with the scientific knowledge base on the one hand, and encouraging their critical reflection upon that knowledge, on the other (Creemers et al., 2013), is drawn and used for the development of the teacher professional development programme. Moreover, the study drew upon ideas from the disciplines of philosophy, psychology and education for determining the content core of the programme. The content of the teacher professional development programme was the outcome of certain processes: i) adopting a clear operational definition of the concept of critical thinking (Facione, 1990a) so as to ensure a strong theoretical underpinning for the programme that would delineate its substance (Creemers et al., 2013; McGuinness, 1999); ii) investigating instructional paradigm(s) and/or teaching skills, methods, strategies, or tactics that if employed, could enhance critical thinking in class, and iii) clarifying the presuppositions and/or principles for a critical-thinking based instruction, recommendations that several meta-analyses in the field of critical thinking have made (e.g. Abrami et al., 2008; Bangert-Drowns & Bankert, 1990; Behar-Horenstein & Niu, 2011; Niu et al., 2013).

Secondly, the study aimed to empirically examine and evaluate the effectiveness of the teacher professional development programme. To this end, the study collects empirical data from two levels, namely, from the teacher and the student, something that the research in the field of teacher effectiveness in general, encourages (e.g. Creemers & Kyriakides, 2006; Creemers et al., 2013). On the one hand, teachers were empowered to teach for critical thinking with a view to substantially understand what critical thinking is all about and how teaching can be oriented towards the promotion of critical thinking. On the other, students were given opportunities to improve their critical-thinking skills through instruction that was gradually improving (Creemers et al., 2013; Paul, 2005). Therefore, the distinctive feature of the study is that the impact of the intervention - teacher professional development programme upon the dependent variables of student critical-thinking outcomes and teacher effectiveness in teaching for critical thinking is evaluated. In accordance to that, the study uses a combination of factors (e.g. teachers' engagement in professional development) and effects (e.g. student critical-thinking outcomes) in the research design, something that makes the discussion of the results more interesting. Even more, identifying relationships between processes (i.e. teaching practice) and products (i.e. what students learn) has always been important in spite of the difficulties and challenges that researchers engaged in that kind of work face (Hiebert & Grouws, 2007).

Thirdly, the study takes into account the argument that teaching is best seen as a system of interacting features rather than a collection of independent features that may alone have an impact on student learning (Creemers et al., 2013; Hiebert & Grouws, 2007). To this end, the study is innovative in that it considers important to examine whether (and to what extent) certain contextual variables, either student- (e.g. academic achievement) or teacher-related (e.g. teaching experience), in relation to teachers' engagement in professional development, account for the improvement of student critical-thinking outcomes as measured in the post-intervention. In that way, the study focuses on other contextual variables that could potentially predict the treatment effect size as well.

Main Assumptions

The present study adopts two main assumptions that were granted as presuppositions for the research procedures to take place. Firstly, the study adopts the widely supported belief that critical thinking can be taught, learned and developed with practice (e.g. Barnes, 2005; Halpern, 1989; Swartz, 2003; van Gelder, 2005). Secondly, the study accepts that teachers can address student poor critical-thinking outcomes and achieve gains given that they are purposefully empowered on how to teach for, and promote, critical thinking in class (Abrami et al., 2008; Ennis, 1987; Flores et al., 2012; McGuinness, 1999; Paul, 2005; Paul et al., 1997; Stapleton; 2011).

With regard to the first assumption of the study, researchers stress that students will not eventually and spontaneously become good critical thinkers unless there is a deliberate critical-thinking based instruction (Angeli & Valanides, 2009; Astleitner, 2002; Garside, 1996; Halpern, 1998; Kennedy et al., 1991; Prawat, 1991; Swartz, 2003). In addition, research has proven that learners, who persistently and purposefully receive critical-thinking based instruction, that is cautiously planned and effectively implemented and with strong commitment from teachers, generally do have better critical-thinking outcomes than others, who do not undergo such instruction (Barak et al., 2007; Nickerson, 1984; Sternberg & Bhana, 1986). In fact, students of different ability levels can benefit from such an instruction (Kennedy et al., 1991). A deliberate instruction that is based on a substantive concept of critical thinking is more likely to promote the acquisition of substantive knowledge (Paul, 2005) and motivate meaningful, memorable connected learning of relevant thinking skills and content (Ennis et al., 1985, 2004, 2005; Yeh, 2001). Besides, teaching is effective (or not) for helping students achieve particular kinds of learning objectives (Hiebert & Grouws, 2007), in that case, critical thinking. In fact, students are not motivated towards learning when they see no value in it (Elder, 1997). Conversely, they respond to instruction that invites them to use that kind of knowledge so as to make sense of important human issues and questions (Kurfiss, 1988) since teaching should be seen as ‘a caring, flexible representation of the different aspects of reality, in which students experience the whole and reflect on self and others’ (Papastephanou & Koutselini, 2006, p. 162), a view that is consistent with the educational discourse on critical thinking. In this respect, success in instruction is deeply connected to the intellectual quality of student learning and student gains in the ability to think critically (Elder & Paul, 2010).

With regard to the second assumption of the study, which is in accordance with the first assumption, research reveals that teachers have the power to enhance students’ critical thinking more than tests, texts, curriculum, or schedule (Savage, 1998). Besides, that was what Bruner (1960) claimed years ago when he was asked to discuss curricula, as curricula should primarily address teachers, since any effect of curricula on students would come through their effect on teachers. In that vein, students’ critical thinking can be enhanced only when teachers have in-depth understanding of what critical thinking entails or is about and, consequently, can effectively integrate critical-thinking principles in their teaching. Besides, *“one cannot effectively teach what one does not understand”* (Flores et al., 2012, p. 221) while as Facione (1990c) puts it, who teaches critical thinking is less important than knowing how to teach it. Nevertheless, if one wants to improve reasoning, it means that he/she needs to be in a position to distinguish good reasoning from bad (Philips, 1988). Therefore, both matter, since the ‘who’ cannot be entirely separated from his/her instructional essence. For example, if teachers do not understand that students must think their way through what they read and what they write (reading closely and writing substantively), they cannot design learning environments for promoting critical thinking (Paul, 2005). For that reason, teachers should and could be engaged in professional development in teaching for critical thinking. As Paul (1992) verifies based on his experience as a trainer, teachers whom he has worked with have been able to successfully remodel standard lessons of kindergarten through high school to infuse critical-thinking objectives when they were engaged in a well-planned and concerted professional development. Besides, research findings reveal that teachers can improve their teaching skills and have a significant impact on student achievement, given that they undergo appropriate treatment and participate in effective professional development programmes (Antoniou, Kyriakides, & Creemers, 2011; Munro, 1999).

Definitions of Terms

The present study has been motivated by certain theoretical underpinnings that refer to the following main key-concepts and terms.

Critical Thinking

According to the Delphi Report on critical thinking, which was the outcome of a two-year Delphi research project involving 46 experts in thinking, critical thinking is a purposeful reflective process during which a person forms a self-regulatory judgment so as to decide what to believe or do in a given context (Ennis, 1987, 1989, 1991; Facione, 1990a). In doing so, that person uses a set of cognitive skills, namely, analysis, interpretation, evaluation, inference, explanation, as well as self-regulation processes and their respective sub skills (Facione, 1990a; Facione & Facione, 1994). In short, critical thinking is essential as a tool of inquiry (Facione, 1990) that can assure competency in the core critical-thinking skills. Those skills are not used in any order. Rather, they exist conjointly and complementarily (e.g. Bernard et al., 2008; Ennis et al., 1985, 2004, 2005; Facione, 1990a, 2000; Zohar et al., 1994), something that manifests the non-linear character of CT (e.g. Ennis et al., 2005, 2004, 1985; Facione, 2000; Facione & Facione, 1996; Prawat, 1991).

Student Critical-Thinking Performance

Student critical-thinking performance is determined by the quantity and quality of meaning that the student derives from what he/she reads and perceives (deep understanding) and that he/she expresses in what he/she writes and says (substantive writing) (Bean, 2011; Lipman, 1988; Paul, 2005) by using a combination of core critical-thinking skills (Facione, 1990a; Paul, 2005). These skills concern interpretation (=decoding significance; clarifying meaning; categorizing), analysis (=identifying and comparing ideas; identifying and analyzing arguments), evaluation (=assessing claims and arguments), inference (=querying evidence; conjecturing alternatives; drawing conclusions), explanation (=stating results; explaining procedures; generating and presenting arguments), and self-regulation processes (=self-examination and self-correction) (Facione, 1990a).

Teaching Approaches

Teaching approaches refer to broad instructional categories and frameworks on how to teach for critical thinking, that is, whether critical thinking should be taught separately from a school subject-matter course (the general approach), be explicitly infused in instruction in school subject-matter areas or courses (the infusion approach), result from a student's deep immersion in the subject-matter area (the immersion approach) or be taught as a combination of the general with either the infusion or immersion approach (the mixed approach) (Ennis, 1989).

The Mixed Teaching Approach

The mixed teaching approach refers to teaching critical-thinking skills directly as a separate goal and/or explicitly in the context of their use or application to specific subject-matter courses and/or other content (e.g. Ennis, 1989, 1997; Plath et al., 1999). Under it, students are involved in subject-specific critical thinking instruction, but there is also a separate thread (within the course) aimed at teaching general principles of critical thinking (Abrami et al., 2008; Ennis, 1989, 1997). In short, the mixed approach refers to a combination of the general approach with either the infusion or the immersion approach (Ennis, 1989). The infusion approach calls for explicitly and directly teaching for critical-thinking skills within a subject aimed at not just encouraging students to think about what they are learning, but also at helping them to become aware of what processes this involves so that they can improve how they think for long-lasting effects (e.g. Brown, 1997; Dewey & Bento; 2009; Ennis, 1989; Swartz, 2003). On the contrary, the immersion approach, although it is a similar thought-provoking kind of subject-matter instruction in which students get deeply immersed in the subject, does not make the general critical-thinking skills and principles explicit (e.g. Angeli & Valanides, 2009; Ennis, 1989; Prawat, 1991).

Critical-Thinking Based Instruction – Teaching for Critical Thinking

The critical-thinking based instruction is oriented towards teaching for critical thinking and is determined by certain instructional factors and principles related to the critical-thinking objective. These briefly concern: a) setting a certain context in the lesson (i.e. material understanding, making an evaluative judgment, solving a problem or making a decision) under which one would engage in critical thinking (Ennis, 1989, 1991; Facione, 2011; Fischer et al., 2009; Shim & Walczak, 2012), b) explicitly teaching for critical thinking (Ennis, 1989; McGuinness, 1999; McTighe, 1985; Swartz, 2003; Zohar et al., 1994) by stressing the language of the thinking process and using explicit prompts and critical-thinking concepts (Bailin et al., 1999a; Swartz, 2003), c) purposefully integrating critical thinking into content instruction (Plath et al., 1999; Swartz, 2003; Zohar et al., 1994), d) providing students with opportunities to practice critical thinking in structured challenging tasks and critical-thinking rich activities (Plath et al., 1999; Swartz, 2003; van Gelder, 2005), e) using teaching strategies and modeling that enable students to use the right type of thinking at the right time for skillful critical-thinking performances (Swartz, 2003; Willingham, 2007), and f) building a learning environment of thoughtfulness and self-reflection (Newmann, 1991; Plath et al., 1999; Swartz, 2003) that also enhances an aporetic side of thought (Papastephanou & Angeli, 2007).

Teacher Professional Development Programme in Teaching for Critical Thinking

The teacher professional development programme in teaching for critical thinking is explicitly based on a substantive concept of critical thinking (Facione, 1990a) and focused on progressive improvement of instruction through developing teachers' critical thought (Paul, 2005). In particular, the programme is developed based on an integrated approach to professional development the major elements of which concern providing teachers with the scientific knowledge base and encouraging their critical reflection upon that knowledge, which is mainly based on their teaching experiences (Creemers et al., 2013). According to the design of the programme, teachers participated in 24 training meetings - sessions of initial, interim and ongoing training during which they were getting continuous support on how to enhance their students' critical thinking in the elementary lesson of Language Arts. The training sessions took place from November 2016 to May 2017 on a school basis and were aligned both horizontally and vertically, outlining a sequence of themes and providing a clear scope upon what areas teacher participants would be empowered. More specifically, teacher participants, either individually or as a group (in case there was more than one teacher participant at a school), participated in a training session once a week, for 80 minutes each time. Every training session was carried out in an interactive way, while there was both a theoretical and practical part, as well as a reflective part where instructional implications of critical thinking were discussed.

Outline of the Study

The study is organized into six chapters. Chapter I briefly explains the research background and provides the rationale for the selection of the research area. Moreover, the first chapter contains the research purpose, objectives and research questions and gives insight into the importance, the significance and the originality of the study.

Chapter II constitutes a literature review, and accordingly, contains the theoretical framework(s) of the research area. In particular, the second chapter contains definitions of critical thinking and sheds light on the development and practice of critical thinking. In addition, viewpoints of theory and research with regard to the teaching for critical thinking, that is, teaching approaches, methods/strategies and teacher behaviors, are presented in a logical manner. Moreover, the second chapter presents theoretical approaches and research findings on teacher professional development while research efforts involving teacher professional development programmes in critical thinking are presented as well. At the end of the chapter the research agenda is set.

Chapter III addresses research methodology. The third chapter explains the method chosen and contains information on the participants, the data collection procedures, the intervention study and the choice and implementation of data collection methods and instruments. The data analysis aspect of the study and discussions of ethical considerations are also included in the third chapter.

Chapter IV contains a presentation of the primary data findings and results, which is facilitated through tables and figures. Brief discussions are included to explain each table. Data findings and results are organized based on the research questions and the type of data, namely, the qualitative and quantitative data obtained.

Chapter V consists of a discussion of the results. In the fifth chapter, findings of the literature review are compared to primary data findings while the chapter summarizes the level of achievement of the research purpose and objectives. In addition, this chapter acknowledges the limitations of the study.

Chapter VI briefly and critically discusses the main conclusions of the study. And further, the chapter highlights the scope for future studies in the same research area.

CHAPTER II

REVIEW OF THE LITERATURE

Chapter II provides a review of the literature organized into three parts. In part one definitions of critical thinking, philosophical, psychological and educational conceptions of critical thinking, explanations on the critical-thinking skills and dispositions, as well as aspects of critical thinking development, are presented. Part two focuses on thoroughly presenting aspects of teaching for critical thinking, that is, teaching approaches, teaching strategies and principles for a critical-thinking based instruction, as well as aspects of critical thinking assessment. In part three theory and research on teacher professional development is presented and teachers' conceptions of critical thinking are mentioned. Chapter II ends by summarizing the main points included in the chapter and setting the research agenda of the study. Figure 2.1 presents the theoretical framework of the study.

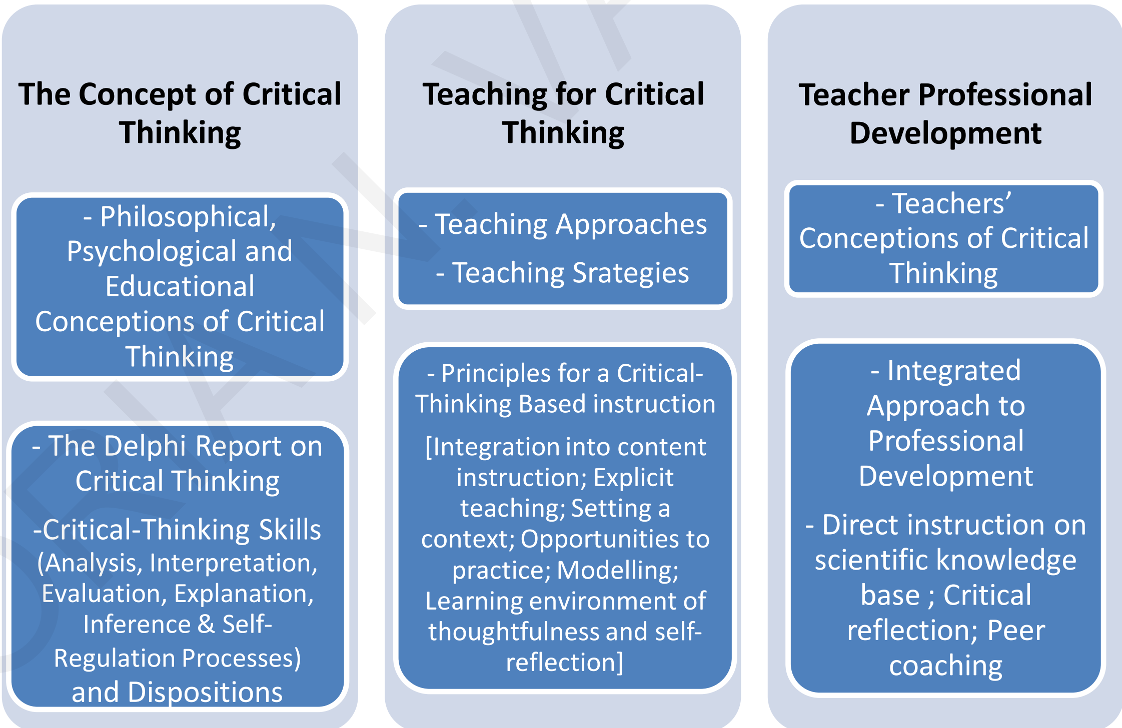

Figure 2.1. The theoretical framework of the study

The Concept of Critical Thinking: Definitions and Explanations

Despite its fame as a major educational objective, critical thinking has always been a complex and contested construct for cognitive scientists, philosophers and psychologists

(Abrami et al., 2008; Brookfield, 2003; Daniel et al., 2005; Fasko, 2003; Nickerson, 1988; Pithers & Soden, 2000; ten Dam & Volman, 2004) as well as for educators. Critical thinking is ill-defined (Kennedy et al., 1991) since it has been developed in many ways and directions based on different theoretical paradigms (e.g. Ennis, 1987, 1989; Facione, 1990a; Halpern, 1998, 2002; Kurfiss, 1988; Lipman, 1988; Paul, 1981, 1992; Siegel, 1985; Sternberg, 1986). In fact, the concept of critical thinking has been developing over hundreds of years (Fisher, 2001) and its origins lie in ancient Greece (from the teaching technique of Socrates, Plato, Aristotle, and the Greek skeptics) and can be traced also to Descartes (Costa, 2003; Fasko, 2003; Fisher, 2001; Presseisen, 1986; Staib, 2003) and, more recently to John Dewey (Paul et al., 1997). Dewey defined critical thinking as 'reflective thinking' (Fisher, 2001), that is an instrumental version of critical thinking according to Keeley, Browne, and Kreutzer (1982). John Dewey (1933), the American philosopher, psychologist and educator, who is considered to be the father of the modern critical-thinking tradition, described critical thinking as *"an active, persistent and careful consideration of a belief or supposed form of knowledge in light of the grounds which support it and the further conclusions to which it tends"* (p. 9). His definition and ideas on thinking gave ground to the development of learning goals stressing understanding and critical thinking rather than rote learning and blind acceptance (Garnham & Oakhill, 1994).

Based on Fischer's (2001) unpacking of Dewey's definition, critical thinking is essentially conceptualized as an active process in which you think things through for yourself without receiving them passively by someone else. Indeed, nearly all cited definitions of critical thinking emphasize the active and reflective nature of critical thinking (e.g. Ennis, 1987, 1989; Halpern, 1998; Paul, 1992; Swartz, 2003). For example, Paul, Binker and Weil (1990), defined critical thinking as a disciplined, self-directed thinking coming in two forms: *"If disciplined to serve the interests of a particular individual or group, to the exclusion of other relevant persons and groups, it is sophistic or weak sense critical thinking. If disciplined to take into account the interests of diverse persons or groups, it is fair minded or strong sense critical thinking"* (p. 361). Similarly, Scriven and Paul (1987) assert that critical thinking is an 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. In this context, Fisher and Scriven (1997) contend that *"critical thinking concerns a skillful and active interpretation and evaluation of observations and communications, information and argumentation"* (p. 21). Fisher (2001) even argues that the reflective nature of critical thinking can also be evaluative, involving both criticism and creative thinking since, for example, one often has to be imaginative and creative about alternatives when evaluating arguments. Along the same line of reasoning, Zoller (1999) describes critical thinking as reflective evaluative thinking, in terms of what to accept (or reject) and what to believe in, followed by a decision of what to do (or not to do) and the subsequent act of taking responsibility for both the decisions made and their consequences. As Ruggiero (2003) explains in a more practical way, critical thinking aims at not making just a choice or finding an answer, but the best possible choice or answer. For that reason, critical thinking is a careful and persistent process in which you think about a decision before jumping to a conclusion, considering the reasons you have for believing something, and the implications of your beliefs (Fisher, 2001). Besides, critical thinking concerns skilful reasoning, that is, giving reasons and evaluating reasoning as well as possible (Bailin et al., 1999b; Fisher, 2001; Paul et al., 1997). Therefore, *"one characteristic that uniquely defines critical thinking is that individuals are capable of stepping back and reflecting on the quality of their thinking"* (Niu et al., 2013, p. 115).

For many theorists, the concept of critical thinking is rather multi-dimensional, since it includes too many dimensions: The intellectual (logic, reason), the psychological (self-awareness, empathy), the sociological (the socio-historical context), the ethical (involving moral norms and evaluation), and the philosophical (the meaning of human nature and life) (Paul et al., 1997). Some even focus on the emotional dimensions of critical thinking supporting that people can think critically with sensitive awareness instead of relying only on evidence and related analysis (e.g. Brookfield, 2003; Frijhters et al, 2008). Besides, critical thinking provides that crucial link between intelligence and emotion, which enables individuals to apply sound judgment and reasoning to both thoughts and emotions (Elder, 1997). Similarly, Daniel et al. (2005) reckon that critical thinking is a more complex concept than other kinds of higher-order thinking, such as problem-solving or creative thinking, because it encompasses at least two cognitive modes (logical and creative) if not three (some add meta-cognitive or caring-thinking). In a similar vein, in his article about a streamlined conception of critical thinking Ennis (1991) asserts that, despite the emphasis given to reflection, reasonableness and decision making, creative acts such as formulating hypotheses, considering alternatives and possible solutions are also involved in critical thinking. In that sense, critical thinking encompasses a creative process in which the thinker should take into account all the gathered data so as to formulate a response, draw a conclusion or make a decision (Hudgins, Riesenmy, Ebel, & Edelman, 1989).

Efforts to define and measure critical thinking became more intense throughout the last quarter of the twentieth century (e.g. Kurfiss, 1988). In the literature, critical thinking is conceptualized by two primary academic disciplines: philosophy and psychology (Bailin & Siegel, 2003; Fasko, 2003; Lewis & Smith, 1993). Philosophical conceptions of critical thinking are essentially normative while psychological conceptions of critical thinking are essentially descriptive (Bailin & Siegel, 2003). For example, from a philosophical point of view, critical thinking has been conceptualized as 'reasonable reflective thinking that is focused on deciding what to believe or do' (Ennis, 1987, 1989, 1991). In that sense, critical thinking is conceptualized as a competence in terms of intellectual resources that include background knowledge, knowledge of critical thinking standards, possession of critical concepts, knowledge of strategies or heuristics useful in thinking critically, and certain habits of mind or attitudes (Bailin et al., 1999a). Psychologists, on the other hand, emphasize skills arguing that critical thinking comprises *"the mental processes, strategies, and representations people use to solve problems, make decisions, and learn new concepts"* (Sternberg, 1986, p.3). However, neither psychology nor philosophy upend one another, since they have both contributed in their own way to an understanding of critical thinking (Daniel et al., 2005). Besides, "*the problem-solving strategies derived from psychology and the disciplined thinking represented by philosophical thought both contribute to achieving the goal of learning to reason"* (Lewis & Smith, 1993, p. 132).

Despite their disagreements or differences, which mainly lie in how broadly or narrowly the construct of critical thinking is conceptualized (Sternberg, 1986), there are agreement areas, such as the distinction between skills (e.g. analyzing) and dispositions (e.g. open-mindedness) (Ennis, 1987, 1989; Facione, 1990a; Facione et al., 1997; McPeck, 1990; Fisher, 2001). Besides, critical thinking encompasses the processes of solving problems, making decisions and taking actions by using certain skills and dispositions (Shim & Walczak, 2012). Skills (or abilities) concern the cognitive aspect of critical thinking while dispositions, conceived as attitudes in social psychology (Facione, 2000), concern the more affective or attitudinal aspect (Bangert-Drowns & Bankert, 1990; Kennedy et al., 1991). The conceptualization of critical thinking as a two-factor model in which critical-thinking skills and dispositions combine to determine the actual critical-thinking performance was confirmed by the study of Taube (1995), who used confirmatory factor analysis to investigate the model empirically. However, as Lipman (1988) asserts, defining critical thinking only in terms of certain outcomes, that is, solutions, decisions and conclusions, and characteristics such as reflective or active, narrows our understanding of the concept; it is more than that. A third critical thinking perspective within the field of education, which is often a mixture of philosophical and psychological theories on critical thinking, is also cited by theorists (Fasko, 2003; Sternberg, 1986).

Given that critical thinking is a complex and contested construct to study (Abrami et al., 2008; Bangert-Drowns & Bankert, 1990; Brookfield, 2003; Daniel et al., 2005; Fasko, 2003; Nickerson, 1988; Nieto & Saiz, 2008; Pithers & Soden, 2000; ten Dam & Volman, 2004), there is obviously a notable lack of consensus concerning its definition, which makes it more difficult to accept any given definition of critical thinking as the only correct one (Bailin et al., 1999a; Paul et al., 1997). Besides, any brief definition of critical thinking is bound to have important limitations (Paul et al., 1997). The fact that there is no commonly accepted definition of critical thinking (Bangert-Drowns & Bankert, 1990; Fasko, 2003; Fischer, Spiker, & Riedel, 2009; Flores et al., 2012; Taube, 1995) may even impede the abilities of researchers and teachers to train, teach and measure critical thinking (Dwyer et al., 2014). However, this variety of definitions is not necessarily problematic but rather advantageous, since it allows insights into alternative perspectives and paradigms (Paul, 1992). For example, Papastephanou and Angeli (2007) suggest such a new paradigm, acknowledging the significance of skills' development but going beyond that to emphasize a critical profundity, or else what they call an 'aporetic' stance toward knowledge, that prompts the individual to reflect upon daily situations, problematic or not. In this respect, the 'safe' choice for researchers and practitioners would be to study all theories and definitions for critical thinking and filter them accordingly so as to adopt a functional and defensible definition, which should be represented in the measured critical-thinking outcomes of any study (Abrami et al., 2008; Halpern, 2001). Besides, definitions of a concept are the ones that are likely more controversial than concepts and thus generally require defense (Ennis, 1991). Nevertheless, it should be taken into account that the agreements on the concept of critical thinking clearly outweigh the disagreements or differences (Halpern, 2001; Lai, 2011; Sternberg, 1986).

Philosophical Conceptions of Critical Thinking

The writings of Socrates, Plato, Aristotle, and more recently, Matthew Lipman, Robert Ennis and Richard Paul, constitute examples of the philosophical approach to critical thinking. As Paul et al. (1997) point out, the word 'critical' derives etymologically from two Greek roots: "kriticos", which means 'discerning judgment' and "kriterion", which means 'standards'. Etymologically, then, the word implies the development of "discerning judgment based on standards". In that sense, philosophical conceptions of critical thinking refer first and foremost to standards, perfections or qualities of thought, such as clarity, relevance, specificity, reasonableness, accuracy, consistency (Paul, 1992; Paul et al., 1997), emphasizing that way its normative character. From a philosophical point of view, thinking is 'critical' when it meets relevant standards or criteria of acceptability and thus it is thought of as 'good thinking' (Bailin, 2002; Bailin & Siegel, 2003; Fisher & Scriven, 1997). Similarly, Lipman (1988) points out that critical thinking is thinking that employs criteria based on which it can be assessed as opposed to uncritical thinking and thoughtless action that is unstructured. Thus, if the thinking is sloppy, superficial, careless, rash or naive, then this is not critical thinking, since the thinking should meet standards of adequacy and accuracy (Bailin et al., 1999a). Critical thinkers can rely upon time-tested criteria such as validity, evidential warrant, and consistency (Lipman, 1988). However, one can learn to think critically without being able to name the standards or criteria of critical thinking (Bailin et al., 1999a). In fact, discourses on critical thinking based solely on application of certain rules and criteria appear weak in that they treat critical thinking as effective performance of a task, based on an unvaried set of criteria, without encouraging a critical stance to either the task or the criteria as such (Papastephanou & Koutselini, 2006).

In addition, critical thinking is directed toward some end or purpose aiming at forming a judgment (Bailin et al., 1999a). In fact, making sound and self-regulatory judgment(s) reflectively and purposefully is the outcome of critical thinking (Abrami et al., 2008; Facione, 1990a; 2000; Lipman, 1988). Thus, critical thinking is a thoughtful, purposeful process of forming judgments using reasons and evidence (Paul, 1992). From this point of view, *"critical thinking is skillful, responsible thinking that facilitates good judgment because it relies upon criteria, is self-correcting, and is sensitive to context"* (Lipman, 1988, p. 39). And further, critical thinking means exercising good judgment that rests upon proficient reasoning skills that can assure competency in inference, inquiry and concept-formation (Lipman, 1988). Similarly, McPeck (1990) emphasizes that critical thinking can be influenced by the subject and (its) context and thus it varies from field to field since, *"it is disciplined, self-directed thinking which exemplifies the perfections of thinking appropriate to a particular mode or domain of thought"* (Paul et al, 1990, p. 361). In that vein, critical thinking is a normative concept in that it requires mastery of context-specific knowledge to evaluate specific beliefs, claims, and actions (Bailin & Siegel, 2003). In fact, what characterizes thinking which is critical is the quality of the reasoning that learners need to understand in order to apply it (Bailin et al., 1999b; Lipman, 1988).

Therefore, from a philosophical point of view, critical thinking is conceptualized as 'logical thinking' or 'logical reasoning' as a moral force to promote good (Daniel et al., 2005). According to Paul (1981), reasoning refers to making use of elements in a logical system to draw conclusions that could be either explicit or implicit in behavior. Siegel

(1985) has similarly contended that critical thinking involves two components related to good reasoning-evaluation, that is, the ability to assess reasons properly and the disposition to seek reasons for grounding judgment. However, within the philosophical tradition, there are theorists who contend that critical thinking involves more components than good reasoning and evaluation, such as appropriate deliberation or reflection to think critically (i.e. considering plausible alternatives) (Bailin et al., 1999a). According to Paul et al. (1997), the core meaning of critical thinking is constituted by four such interrelated components, two of which relate to reasoning: a) the ability to engage in reasoned discourse; and b) reasoning operating in the context of intellectual standards (i.e. clarity, accuracy, precision, relevance, logic). As Paul et al. (1997) further explain, critical thinking also involves: a) analytic inferential skills, that is, the ability to formulate and assess goals and purposes, questions and problems, information and data, concepts and theoretical constructs, assumptions and presuppositions, implications and consequences, point of view and frames of reference; and b) the commitment to a fundamental value orientation that includes certain traits and dispositions, such as intellectual courage, empathy, integrity and perseverance, faith in reason and fair-mindedness.

Ennis (1987, 1989, 1991) has also emphasized the normative dimension of critical thinking, defining it as reasonable reflective thinking that is focused on deciding what to believe or do, resulting from the interaction of attitudes toward critical thinking with a set of critical-thinking skills. Deciding what to believe or do seems to be the end of the critical-thinking process, which, according to the unpacking of Ennis' definition, starts as a problem-solving process in terms of interacting with the world and people, and continues as a reasoning process in terms of examining information and previously acceptable conclusions, and making inferences through inductive and deductive thinking and value judging (Angeli & Valanides, 2009; Angeli et al., 2011). Similarly, Watson and Glaser (1980) described critical thinking as (a) an attitude of enquiry allowing learners to accept the general need for evidence in what is asserted to be true; (b) knowledge of the nature of valid inferences, abstractions and generalizations in which the weight of accuracy of different types of evidence is logically determined; and (c) skills in using and applying those attitudes and knowledge.

In this respect, Ennis (1987; 1989), Siegel (1988), Paul et al. (1997), Watson and Glaser (1980), as well as most philosophical accounts on critical thinking, agree that critical thinking involves two rather related dimensions: a) skills or abilities (e.g. examining reasons) that concern the more cognitive aspect of critical thinking, and b) dispositions (e.g. open-mindedness to alternatives) that concern the more affective aspect (Kennedy et al., 1991). Therefore, critical thinking functions as a complex of skills, practices, dispositions, attitudes and values (Paul et al., 1997).

Psychological Conceptions of Critical Thinking

In contrast to philosophical conceptions of critical thinking, which are essentially normative (Bailin & Siegel, 2003), contemporary psychological accounts on critical thinking agree that the concept is rather a descriptive one, as Bailin and Siegel (2003) comment. Their contradiction lies in two points. Firstly, psychologists tend to focus on how people actually think and not on how they might think under ideal conditions, just like philosophers do by having in mind the rules of logic (Sternberg, 1986). In this respect, psychologists are more concerned with the thinking process and how this process can help people make sense out of their experience (Lewis & Smith, 1993). The basic principles for defining critical thinking are taken from cognitive psychology, the empirical branch of psychology, which addresses how people think, learn, and remember, and in particular, how people acquire, utilize, organize, and retrieve information (Halpern, 1998). Secondly, psychologists characterize critical thinking by the types of actions or behaviors critical thinkers can do, taking into account the personal and environmental/situational limitations or constraints that often affect the full development of the critical-thinking capacity (Sternberg, 1986; Willingham, 2007), rather than indicating criteria or standards of 'good thinking'. Some of these constraints may concern limited time, information or motivation (Sternberg, 1986). Therefore, from a psychological point of view, as Bailin and Siegel (2003) comment, critical thinking is more or less conceptualized in terms of cognitive skills, mental processes and strategies that will most probably lead to desirable outcomes such as making choices (Halpern, 1998), and could be generalized and transferred across a variety of contexts (Halpern, 1998, 2002).

These skills may include concepts such as interpreting, predicting, analyzing, and evaluating (Abrami et al., 2008), while those mental activities that are typically called 'critical thinking' may concern a subset of three types of thinking: reasoning, making judgments and decisions, and problem solving (Willingham, 2007). Similarly, Astleitner (2002) asserts that critical thinking mainly consists of evaluating arguments or propositions while Sternberg (1986) contends that 'critical thinking comprises the mental processes, strategies, and representations people use to solve problems, make decisions, and learn new concepts' (p.3). In fact, the representations, in particular, make explicit and external our reasoning, which is important in being able to be critical about our own and others' thinking (McKendree et al., 2002). According to Fisher (2001), reasoning can display different structures or patterns. For example, one may give a sequence or chain of reasons for a conclusion and another may give various reasons ‘side by side’ for a conclusion. Yet, conclusions are not necessarily at the end of an argument; they may come at the beginning, or anywhere else, or even be unstated and/or implied (Fisher, 2001).

Taken from another perspective, critical thinking should not be conceptualized as a discretely separate phenomenon, but instead a cluster of activities or operations such as assumption analysis and conceptual thinking that are observed, greatly or not, at certain times (Brookfield, 2003). In that vein, critical thinking is *“the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions”* (Halpern, 1989, p. 5), that is purposeful, reasoned and goal-directed (Halpern, 1989, 1998). As Willingham (2007) further asserts, *“critical thinking consists of seeing both sides of an issue, being open to new evidence that disconfirms your ideas, reasoning dispassionately, demanding that claims be backed by evidence, deducing and inferring conclusions from available facts, solving problems, and so forth”* (p. 8). In that sense, psychologists seem to emphasize problem solving rather than reflective thinking.

All the definitions given by psychologists seem to suggest that critical thinking is conceptualized first and foremost as a higher-order thinking skill with a focus on the appropriate learning and instruction processes (e.g. Halpern, 1998). When it comes to higher-order thinking skills, Benjamin Bloom and the cognitive taxonomy of educational objectives, which he developed with his associates, comes to the forefront. In fact, psychologists going back to Bloom’s work come up with their own taxonomy of critical thinking skills, such as Halpern (2002), who suggests the following taxonomy: a) verbal-reasoning skills, b) argument-analysis skills, c) thinking skills as hypothesis testing, d) thinking in terms of likelihood and uncertainty, and e) decision-making and problem-solving skills. According to Halpern (2002), these five categories define an organizational rubric for a skills-approach to critical thinking for college students, if taken together.

The Educational Approach to Critical Thinking

While philosophical approaches to critical thinking seem to specify what learners could ideally do and psychological theories tend to specify what learners can actually do under certain circumstances, the educational approach to critical thinking offers a mixture of the two (Sternberg, 1986). Besides, any distinctions made by these disciplines on the basis of their perspectives, are not clearly specified in a classroom (Cuban, 1984; Sternberg, 1986).

In that sense, the educational approach to critical thinking is based on years of classroom experience and observations of student learning, unlike both the philosophical and the psychological traditions on critical thinking (Sternberg, 1986).

Dewey's (1933) work on thinking seems to have given the concept of critical thinking acclaim in education (Angeli et al., 2011; Simpson & Courtney, 2002). However, with his hierarchical taxonomy for information processing skills Bloom (1956) seems to be a leading figure in the educational tradition of theorizing critical thinking. In fact, when it comes to critical thinking and teaching, teachers and practitioners often cite Bloom and refer, as Willingham (2007) points out, to the higher-order thinking skills of his taxonomy. Even more, the three highest levels of Bloom's taxonomy (analysis, synthesis, and evaluation) are frequently equated with critical thinking (Kennedy et al., 1991; ten Dam & Volman, 2004) in contrast to lower-order thinking skills focusing on knowledge, comprehension and application. In addition, teachers tend to use the concepts of critical thinking and higher-order thinking skills interchangeably with others, such as problem solving, creative thinking or metacognition (Cuban, 1984). This is problematic in many ways. Firstly, representing critical thinking with higher-order thinking means that other kinds of higher-order thinking, such as problem-solving or creative thinking, are not taken into account (ten Dam & Volman, 2004). Secondly, concepts within Bloom's taxonomy lack the clarity necessary to guide instruction and assessment in an effective way (Sternberg, 1986). In fact, Bloom's taxonomy does not offer many useful, practical guidelines for teaching (Ennis, 1981; Paul, 1985), while educators seem to still argue whether Bloom's taxonomy represents a prescriptive or a descriptive model of human thinking (Sternberg, 1986). As Ennis (1993) argues, hierarchy seems also to be a problem in Bloom's taxonomy since the three levels (analysis, synthesis, and evaluation) are not really hierarchical but rather interdependent.

The Delphi Report on Critical Thinking

In 1990, under the sponsorship of the Committee on Pre-College Philosophy of the American Philosophical Association, a cross-disciplinary international panel of 46 expert theorists in thinking convened by Peter Facione, a prominent philosopher and writer in the field of critical thinking, participated in a two-year Delphi research project (Facione, 1990a; 2000) so as to reach a consensus. The key result of that inquiry was the articulation of a conceptualization of critical thinking it terms of two dimensions, namely cognitive skills and affective dispositions. In that sense, in the Delphi Report critical thinking was described as a kind of judgment, in particular a purposeful, self-regulatory judgment (Facione & Facione, 1994), that is, a purposeful thinking process (Facione, 1990a; 2000), which also includes self-evaluation processes: *"We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment was based. Critical thinking is essential as a tool of inquiry. Critical thinking is a pervasive and self-rectifying human phenomenon"* (Facione, 1990a, p. 3). The Delphi report analyses the cognitive dimension of critical thinking in terms of core skills and subskills warning that "good critical thinking is not rote, mechanical, unreflective, disconnected execution of sundry cognitive processes… not to lose sight of the whole while attempting to attend well to its many parts" (p.11).

Apart from the description of critical-thinking skills and related sub skills, the APA Delphi Report's consensus statement provided a portrayal or else a characterological profile of the ideal critical thinker that an instructor should try to nurture: *'The ideal critical thinker is habitually inquisitive, well-informed, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit...'* (Facione, 1990a, p. 3; Facione & Facione 1994). In this respect, the definition also stresses affective dispositions (Facione, 1990a), namely, the inclination of the learner to think critically or the motivation to do so (Facione, 1990a; Facione, Facione & Giancarlo, 1997).

The APA Delphi Report's consensus statement regarding critical thinking was intended as a guide to curriculum development and critical thinking assessment (Facione, 1990a), while it has been widely adopted by research studies (e.g. Angeli & Valanides, 2009) and mentioned in literature reviews (e.g. Simpson & Courtney; Lai, 2011). In this respect, many tests aimed at measuring and assessing the development of critical thinking have been designed based on that definition. Some of these are the California Critical Thinking Skills Test, the California Critical-Thinking Dispositions Inventory or the Test of Everyday Reasoning. Many of these have been widely used in many educational studies (e.g. Angeli & Valanides, 2009; Blattner & Frazier, 2002; Malamitsa et al., 2009; Torff & Warbutron, 2005). Although some of these tests have been designed as general tests of critical thinking rather than tests embedded within the context of a specific domain, Facione (2000) acknowledges the importance of domain-specific knowledge in any use of critical-thinking skills, as these are described in the Delphi report.

As Giancarlo, Blohm and Urdan (2004) comment, before the Delphi Project, there was no clear consensus definition of critical thinking, although the concepts advanced by several theorists in the field such as Ennis, Paul, Lipman, Swartz, and Sternberg were prominent and influential. However, the APA Delphi Report's consensus proves that all definitions, approaches and theories developed for conceptualizing critical thinking seem to share the same direction. This direction concerns the pursuing of the up-grading of the quality of human thinking by the promotion of special skills, abilities, insights and attitudes that empower the thinker to mindfully control his/her thinking (Paul et al., 1997). Besides, taking into account that critical thinking refers to good quality thinking determined by the degree to which the thinking meets the relevant criteria (Bailin & Siegel, 2003), and considering that critical thinking processes (e.g. analyzing, evaluating, explaining) can be inferred by their outcomes (Bailin, 2002), leads to both descriptive and normative conceptions of critical thinking being taken into account so that nothing which is central to critical thinking is left out.

The Cognitive Dimension of Critical Thinking: Critical-Thinking Skills

Critical thinking is thinking that has a purpose. In that vein, one engages in critical thinking and uses critical-thinking skills when he/she is asked to perform certain tasks, such as understanding some material, making an evaluative judgment, solving a problem or making a decision (e.g. Ennis, 1989, 1991; Facione, 2011; Fischer et al., 2009; Shim & Walczak, 2012). Fischer et al. (2009) came to the conclusion of the four tasks based on the critical-thinking model they developed, which they used for making specific testable predictions about the factors that influence critical thinking and its psychological consequences. Most of the times, people engage in such tasks either orally or through the written products they produce (Bean, 2011; Ennis, 1991; Lipman, 1988; Nickerson, 1984; Paul, 1992, 2005) using a combination of critical-thinking skills. Besides, skills are critical because they are considered as tools that permit the application of any kind of knowledge to the solution of (new) problems (Newmann, 1991).

According to Fisher (2001), critical-thinking skills are pretty valuable and, if one gets used to using them, they can expand his/her understanding in many contexts. Learners need to use critical-thinking skills so as to distinguish the most relevant information they receive in relation to the aims they pursue (Lipman, 1988). For example, if one needs to re-evaluate a point of view in light of new information, he/she needs to consider and evaluate the most relevant one, so as to draw a reliable conclusion. However, as Bailin et al. (1999a) point out, the strategies or heuristics, such as asking for examples to clarify meaning or making a list of reasons for and against to make a decision, are the ones that will guide learners in various thinking tasks that involve the application of critical-thinking skills.

Theorists and researchers in the field of critical thinking emphasize different critical-thinking skills according to the theoretical paradigm they defend. For example, for some critical-thinking skills concern judging credibility of sources, analyzing arguments, identifying the focus of the issue, answering and asking clarifications and/or challenging questions (Ennis, 1987, 1993; Kennedy et al., 1991), considering multiple perspectives, examining implications and consequences, resolving disagreements with reason and evidence, and re-evaluating a point of view in light of new information (Paul, 1995). For Swartz (2003), critical-thinking skills concern skills of assessing the reasonableness of ideas. For Ennis (1993), judging the quality of an argument, including the acceptability of its reasons, assumptions or evidence, is also included in the list of critical-thinking skills.

Even though different names may be given, it seems that there is a certain core of critical-thinking skills that critical thinkers should use and that could appear in a reasonably complete list (Sternberg, 1986). Such a short list or taxonomy is proposed by Halpern (1998), who asserts that it can be used as a guide for instruction and includes: (a) verbal reasoning skills that are needed to comprehend and defend against the persuasive techniques that are used in everyday language; (b) argument analysis skills that are needed to identify reasons that run counter to the conclusion, stated and unstated assumptions, irrelevant information, and intermediate steps; (c) skills in thinking as hypothesis testing that are needed to explain, predict, and control events; (d) likelihood and uncertainty that should play a critical role in almost every decision; and (e) decision-making and problem-solving skills that involve generating and selecting alternatives and judging among them, even though all critical-thinking skills may be used to make decisions and solve problems. The Delphi's report consensus statement also offered a rich description of critical-thinking skills and sub skills a critical thinker should exhibit (Facione, 1990a). In particular, those core critical-thinking skills concern interpretation, analysis, evaluation, inference and explanation, as well as deduction (deductive reasoning) and induction (inductive reasoning) (Facione, 1990a). In addition, self-regulation processes, namely, self-examination and self-correction, appear in the list. Table 2.1 presents the Delphi Report's consensus list of critical thinking cognitive skills and subskills (Facione, 1990a).

Table 2.1

The Delphi Report's Consensus List of Critical Thinking Cognitive Skills and Subskills

Consensus List of Critical-Thinking Cognitive Skills and Subskills	
Critical-Thinking Skills	**Critical-Thinking Subskills**
1. Interpretation	▪ Categorize ▪ Decode Significance ▪ Clarify Meaning
2. Analysis	▪ Examine Ideas ▪ Identify Arguments ▪ Analyze Arguments
3. Evaluation	▪ Assess Claims ▪ Assess Arguments
4. Inference	▪ Query Evidence ▪ Conjecture Alternatives ▪ Draw Conclusions
5. Explanation	▪ State Results ▪ Justify Procedures ▪ Present Arguments
6. Self-Regulation	▪ Self-examination ▪ Self-correction

To start with, the skill of interpretation includes the sub skills of categorization, decoding significance and clarifying meaning of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria (Facione, 1990a). Apart from its reference in the Delphi report, Fisher and Scriven (1997) have also placed emphasis on interpretation as an important initial step to drawing conclusions, since it involves constructing and selecting the best of various alternatives. Abrami et al. (2008) described interpretation as a core critical-thinking skill as well.

Another important skill of critical thinking cited by many theorists is analysis (e.g. Ennis, 1987; Halpern, 1998; Paul, 1992). Analysis skill is related to the sub skills of examining ideas, identifying arguments, reasons and claims among statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgment, experience, information or opinion, as well as analyzing arguments (Facione, 1990a). For Swartz (2003), analysis is involved in the skills of clarifying ideas that enhance one's understanding and the ability to use information. Some critical-thinking examples requiring analysis concern identifying conclusions, reasons and assumptions (Ennis, 1993), identifying similarities and differences or analyzing arguments (Ennis, 1991; Halpern, 1989, 1998, 2001), each of which is basically a set of statements with at least one conclusion and one reason that supports the conclusion (Halpern, 1998). In fact, for many experts in the field, argument analysis is the core of critical thinking (e.g. Marin & Halpern, 2011). In addition, identifying hypotheses that should have been taken into account or delineating the relations between sentences and paragraphs in a text also concern the critical-thinking skill of analysis.

Theorists have also placed emphasis on *evaluation* (e.g. Ennis, 1987, 1993; Kennedy et al., 1991; Lipman, 1988; Swartz, 2003), which, according to the Delphi report, concerns the assessment of credibility of statements, sources or other representations, which are accounts or descriptions of a person's perception, experience, belief, or opinion, and the assessment of arguments' quality among statements, descriptions, questions or other forms of representation (Facione, 1990a). Becoming skeptical when one needs to critically evaluate statements he/she daily listens to and for which speakers may have obvious motives to provide misleading information is, for example, an example requiring evaluation skills. In fact, in this case, research shows that even elementary-school-age children between the ages of seven and ten become increasingly skeptical of the statements of individuals, who may have a strong self-presentation concerning evaluative characteristics (e.g. honesty or intelligence), as Heyman (2008) comments. However, children's reasoning about the claims or statements of others can be substantially shaped by social experience (e.g. nationality) (Heyman, 2008), while as Ennis (1993) argues, *'critical thinking must get beyond skepticism'* (p. 180). For Swartz (2003), skills for assessing the reasonableness of ideas lead to good judgment, while Halpern (1998) considers that rating argument quality so as to determine its overall strength has to do with evaluation. Besides, its essence, critical thinking involves evaluating the thinking process, that is, the reasoning that went into the conclusion one arrived at or the kinds of factors considered in making a decision (Halpern, 1998). As Ruggiero (2003) further explains, the essence of critical thinking is, in fact, evaluation and judgment since the assessment of supporting evidence and conflicting interpretations have no purpose other than to produce irrefutable conclusions.

The critical-thinking skill of inference, also included in the Delphi report, concerns the sub skills of identifying elements needed to draw reasonable conclusions, forming conjectures and hypotheses, considering relevant information and drawing conclusions from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation (Facione, 1990a). According to Philips (1988), inferences in reading tend to be good to the extent that readers integrate relevant text information and background knowledge to construct complete interpretations, which should be consistent with both the textual information and background knowledge. According to Ennis (1991), inferences can be of three basic kinds, namely, inductive, deductive and value judging (as process, not product), while the ability to see or formulate alternatives is a key feature in all three types of inference. Making inferences using inductive or deductive reasoning is considered a core critical-thinking skill by many theorists (e.g. Ennis, 1987, 1991, 1993; Facione, 1990a; Paul, 1992; Willingham, 2007; Swartz, 2003). In particular, deductive reasoning may be viewed in relation to formal logic, which, according to Voss, Perkins, and Segal (2009), has as its primary unit of analysis the argument. The formal argument typically consists of two premises and a conclusion and is considered valid only if it follows from the premises in such a way that is consistent with the rules of logic (Voss et al., 2009). Thus, deductive reasoning skills result in drawing conclusions that cannot be false given that those rules, core beliefs, values, policies, principles or procedures examined were true (Facione, 1990a). In this respect, strong deductive reasoning skills affect decision making in precisely defined contexts where those rules, core beliefs, values, policies, principles or procedures completely determine the outcome (Facione, 1990a).

On the contrary, inductive reasoning can be viewed in relation to informal logic, since, according to Voss et al. (2009), in informal logic the arguments are typically inductive, or at least non deductive. Inductive reasoning skills are used when drawing inferences about what one thinks is true based on analogies, case studies, prior experience and behaviors, statistical analyses, and/or simulations (Facione, 1990a). Social scientists seem to prefer this kind of informal reasoning (e.g. Sadler & Zeidler, 2004), which is the type of thinking that occurs when considering open-ended, ill-structured problems, often inductive (rather than deductive), which are contentious without definite and correct answers or clear-cut solutions (e.g. Kuhn, 1991; Means & Voss, 1996; Sadler & Zeidler, 2004; Zohar & Nemet, 2002). These problems seem to be subject to a number of possible responses (Kuhn, 1991), while according to Halpern (1998, 2002), reasoning verbally, especially in relation to such concepts of likelihood and uncertainty, is of great importance. For Zohar and Nemet (2002), informal reasoning involves reasoning about causes and consequences, advantages and disadvantages, or pros and cons, of particular propositions or decision alternatives. Again, of course, the question of whether the conclusion follows the premises is put forward, but in this case the quality of an argument is not determined by a set of logical rules; instead, it is determined by its soundness, that is, whether the reasons are acceptable or true, whether the reasons support the argument and the extent to which counterarguments are taken into account (Voss et al., 2009). According to Sadler and Zeidler (2004), high-quality informal reasoning concerns the ability of the individual to articulate coherent arguments which do not contradict his/her other positions, and analyze those arguments from multiple perspectives. Conversely, deficient informal reasoning concerns unclear or contradictory arguments or the inability of the individual to conceptualize an issue’s complexity because he/she insists on a single perspective (Sadler & Zeidler, 2004).

Another core critical-thinking skill is explanation that concerns stating the results of one's reasoning and justifying that reasoning in terms of the evidential, conceptual, methodological, criteriological, and contextual considerations upon which one's results were based; and presenting one's reasoning in the form of cogent arguments (Facione, 1990a). According to the Delphi report consensus statement on critical thinking, stating results concerns, in particular, the production of accurate statements, descriptions or representations of the results of one's reasoning activities so as to analyze, evaluate, infer from, or monitor those results (Facione, 1990a). Justifying procedures aims at presenting the considerations one used in forming interpretations, analyses, evaluations or inferences so that one might evaluate them or remedy perceived deficiencies (Facione, 1990a). And thirdly, presenting arguments concerns basically generating reasons for accepting some claim (Facione, 1990a).

Taking into account that the outcome of critical thinking should be making sound and self-regulatory judgment(s) in a reflective way (Abrami et al., 2008; Facione, 1990a; 2000; Lipman, 1988), self-regulation could not be left out from the list of core critical-thinking skills. Self-regulation processes, according to the Delphi report on critical thinking, concern self-consciously monitoring one's cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis and evaluation to one's own inferential judgments with a view toward questioning, confirming, validating, or correcting either one's reasoning or one's results (Facione, 1990a, p. 19). In particular, self-regulation processes involve in a hierarchical way self-examination and self-correction since one should firstly reflect and make a metacognitive assessment and then decide how to remedy or correct, if possible, those mistakes and their causes (Facione, 1990a). In that sense, metacognition seems to be at the core of critical thinking (Dewey & Bento, 2009). As Facione and Facione (1996) further explain, metacognitive reflection on what one is doing and why, is a key to critical thinking and, therefore, critical thinking is not just a rote application of critical-thinking skills.

With regard to the application of critical-thinking skills, many theorists in the field argue about an interdependency of those skills in most thinking tasks that call for not operating separately but rather complementarily (Bailin et al., 1999a; Bernard et al., 2008; Ennis, 1991; Ennis et al., 2005, 2004, 1985; Facione, 2000; Facione & Facione, 1996; Swartz, 2003). As Facione (2000) explains, there isn't any order in which one can use those skills so as to form a judgment about what to believe or do. In addition, critical-thinking skills can apply not only to the question or evidence at hand, but to the products of the work of other critical-thinking skills as well (e.g. analyzing or evaluating an interpretation of data), something that manifests the non-linear character of critical thinking (Ennis et al., 2005, 2004, 1985; Facione, 2000; Facione & Facione, 1996; Prawat, 1991). Besides, when individuals engage in thinking tasks in their lives, they rarely use the critical-thinking skills in isolation since these skills are rather interdependent and blend together when they need to skillfully make a decision and solve a problem (Ennis, 1991; Ennis et al., 2005, 2004, 1985; Swartz, 2003; Zohar et al., 1994). Consequently, instruction or assessment that focuses on simply teaching students a set of new and discrete skills or the practice of a single critical-thinking skill in isolation from the possible influence of any of the others is not a good idea, or it is rather problematic (e.g. Bailin et al., 1999a; Facione, 2000; Facione & Facione, 1996). This, of course, does not quash the fact that students need to be taught specific sub skills and trained in related instructional activities at each time (Astleitner, 2002). Nevertheless, from the research perspective, it would be wiser to concentrate on critical thinking as a collection of highly interrelated skills and abilities not operating separately but existing conjointly and complementarily, instead of trying to explore unique qualities or skills associated with critical thinking, as Bernard et al. (2008). In fact, it may be difficult to identify the unique effect of each skill separately since when solving a problem one uses a number of critical-thinking skills simultaneously (Zohar et al., 1994).

The Affective Dimension of Critical Thinking: Critical-Thinking Dispositions

Dispositions have variously been conceptualized as attitudes toward critical thinking (Halpern, 1989; Giancarlo et al., 2004) or habits of mind (Bailin et al., 1999a; Hudgins et al., 1989). According to Facione et al. (1997), dispositions toward critical thinking refer to the motivation and inclination of the learner to be involved in meaningful critical thinking about issues, making decisions and/or solving problems. In a similar vein, Taube (1995) asserts that "critical thinking disposition implies a willingness to expend cognitive effort in solving everyday problems" (p. 6). In this respect, "there are certain kinds of things critical thinkers must be able but also inclined to do" (Bailin et al., 1999a, p. 289). Besides, defining critical thinking merely in terms of skills involves the risk of making the concept trivial by characterizing it as a set of techniques (Facione, 2000; Papastephanou & Angeli, 2007), while engaging in good thinking is also a matter of being disposed towards it (Bailin et al., 1999b; Fisher, 2001; Ku, 2009; Taube, 1995). As Bangert-Drowns & Bankert (1990) characteristically say, "critical thinking is an inquisitive disposition toward experience, a predisposition to intellectually act in a consistent way over time and in different situations" (p.4). Under this framework, the ultimate goal for teaching students to become critical thinkers is the development of a disposition to do so (Hudgins et al., 1989).

Dispositions, as attitudes, values, and inclinations, are dimensions of an individual's personality that relate to how likely an individual is to identify and solve a problem by using reasoning (Giancarlo et al., 2004). Critical-thinking dispositions concern, among others, the readiness to determine and maintain focus on the conclusion or question, the willingness to take the whole situation into account, the open-mindedness to look for alternatives, the inquisitiveness to seek and offer reasons, amenable to being well informed and the maturity to withhold judgment when evidence and reasons are insufficient (Ennis, 1987; Facione, 1990a; Kennedy et al., 1991). Similarly, according to Halpern (1998) "the dispositions that a critical thinker should exhibit concern: (a) willingness to engage in and persist at a complex task, (b) habitual use of plans and the suppression of impulsive activity, (c) flexibility or open-mindedness, (d) willingness to abandon nonproductive strategies in an attempt to self-correct, and (e) awareness of the social realities that need to be overcome (such as the need to seek consensus or compromise) so that thoughts can become actions' (p. 452). Ennis (1991) lists 12 such dispositions: (a) to be clear about the intended meaning of what is said, written or communicated, (b) to maintain focus on the conclusion or question, (c) to take into account the total situation, (d) to seek and offer reasons, (e) to be well informed, (f) to look for alternatives, (g) to be precise, (h) to be reflectively aware, (i) to be open-mined, (j) to withhold judgment when the evidence and reasons are insufficient, (k) to take/change a position when the evidence and reasons are sufficient, (l) to use one's critical thinking abilities. In the initial development of the California Critical Thinking Disposition Inventory (CCTDI) that was conceptually based on the Delphi's Report consensus definition of 1990, Facione and Facione (1992, cited in Facione, 2000) came up with seven elements or aspects of the overall disposition toward critical thinking: truth-seeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness, and maturity of judgment.

Dispositions are considered an important part of critical thinking by Paul (1981, 1992) as well, who specifically refers to traits of mind, namely, intellectual humility, intellectual courage, intellectual empathy, integrity, intellectual perseverance, faith in reason and intellectual sense of justice. Specifically, open-mindedness and taking into account other people and perspectives are central to Paul's (1981) notion of a 'strong sense' of critical thinking. Teaching critical thinking in the 'strong sense' exceeds 'egocentric and sociocentric thinking,' because it aims to help students to develop reasoning skills in those areas (i.e. political, social, personal) where they are most likely to have egocentric and sociocentric biases (Paul, 1981). Therefore, the ideal critical thinker should put extra effort into changing minds when evidence and reasons strongly contradict one's own beliefs (Ennis, 1991; Papastephanou & Angeli, 2007; van Gelder, 2005). Dispositions are related somehow to the so called perfections of thought listed by Paul (1992): Clarity, precision, specificity, accuracy, relevance, consistency, logicalness, depth, fairness, completeness, significance, and adequacy (for purpose). The achievement of these perfection standards require extensive practice and long-term cultivation, while they often need to be adjusted to a particular domain of thought (Paul, 1992). Moreover, while dispositions are important qualities, they are not mutually exclusive; rather, they are interdependent (Ennis, 1991).

According to various research results, dispositions toward critical thinking play an important role in students' critical-thinking performance (McBride, Xiang, & Wittenburg, 2002). For example, Giancarlo and Facione (1994, cited in Facione, 2000) found a positive correlation between overall critical-thinking skills and critical-thinking disposition in their study with 193 10th grade high-school students. In another research of Facione and Facione (1997, cited in Facione, 2000) with 1557 nursing students, a positive correlation was again found between critical-thinking skills and critical-thinking disposition, even if only 4% of the variance in critical-thinking skills test scores could potentially be attributed to or associated with the variance of these college students' critical-thinking dispositions test scores, or vice versa (it failed to account for 96% of the variance). Research on critical-thinking skills and dispositions has also shown that college students with a stronger initial disposition toward critical thinking could show greater development in critical-thinking skills by the end of their studies than those with a weaker initial disposition toward critical thinking (Facione & Facione, 1997, cited in Facione, 2000).

However, even before the development of the high-profile definition by the American Philosophical Association Delphi panel of 46 experts, including leading distinguished critical-thinking scholars such as Ennis, Facione, and Paul, theorists working in the area of critical thinking had already recognized that the ability to think critically differs from the disposition to do so (Ennis, 1987). In fact, recent empirical evidence seems to confirm that notion, in that critical-thinking skills and dispositions are not dependent learning tracks but separate entities (Barak et al., 2007; Facione, 2000), since there is a distinction between the disposition or willingness to think critically and the ability to think critically, that is the critical-thinking process itself (Facione, 2000; Halpern, 2002). Certainly, many individuals are both disposed (willing) to address problems and make decisions using critical-thinking skills and skilled (able) to do so (Insight Assessment, 2015). However, being skilled does not mean that one is disposed to use critical thinking, and being disposed toward critical thinking does not assure that one is skilled (Facione, 2000). People, in general, might be either positively or negatively disposed to use critical thinking or even rather ambivalent in their tendencies or inclinations (Facione, 2000). Thus, a student might possess thinking skills and be able to think critically but might lack the disposition or motivation to do so (Kennedy et al., 1991; Yeh, 2001). So, while a student might not have the disposition to use critical-thinking skills, he/she could possibly exhibit critical-thinking skills on a particular situation (Fisher & Scriven, 1997). It is for that reason that empirical, often psychological, research attention has placed emphasis on the critical-thinking skills, as ten Dam and Volman (2004) point out, and on the instructional approaches and processes for promoting them (Frijhters et al., 2008), since lack of disposition(s) does not automatically mean lack of critical-thinking skills (Yeh, 2001).

However, taking into consideration the motivational theory, a learner positively disposed to use critical thinking is more motivated to achieve mastery of critical-thinking skills (Facione, 2000) by persisting at challenging, interesting and novel tasks that have a degree of open-endedness and uncertainty that call for critical thinking (Lai, 2011; McGuinness, 1999). Hudgins et al. (1989) even proposed a prescriptive model of self-directed critical thinking applied to everyday problems consisting of two basic components, the cognitive one composed of three intellectual skills, that is, task definition, strategy formulation and monitoring the thinking process, and the motivational one, which indicates that the skills should function spontaneously and independently. From this point of view, as Facione (2000) assumes, teachers should motivate students to think critically in appropriate circumstances and nurture attitudes such as truth-seeking and open-mindedness, even as they teach the skills, in the proper use of reasons and evidence, and maturity of judgment. Modeling, considering examples, and engaging students in real-life situations and tasks can turn out to be useful approaches for enhancing their critical-thinking dispositions (Ennis, 1991). Besides, an ideal critical thinker cannot be characterized only by his/her cognitive skills but also by how positively disposed toward using critical thinking he/she is, something that has to do with the way he/she approaches life in general (Facione, 1998).

Critical Thinking Development

Any person, young or old, regardless of experience, can participate in higher-order thinking and understand and use critical thinking (Kennedy et al., 1991; Newmann, 1991). Therefore, higher order thinking skills are not only for older children, since young children are also able to benefit from a critical-thinking based instruction (Bailin et al., 1999a; ten Dam & Volman, 2004). In fact, "critical thinking is a type of thought that even 3-year-olds can engage in – and even trained scientists can fail in" (Willingham, 2007, p. 10). Similarly, the APA Delphi report recommends that 'from early childhood, people should be taught, for example, to reason, to seek relevant facts, to consider options, and to understand the views of others' (Facione, 1990a, p. 27) Elementary students can learn, for example, important dispositions or habits of mind, such as respecting others in discussion, being open-minded, and being willing to look at issues from others' point of view, as well as other skills or heuristics, such as asking for examples when a term's meaning is unclear and reminding themselves to double-check claims before accepting them as facts (Bailin et al., 1999a, Heyman, 2008). In that vein, explicit instruction for critical thinking should be built into all levels of the K-12 curriculum, rather than being limited to junior-high or high-school students (Facione, 1990a).

Nevertheless, by the time children enter school, they already use various types of thinking (Swartz, 2003) while they are already making judgments and arguments of various sorts, even if their arguments may not be very good (Bailin, Case, Coombs & Daniels, 1999a). In this respect, factors other than school and teaching may affect and/or motivate their critical - or uncritical - thinking, such as parents, friends and/or other stimuli received from their environment (Nickerson, 1984), namely, children's social experiences (Heyman, 2008). Still, it doesn't necessarily mean that they perform the various thinking tasks skillfully (Swartz, 2003) or that their uncritical thinking can automatically vanish (Kurfiss, 1988) outside school, where there are diverse contradictory explanations (Paul, 1992). When children enter the classroom, they can further develop and improve their critical thinking (Halpern, 1989; Swartz, 2003) and learn to think more consistently, more productively and more effectively (Nickerson, 1984, 1988). And even if Aristotle has claimed that humans are naturally inclined to think critically, they are not designed to be all that critical, as van

Gelder (2005) argues. Besides, critical thinking is a highly contrived and complex activity for humans (van Gelder, 2005), while the fact that individuals think spontaneously does not mean that they think as effectively as they might (Nickerson, 1988). On the contrary, children's critical-thinking skills are amenable to development and improvement given that they receive specific and purposeful instruction so as to skilfully exercise the various cognitive skills (e.g. analysis, evaluation) in integrated wholes (Halpern, 1989; Nickerson, 1988; van Gelder, 2005).

The point is that the critical thinking ability varies with age (Kennedy et al., 1991). Even if students are capable of confronting challenges in interpretation, analysis, and manipulation of their knowledge, they differ in the kinds of challenges they are able to master (Newmann, 1991). As Elder and Paul (2010) explain, students should pass through stages of development in critical thinking, so as to fully develop as critical thinkers. In particular, the authors assert that there are levels of intellectual development that people go through as they improve as thinkers, namely, the unreflective thinker (stage one), challenged thinker (stage two), the beginning thinker (stage three), the practicing thinker (stage four), the advanced thinker (stage five), and the accomplished thinker (stage six). With regard to their skill in thinking, unreflective thinkers may have developed various thinking skills but neither are they aware of them, nor do they monitor their thought; thus, they inconsistently apply their implicit skills, while prejudices and misconceptions often undermine the quality of their thought (Elder & Paul, 2010). Similarly, challenged thinkers may have developed limited and implicit critical-thinking abilities, which may more easily deceive them into believing that their thinking is better than it actually is. Beginning thinkers, unlike unreflective and challenged thinkers, become aware of their thinking skills and begin to monitor their own thoughts, although sporadically, by using standards of assessment such as clarity, accuracy or precision (Elder & Paul, 2010). One step forward, practicing thinkers have enough thinking skills to begin to regularly monitor their own thoughts and identify strengths and weaknesses. Advanced thinkers, on the other hand, regularly monitor their own thinking and improve it thereby, since they have excellent knowledge of the qualities of their thinking. Elder and Paul (2010) complete their stage theory for critical thinking development with the accomplished thinkers, who regularly, effectively, and insightfully critique their own use of thinking in their lives, and improve it thereby.

With regard to instruction, Elder and Paul (2010) make an effort to place the stages of their model into the levels of education, considering that, for example, in elementary school an essential objective would be that students become "beginning" thinkers, while middle and high school would aim at helping all students to become, at least, "practicing" thinkers.

What is important is that teachers need to take students through the stages of intellectual development (Elder & Paul, 2010), regardless of their age and/or educational level. Besides, students will not eventually and spontaneously become good critical thinkers unless there are certain preconditions, that is, a deliberate critical-thinking based instruction, structured by means of carefully designed instructional activities focusing on enhancing critical-thinking skills (Angeli & Valanides, 2009; Astleitner, 2002; Elder & Paul, 2010; Garside, 1996; Halpern, 1998; Kennedy et al., 1991; Prawat, 1991; Swartz, 2003). Undergoing a long period of active learning and focused training aiming at improvement, practicing the skills for improvement, practicing activities gradually becoming harder and close guidance and feedback on performance by a teacher or coach define the characteristics of any deliberate practice (Ericson & Charness, 1994), which, according to van Gelder (2005), applies for critical-thinking based instruction as well. According to Siegel (1985), educational activities have to be organized and take place *'with a view to fostering in students the skills, abilities and dispositions, which constitute critical thinking'* (p. 70). In fact, research has proven that learners, who persistently and purposefully receive critical-thinking based instruction, which is cautiously planned and effectively implemented and with strong commitments from the teachers, generally do have better critical-thinking performance than others, who do not undergo such instruction (Barak et al., 2007; Nickerson, 1984; Sternberg & Bhana, 1986). And further, students of different ability levels can benefit from such an instruction (Kennedy et al., 1991).

Critical Thinking and Teaching Approaches

A question that theorists and researchers have tried to answer for more than three decades is how a critical-thinking based instruction should be designed to be effective and whether this instruction should be direct or not. According to Swartz (2003), there are two main instructional approaches to teaching critical thinking, that is, the teaching *of* thinking that concerns the direct instruction of thinking in non curricular contexts and the teaching *for* thinking that concerns the use of methods, strategies and activities which engage students in thinking in curricular contexts. McTighe (1987) suggests a third approach which has recently generated some interest, that is, teaching *about* thinking that focuses on helping students become aware of the way they think. In particular, Ennis (1989) explains that teaching approaches refer to broad instructional categories and frameworks on how to teach for critical thinking, that is, whether critical thinking should be taught separately from school subject-matter courses (the general approach), be explicitly infused in instruction in school subject-matter courses or areas (the infusion approach), be implicitly taught and result from a student's deep immersion in the subject-matter area (the immersion approach) or be taught as a combination of the general with either the infusion or immersion approach together (the mixed approach) (Ennis, 1989).

The Background Knowledge Argument

Some researchers strongly believe that critical-thinking skills can be taught directly and separately from a subject matter since critical thinking is a universal generic skill that can be learned in classes and transferred from one discipline to the other in all directions regardless of the subject (e.g. Ennis, 1987, 1993). For them, critical thinking is understood as a set of general cognitive skills and dispositions applying to 'the correct assessing of statements' (Ennis, 1987). Therefore, all a person needs to be a critical thinker is a set of general heuristics that could be effectively used in various contexts and situations.

On the other hand, there are researchers who contend that the claim of critical-thinking skills being generic and thus applicable in any context regardless of background knowledge is clearly false, since background knowledge in the particular area is a precondition for critical thinking to take place, or else one of the important determinants of the quality of thinking (Bailin et al., 1999b; Bailin, 2002; Hudgins et al., 1989; Swartz, 2003). In this line of reasoning, there is the subject-specificity view of critical thinking with three versions, that is, the conceptual, the epistemological and the empirical version (Kennedy et al., 1991). The *conceptual version* holds that thinking is always about something, some specific subject, thus general thinking skills cannot conceptually exist (McPeck, 1990). The *epistemological version* holds that critical-thinking skills vary from one subject area to another since different things constitute good reasons in different subject areas (McPeck, 1990), something that Bailin et al. (1999a) also assume. The *empirical version* held by many cognitive psychologists (e.g. Glaser, 1984) holds that critical-thinking skills are domain-specific, influenced by the content of the domain, and thus they are unlikely to transfer to other domains. In this respect, the development of critical thinking is not completely independent of the development of knowledge (Bailin et al., 1999a) since 'the processes of thinking are intertwined with the content of thought (that is, domain knowledge)' (Willingham, 2007, p. 8). Teaching critical-thinking skills, such as selecting, interpreting, outlining, and creating appropriate information within content, can become the major focus so as to facilitate the learning of content knowledge (Ennis, 2011;

Bryan, 2000; Zohar & Nemet, 2002). Dewey (1933) has long ago pointed out that teaching for thinking enhances the learning of content knowledge while Zohar and Nemet (2002) found through a critical-thinking intervention effort that students' performance improved both in terms of content knowledge and argumentation quality. In that sense, thinking critically about specific topics implies higher-order thinking about these topics and results in less rote and more meaningful learning that improves understanding (Zohar et. al., 1994). Therefore, the background knowledge, understanding and experience(s) learners have in a certain subject considerably determines the degree to which they will be capable of thinking critically in that subject (Bailin et al., 1999a; Ennis, 1987, 1991; Hudgins et al., 1989, Newmann, 1991). In that vein, the importance of the content is highlighted since students' critical thinking cannot be developed unless they are given something to think about (Brown, 1997; Ennis, 1987; McPeck, 1990; Nickerson, 1984) and they are engaged in serious learning about meaningful, rich domain-specific subject matter (Newmann, 1991).

Apart from the two contradictory schools of thought with regard to the background knowledge argument in teaching for critical thinking, there is a third school of thought represented by theorists, who maintain that critical thinking includes both general and domain-specific elements. Those seem to acknowledge that the fact that critical thinking is subject-specific, does not make it discipline-specific in a way that requires the lodging of critical-thinking instruction within the disciplines since the word subject has a broad meaning and not a narrow one (Ennis, 1987). Therefore, thinking critically without content is not possible, but teaching content-free general critical-thinking skills and principles is possible (Ennis, 1989, 1997). In particular, students do not need to become subject matter experts before they can start to learn to apply critical thinking in a subject since these things can go on together, each helping the other (Ennis, 2011; Ennis et al., 2005). In proof of that, as Ennis (1997) points out, there are some critical-thinking principles (e.g. showing something to be a necessary condition does not prove that it is a sufficient one) that are common across many domains. In that sense, while it is acknowledged that background knowledge or information or familiarity with the subject and/or the situation calling for critical thinking is indispensable and necessary to effective critical thinking (Hudgins et al., 1989), it is not a sufficient condition for enabling critical thinking and/or skilled argumentation within a given subject (e.g. Ennis, 1991, 2011; Iordanou & Constantinou, 2015; Lai, 2011). This reveals that something else, beyond topic knowledge, needs to develop to support students' critical-thinking skills. Based on this argumentative discourse, Ennis (1989) has elaborated on four teaching approaches in teaching for critical thinking, namely, the general, the infusion, the immersion, and the mixed approach.

The General Approach. The general approach or stand-alone approach, as Prawat (1991) defines it, focuses on teaching critical-thinking skills independently of a subject-matter course or content or in stand-alone, nonacademic courses, that is, somehow in a de-contextualized way. It can take place in separate informal logic courses (i.e. college and secondary schools) or separate instructional units (i.e. elementary school) (Ennis, 1989; Swartz, 2003). There are, though, instructional examples of the general approach that usually do involve content (e.g. local and national political issues) about which the critical thinking is done (Ennis, 1989). Besides, thinking always occurs within a domain of knowledge, a domain-specific content (Brown, 1997; Halpern, 1998). This content is not, however, necessarily included in the school-curriculum subjects (Ennis, 1989). An advantage of the general approach is that students can work with their critical-thinking skills without the stress of being evaluated on their subject-matter knowledge (Angeli & Valanides, 2009; Prawat, 1991). Theorists who seem to support the generalist thesis (e.g. Paul, 1992; Sternberg, 1986) assert that the understanding and application of rules of logical inference, as taught in critical-thinking or logic classes (and not necessarily in specific disciplinary areas), may assist in the transfer of those skills and principles of critical thinking in different content areas and tasks. However, general critical-thinking skills do not readily transfer (Prawat, 1991) and thus this transfer cannot be always guaranteed (Angeli & Valanides, 2009).

The Infusion Approach. It was not until the 1990s that the critical thinking teaching method had shifted from the general approach to the infusion approach (Angeli & Valanides, 2009) or embedding approach (Prawat, 1991). The supporters of the infusion approach (e.g. Brown, 1997; Glaser, 1984; Marin & Halpern, 2011; Swartz, 2003) seem to believe that critical-thinking skills are not general skills that can be applied across different disciplines indiscriminately but rather specific skills that can be influenced by the content of the different curriculum subjects (McPeck 1990). Even if he admits that he does not like the term, McPeck (1990) supports the infusion approach as the most effective one for teaching critical thinking, because the interfield variation, that is, the fact that different things constitute good reasons in different fields, calls for critical thinking to vary from field to field. This entirely context-dependent "specifist" view of critical thinking calls for the infusing or embedding of general critical-thinking skills into the curriculum (Parwat, 1991; Swartz, 2003). At any rate, their teaching is made explicitly (Ennis, 1989) in the context of the different subject matters (Brown, 1997; Prawat, 1991), so that transfer to other domains is possible (Brown, 1997; Swartz, 2003). Infusion lessons focus on the direct instruction in specific critical-thinking skills aiming at not just encouraging students to think about what they are learning, but also at helping them to become aware of what processes this involves so that they can improve how they think for long-lasting effects (Swartz, 2003). In that sense, mere memorization is avoided while higher-order learning is promoted (Zohar et al., 1994). And further, there are two sets of objectives in infusion lessons, that is, improved thinking and enhanced content learning (Swartz, 2003), which are reached if there is an equal balance between the teaching of critical-thinking skills and content (Angeli & Valanides, 2009). If not, a focus on thinking skills may actually divert attention away from the curricular issue that is important for students to think about (Prawat, 1991), an argument frequently used by the critics of the infusion approach.

Supporters of the infusion approach (e.g. Brown, 1997; Marin & Halpern, 2011; Swartz, 2003) stress the importance of teaching critical thinking through real and authentic ill-defined problems. The main arguments lie, on the one hand, on the fact that these problems need critical-thinking skills anyway while, on the other hand, they stimulate students by encouraging them to be actively involved (ten Dam & Volman, 2004). Still, even the instructional choices incorporating ill-defined problems to engage students in different kinds of learning experiences may differentially affect their critical-thinking performance (Angeli & Valanides, 2009). In addition, the effects of specific teaching methods and/or instructional sequences used in the infusion approach – or even in other approaches – may be different for different groups of students (ten Dam & Volman, 2004). In fact, research often reveals a differential impact of the characteristics of a specific instructional design or teaching practices on the learning processes and the learning results of different groups of students (Frijhters et al., 2008; Shim & Walczak, 2012). In this perspective, there are many supporters of the infusion approach, who argue on the sequence of tactics applied, that is, which is the most appropriate starting point for teaching critical-thinking skills (Prawat, 1991). This would be more easily clarified if students' prior knowledge is taken into account (Angeli & Valanides, 2009), but still the skills-first approach seems to be more consistent with the infusion approach (Parwat, 1991; Swartz, 2003). Swartz (2003) even proposes a certain instructional sequence that starts with students' introduction to the thinking skill goal of the lesson along with the content, continues with students' engagement in a guided thinking activity within the content and then in a reflective activity in which students explicitly think about their thinking, and ends with encouraging students to apply the thinking skill or process taught to other situations.

The Immersion Approach. An approach similar to the infusion approach is the immersion approach. Their difference lies in the fact that the principles of critical thinking are not made explicit (Ennis, 1989). The immersion approach calls only for thinking in the subject area (Kennedy et al., 1991) and places emphasis on ideas, not skills and/or processes, as the most important intellectual resource in promoting thought (Prawat, 1991). Therefore, critical-thinking skills and principles are never made explicit during teaching with the immersion approach (Angeli & Valanides, 2009; Ennis, 1989; Prawat, 1991; Valanides & Angeli, 2005), while ideas functioning as perceptual schemata are situated, that is, taught in the context of their application as tools that could help students understand certain phenomena (e.g. 'balance,' 'energy flow') (Prawat, 1991). In that vein, students in an immersion-approach learning environment are left to infer critical-thinking skills and principles by being engaged in verbal interaction, dialogue or discourse where they are encouraged to interpret, analyze, and evaluate different points of view by responding to relevant questions (e.g. *'Have you analyzed the problem in depth? What are your reasons for supporting this point of view?'*) (Angeli & Valanides, 2009; Prawat, 1991; Valanides & Angeli, 2005). The theoretical framework of social constructivism constitutes the context of the immersion approach since it assumes that knowledge is contextually generated through social interaction and dialogue through which individuals gradually expand their levels of knowing (Yang, 2008). Interaction can be facilitated through a Socratic questioning aiming to promote conceptual understanding. As Paul (1981) puts it, all teachers aiming at fostering their students' critical thinking would like their teaching to have a global "Socratic" effect, with an impact on the everyday reasoning of their students. In this mode of questioning, Socrates highlighted the need for thinking for clarity and logical consistency (Paul et al., 1997).

The Mixed Approach. Recent literature moves away from the dichotomy of general critical-thinking skills versus specific (ten Dam & Volman, 2004), accepting that both some general skills and principles of critical thinking (i.e. what constitutes sound reasoning patterns) and the varieties of subject-specific discourse are of great importance for teaching, learning and practicing critical thinking (Davies, 2006; Facione, 1990a; Swartz, 2003). The general skills are important since they outline what constitutes sound reasoning patterns, invalid inferences and so on, while the latter is important since it outlines how the general principles are used and deployed so as to serve the aims of the subject (Davies, 2006). For example, a student needs to be taught how to identify and analyze the main arguments of an argumentative text for writing a persuasive essay on a similar theme or how to select, analyze and evaluate information given in historical sources for making a sound judgment about the reasons people were travelling in the Bronze Age. Therefore, students can both be taught about critical thinking "as a subject of study in itself", along with specific experience and knowledge within a particular subject-matter area (Ennis, 1989; Kennedy et al., 1991).

Under this framework, there is a fourth approach for teaching critical thinking, namely the mixed approach, consisting of a combination of the general approach with either the infusion or immersion approach (Ennis, 1989). In the mixed approach critical thinking is integrated within a specific content and/or is explicitly taught, meaning that 'there is a separate thread or course aimed at teaching general principles of critical thinking, but students are also involved in subject specific content and critical thinking instruction' (Ennis, 1989, p. 5). Therefore, critical-thinking skills are not taught or learnt separately from the subject matter (ten Dam & Volman, 2004). Besides, instruction in critical thinking that is integrated, or discipline embedded, ensures the development of a knowledge base upon which to exercise critical thinking skills and the identification of criteria for what constitutes critical thinking within a discipline (Plath et al., 1999).

The Instructional Efficacy of the Critical-Thinking Teaching Approaches

Many researchers in the field of critical thinking dealt with comparisons between the four teaching approaches, namely the general, infusion, immersion, and mixed approach as taken from Ennis' (1989) typology (e.g. Angeli & Valanides, 2009; Marin & Halpern, 2011; Plath et al., 1999); their studies, of course were differently designed and enacted.

For example, Angeli and Valanides (2009) examined whether different methods for teaching critical-thinking skills, that is, particular versions of the tactics used in the general, infusion and immersion approach, differentially affect undergraduate students' critical-thinking performance on an ill-defined problem, and found no significant differences. However, they found that students taught with the infusion and immersion approach had significantly better critical-thinking performance than the ones assigned to the control group where there was no explicit instruction, guidance or feedback but a simple engagement of students in problem-solving. Nevertheless, based on the qualitative data analysis of the study, Angeli and Valanides (2009) found that students in the infusion group reported better understandings of critical thinking than students in all other groups. In that sense, the study confirms that thinking about thinking is important since students learn to monitor their own learning and thinking in the long-term (McTighe, 1987; Swartz, 2003). On the contrary, when students do not have a clear picture of what it means to think critically, then any practice or feedback may have limited effectiveness (Yeh, 2001).

In a similar way, Plath et al. (1999) found that a Critical Thinking Unit (run for 32 hours over 4 weeks) comprising explicit and intensive instruction on critical thinking based on a mixed approach philosophy helped fourth-year social work students to improve their critical thinking abilities. Along the same line of reasoning, Marin and Halpern (2011) concluded that explicit instruction is an effective method for teaching critical thinking skills to high-school students. Findings from their two interventional studies revealed that high-school students receiving explicit instruction showed much larger gains than those in the imbedded instruction group (Marin & Halpern, 2011).

Similarly, Dewey and Bento (2009) endeavored to examine the effectiveness of the infusion approach by activating children's thinking skills (ACTS) on the cognitive, social, and emotional development of 404 children n Year 4–6 in primary schools. A significant MANOVA's followed up by ANCOVA's determined a significant difference existed between the cognitive ability test's mean scores between the experimental and control groups when controlling for pre-test scores ($F = 6.291$, $p = .013$, partial $\eta^2 = .020$). Based on the results, the study of Dewey and Bento (2009) demonstrated the potentially powerful effect of an infusion approach to teaching thinking on both children and teachers. Similar studies that aimed to examine the effects of an explicit instruction, which is a key-element of the infusion approach, was the studies of Marin and Halpern (2011). In those studies, explicit and imbedded instructional modes were compared, while the critical-thinking skills of high-school students were assessed with the Halpern Critical Thinking Assessment. According to the results, students receiving explicit instruction showed much larger gains than those in the imbedded instruction group (Marin & Halpern, 2011). A similar study placing emphasis on the explicit instruction of the infusion approach was the study of Bensley, Crowe, Bernhardt, Buckner and Allman (2010), which compared the critical-thinking skill of argument analysis in three groups of students, one getting critical-thinking skills infused directly into their course (experimental) and two other groups getting no explicit critical-thinking skills instruction. According to their results, the group receiving explicit critical-thinking based instruction showed significantly greater gains in argument analysis skills than the groups receiving no explicit critical-thinking instruction.

Apart from independent interventional research studies, meta-analyses aiming to examine the instructional efficacy of the four critical-thinking teaching approaches are also recorded. Abrami et al. (2008) summarized all the available empirical evidence (161 effect sizes from 117 studies, including 27 true experiments) on the instructional efficacy of the four approaches and found that the mixed approach where critical thinking is taught explicitly within a specific content has the largest effect (g+=0.94, SE=0.006). Tiruneh et al. (2014) also reached the same result in their analysis. However, the review of Abrami et al. (2008) included studies from all the levels of education, something that does not allow a clear understanding on the nature of instructional interventions in the context of a specific level of education. Tiruneh et al. (2014) dealt with it since they included in their meta-analysis only studies that took place in higher education.

Nevertheless, the critical-thinking instructional approach alone may not determine the effectiveness of instruction in enhancing students' critical thinking (Tiruneh et al., 2014). For, regardless of the approach, critical-thinking based instruction is mainly based on the assumption that there are clearly identifiable and definable thinking skills which are domain-independent, and can be taught to students so they can recognize, apply and transfer them across domains and in real-life situations (Halpern, 1988; Tiruneh et al., 2014). In addition, there are researchers who claim that a critical-thinking based instruction should be based on the enhancement of an aporetic side of thought, which means to wonder and reflect upon what is usually taken for granted (e.g. the authority of a text as a written and published work (Angeli et. Al., 2011; Papastephanou & Angeli, 2007). In that vein, for achieving the critical-thinking objective, other instructional variables need to be taken into consideration as well.

Teaching for Critical-Thinking: Teaching Qualities, Methods and Strategies

Historically, the published literature on teaching thinking has concentrated on methods which are likely to inhibit rather than enhance students' good thinking (Pithers & Soden, 2000). In fact, there are theorists (e.g. Sternberg, 1987) who have particularly described fallacies obstructing the teaching of critical thinking, as well as the types of teacher behavior that inhibit good thinking. For example, 'any teacher, no matter at what level, who simply agrees or disagrees, just demonstrates and explains, cuts off student responses, uses reproof rather than praise, shakes the learner's confidence in the value of new ideas or uses basically only retrieval or recall types of questions inhibits thinking' (Pithers &

Soden, 2000, p. 242). Sternberg (1986, 1987) has even pointed out that there are more ways to fail than succeed in the teaching of critical thinking.

Nevertheless, empirical research and literature reviews on critical thinking reveal various teaching methods, strategies, tactics and teacher behaviors that assist in critical-thinking based instruction. Although researchers use these terms interchangeably, there is a slight difference between teaching strategies and teaching behaviors that is worth noting. On the one hand, teaching strategies produce improved student understanding in various disciplines at a variety of grade levels and concern among others cooperative learning, learning by design, inquiry-based learning and technology-enhanced teaching (Donovan, Bransford, & Pellegrino, 1999; Schacter & Thum, 2004). Teaching strategies or methods are mostly guided by how students learn, think, feel and understand (Donovan et al., 1999). Teacher behaviors, on the other, concern i) the quantity of academic activity (i.e. quantity, pacing of instruction, classroom management), ii) the quality of teachers' lessons (i.e. giving information, questioning, feedback, opportunities to practice), and iii) the classroom climate (i.e. students' engagement, support) (Kyriakides et al., 2002). In the literature, theorists may refer to tactics so as to explain teacher behaviors (Ennis, 2011). Nevertheless, while there is a distinction between teaching strategies and teacher behaviors or tactics, this is rarely taken into account since in a classroom these are rather seen in conjunction rather than in disjunction.

In this context, empirical research and literature reviews attempted to list major teaching strategies that could promote critical thinking in class. Barak et al. (2007) concluded via class observations that three major teaching strategies employed by teachers, namely (a) dealing with interdisciplinary real-world cases; (b) encouraging open-ended class discussions; and (c) fostering short inquiry experiments to be performed in groups, were related to students' statistically significant pre-post gains on critical-thinking skills. In particular, students' outcomes have shown an improvement in the skills of evaluation and inference, as well as in their disposition towards truth seeking, open-mindedness, critical-thinking self-confidence, and maturity. Similarly, Tsui (2002) conducted class observations and interviews with faculty members and college students and found that writing and rewriting activities/assignments requiring more analysis and less description, as well as class discussion, are likely to be related to the development of students' critical-thinking skills. Staib (2003), on the other hand, assert that real-life student role-play, the use of case studies, group discussion and student-instructor interaction are among the most effective instructional means for developing critical-thinking skills. For many theorists, case-studies are considered compelling alternative instructional tools that can foster critical thinking and improve student reasoning ability (Milner & Wolfer, 2014). Along the same line of reasoning, Paul (1992) even attempted to describe how a critical-thinking based instruction should look like by proposing instructional ideas based on the concept of critical thinking as 'good reasoning' or 'thinking in a disciplined way, according to intellectual standards' so as to encourage teachers to enhance their students' independent thinking. These ideas are usually included in his books and miniatures guides (e.g. 'A miniature guide to critical thinking'). Some instructional ideas are formulated, for example, as such: 'Routinely ask students for their point of view on issues, concepts and ideas,' 'Require regular writing in class,' 'Call frequently on students who do not have their hands up,' 'Think aloud in front of the students' or 'Regularly question the students Socratically' **(**Paul, 1992).

In accordance to the latter point of Paul, many researchers reckon that teachers need to be effective questioners so as to promote students' critical thinking (McTighe, 1987; Savage, 1998) since the level of thinking within a given situation is influenced by the level of the questions asked (King, 1995). In that vein, teachers need 'to get students to defend their responses to questions, entertain a variety of viewpoints, and go beyond mere textbook learning' (Savage, 1998, p. 292). In particular, questions used in class should be thought-provoking in terms of triggering high-level cognitive processes, such as analysis, inference or evaluation (King, 1995), and challenging in terms of sequenced explicit verbal prompts (Shim & Walczak, 2012; Swartz, 2003). For example, when students are called to read, discuss, and understand a text, teachers should bear in mind three levels of questions. These levels concern a) on-the-line questions that ask students to identify given information, b) between-the-lines, hidden or inferential, questions asking students to interpret or infer answers by using evidence, clues and information in combination, and c) beyond-the-lines questions that ask students to reach an informed decision by using prior (contextual) knowledge along with textual information (Language Arts Curriculum, 2016). Various research studies on reading comprehension and higher-order thinking attempted, for example, to investigate whether children's ability to draw inferences and conclusions could be enhanced if purposefully trained through the process of reading. In a relevant study, Hansen (1981) concluded that young students' inference performance could be improved, either through direct strategy training or through changing the kinds of questions they practice answering. Bean (2011), who explicitly correlates deep reading with critical thinking abilities, also suggests some teaching strategies enhancing students' critical thinking during reading, such as avoiding quizzes that encourage students to extract "right answers" from a text rather than bringing their own thinking to bear on a text's argument. Similarly, McKinstery and Topping (2003) propose the Paired Reading (PR) method and the Paired Thinking method (initially developed from the PR method) as effective methods for enhancing the reading and higher-order thinking skills of students.

In particular, many researchers have recognized, Socratic questioning as one of the most powerful and best known teaching strategies for enhancing students' critical thinking (Paul, 1981; 1992; Paul, et al., 1997) either when reading a text or not. As Todd & Freshwater (1999) particularly claim, Socratic questioning functions as an integral part of guided discovery. And further, Socratic questioning is an inductive process incorporating a set of thoughtful questions that motivate students to continually probe the subject (Paul, 1995). Several studies have used Socratic questioning as a teaching tactic in immersion teaching approaches (e.g. Angeli & Valanides, 2009), or even in asynchronous online discussion environments (e.g. Yang, 2008) to examine its effects on learners' critical-thinking performance. In a relevant study with university students, Yang (2008) concluded that an inspired instructor and some energetic teaching assistants using Socratic dialogues during small-group online discussions can successfully develop students' critical-thinking skills. Years ago, Newmann (1991) considered the Socratic manner for encouraging students to justify or to clarify their assertions as an indicator of classroom thoughtfulness. In proof of that, Newmann (1991) included the Socratic questioning in the Classroom Observation Scheme he had developed for classroom observations. With regard to types or levels of questions, there are six categories of Socratic questioning prompts, as Paul (1995) explains: a) questions of clarification (e.g. 'What do you mean?', 'Can you give an example?'); b) questions that probe assumptions (e.g. 'Is it always the case?' Why do you think the assumption holds here?'); c) questions that probe reasons and evidence (e.g. 'What are your reasons for saying that?', 'How could we find out if it is true?'); d) questions about viewpoints or perspectives (e.g. 'Which would be the alternative?'); e) questions that probe implications and consequences (e.g. 'What effect would that have?'); and f) questions about the question (e.g. 'Is the question clear?' 'Do we understand it?'). These categories of Socratic questioning can easily be paralleled with generic critical-thinking skills since, for example, questions of clarification can lead to interpretation, questions that probe implications and consequences can lead to inference while questions about the question can lead to evaluation. In addition to challenging questioning, that stimulates students to view issues from different perspectives, providing intellectual support, that is, providing explanations to help students understand abstract concepts (Shim & Walczak, 2012) or employing the technique of 'wait time' (Ennis, 2011; McTighe, 1987) are likely to encourage more thoughtful thinking by more students.

Other instructional choices that promote critical thinking concern inquiry-based learning and problem-based learning, which offer arenas for students to incorporate certain critical-thinking skills (Bailin et al., 1999a; Pithers & Soden, 2000). For example, students can identify the main issues within the problem, explain how the problem might be resolved or suggest how any proposed resolution might be evaluated (Pithers & Soden, 2000). Besides, *'problem solving is a major use of critical thinking and critical thinking a major tool in problem solving; therefore, the two are best treated in conjunction rather than in disjunction'* (Paul et al., 1997). When employing problem-based learning, educators serve as facilitators, who present students with real-life ill-structured problems and then ask them to collaborate so as to search out potential solutions, rather than teach content (Milner & Wolfer, 2014). One of the aims of the inquiry model is to orient students to learn to ask thoughtful questions (King, 1995), since it focuses on autonomous learning that is inquiry-based (King, 1995). The teacher asks the students thought-provoking questions to elicit information, inferences and predictions from them, while students also engage in asking such questions on their own and addressing in this way their own lack of understanding (King, 1995). In that sense, students become critical thinkers if teachers "encourage them to ask questions, look for evidence, seek and scrutinize alternatives and be critical of their own ideas as well as those of others" (Siegel, 1985, p. 10). For, it is important that students are motivated to ask good questions since, as King (1995) asserts, good thinkers are good questioners. Students can learn to use such questions if they are provided with exemplar generic ones and practice them through cooperative-learning strategies (e.g. asking students to generate thoughtful questions on the studying material and using them to stimulate discussion, either in small groups or as a whole class) (King, 1995). Cooperative-learning applications of inquiry-based learning can be partially attributed to theories of social constructivism (King, 1995) based on which knowledge is contextually generated through social interaction, dialogue and cooperation (Yang, 2008).

Furthermore, many researchers argue that different forms of cooperative learning (e.g. fishbowling, method of academic controversy, small-group teaching) create the appropriate presuppositions for enhancing students' critical thinking (ten Dam & Volman, 2004) since peer-to-peer interaction is promoted. Peer-to-peer interaction, that is, thinking with others in small-groups, instead of thinking alone about an issue, is positively related to gains in critical thinking (Angeli & Valanides, 2009; Bean, 2011). However, group work has better outcomes and promotive interaction is more likely to occur when certain key elements are established, such as ensuring students' assigned roles for structuring positive interdependence (e.g. Johnson, Johnson & Smith, 2007; Koutselini, 2009), since each member’s individual contribution is needed so that the group’s perspective is enriched (Daniel et al., 2005). The teacher’s coaching role in terms of providing feedback, skillfully guiding discussion and facilitating students’ participation may also contribute towards that (e.g. Bean, 2011; Koutselini, 2009; Tsui, 2002), while it is important that the teacher convinces his/her students that group work is valuable and teaches them to work well together (Bean, 2011). Furthermore, students learn best when they are involved in an exchange of points of view or frames of reference (Paul, 1981) through, for example, dialogic activities. Frijters et al. (2008) have, in particular, implemented a dialogic approach to teaching aimed at fostering critical thinking in the context of environmental issues within the subject of Biology to examine whether dialogic activities, as compared to non-dialogic, have an effect on secondary-school students’ critical thinking and learning. The results of their study indicated that students involved in the dialogic approach of teaching scored higher in reasoning skills in terms of producing more positions, supportive arguments and more coordinated and subordinated arguments, than students in the non-dialogic approach. In particular, the 2(condition) x 2(design) ANCOVA for the general fluency of reasoning showed a significant main effect of condition, $F(1, 253) = 16.41$, $p = 0.000$, $\eta2 = 0.06$, with the Dialogic condition outperforming the Non-Dialogic. They also found interactions between student characteristics and learning conditions, meaning that students with higher scores in general reasoning skills profited more from the dialogic approach, whereas in the non-dialogic approach no such relations were observed (Frijters et al., 2008).

In the context of cooperative learning, it seems that class and small-group discussion is related to gains in critical thinking since it triggers discussion through which students can perform and master critical-thinking skills (Angeli & Valanides, 2009; Bean, 2011; Swartz, 2003; Tsui, 2002). In either case, discussion is more effective than lecturing since students try to actively process information rather than merely record it (Tsui, 2002). The method of discussion in general was supported by many theorists in the 80s (e.g. Ennis, 1987; Siegel, 1985) as a means for promoting learners’ critical thinking. In fact, critical discussion plays an important role in most areas of inquiry and practice (Bailin et al., 1999a). For example, it is important for students to be engaged in dialogue with the teacher and reflection so as to evaluate their own thinking (Angeli & Valanides, 2009). To enhance students’ critical thinking the teacher needs to sometimes take the role of a facilitator than that of an instructor (Pithers & Soden, 2000). For instance, based on their findings, Daniel et al. (2005) argue that classroom discussions must be situated within the cooperative context of a ‘community of inquiry’ so that primary-school aged pupils can be stimulated toward a common reflection. Besides, “learning by participation always involves reflection” (ten Dam & Volman, 2004, p. 375). As Lipman (1988) further explains, by converting the classroom into a ‘community of inquiry’, students can become conscious of their own thinking but also of the thinking strategies that their classmates use. Pupils aged 10 to 12 can develop higher-order thinking skills and attitudes related to critical thinking with discussion-based praxis (Daniel et al., 2005). However, in this case critical thinking should be carefully defined so as not be considered synonymous with problem-solving or active learning (ten Dam & Volman, 2004). Active learning or discovery learning are rather ideas complementing the critical-thinking based instruction sharing the view that what learners gain for themselves is more fully possessed than what is given to them (Ruggiero, 2003). Garside (1996), who investigated particularly the effects of group discussion over lecturing on the development of undergraduate students’ critical thinking, found no significant differences between the two methods although significant gains were found from the pre-test to the post-test for group discussion. More specifically, Garside (1996) found that group discussion produced significantly more learning with regard to the higher-level thinking items. Of course, the non significant differences obtained by Garside’s study may reflect some gaps in the study, such as the vagueness with regard to the critical-thinking aspects or components that were targeted during instruction and what kind of tasks were designed for group discussion.

Nevertheless, what teachers need to bear in mind is that there is not only one way to develop critical thinking and there is no universal or best teaching strategy, method or practice since teachers can choose among many so as to accomplish specific goals, such as enhancing students’ critical thinking (Donovan et al., 1999; Garnham & Oakhill, 1994). As Newmann (1991) characteristically puts it, *“solid knowledge on the best techniques for the promotion of thinking does not exist. The effectiveness of technique will probably depend on the nature of the mental challenges presented and characteristics of the students exposed to them”* (p. 326). In addition, the effects of certain teaching strategies, instructional tactics, choices and/or teacher behaviors may be different for different groups of students (Newmann, 1991; ten Dam & Volman, 2004), since learners differ in the way they receive the same instruction (Koutselini, 2013). For example, direct or implicit instruction in critical-thinking skills combined with certain teaching strategies may bring different effects on different groups of students, since learners differ in the way they receive the same instruction (Koutselini, 2008a). Arguably, that is fair enough since, in order to determine the extent to which a student is involved in critical thinking, one would presumably need to know much about the student’s background (Newmann, 1991). In particular, a child's age or knowledge and familiarity with the subject or even his previous academic performance and/or prior knowledge can influence to a larger extent his/her thinking skills and critical-thinking performance (Kennedy et al., 1991; Newmann, 1991).

Principles for a Critical-Thinking Based Instruction

Despite the fact that empirical research has minimum consistency as to specific instructional techniques that effectively enhance students' abilities to think critically (McMillan, 1987; Tsui, 2002), many researchers consider that there are minimal requirements for a critical-thinking based instruction (Newmann, 1991). These critical-thinking principles mainly concern the integration of critical thinking into content instruction (Plath et al., 1999; Swartz, 2003; Zohar et al., 1994), the explicit teaching of critical thinking (Bensley et al., 2010; Ennis, 1989; McGuinness, 1999; Marin & Halpern, 2011; McTighe, 1985; Swartz, 2003; Zohar et al., 1994), the use of teaching strategies enabling students to use the right type of thinking at the right time (Swartz, 2003; Willingham, 2007), the practice of critical thinking through rich critical-thinking tasks and activities (Plath et al., 1999; Swartz, 2003; van Gelder, 2005) and the building of an environment of thoughtfulness and self-reflection (Newmann, 1991; Plath et al., 1999; Swartz, 2003).

To start with, integrating critical thinking into content instruction (Plath et al., 1999; Swartz, 2003; Zohar et al., 1994) is a necessary condition for promoting critical thinking since, as Angeli et al. (2011) characteristically claim, critical-thinking skills cannot be taught divorced from context (p. 309). Besides, helping students to think better in context is a perfectly natural process given that thinking needs to be learned slowly and progressively (Elder & Paul, 2010). Viewing critical thinking that way highlights its contextual nature (Bailin, 2002; Lipman, 1988), since critical thinking always takes place in response to something, that is, a particular task, question, problem, problematic situation or challenge arising in particular contexts (Bailin, 2002; McPeck, 1990). Considering more effective the idea of teaching critical thinking in a particular context, that is, in a subject-matter knowledge, it seems that teachers need to put far more emphasis on the particular forms of reasoning within a particular subject-matter area and to give examples of how these forms of reasoning can be applied both within and outside of that area or context (Pithers & Soden, 2000). Still, what kind of context should be chosen for achieving the critical-thinking objective? As Angeli et al. (2011) explain, "students are usually given material to work critically upon what has occurred within contexts whose effects have already been known and debated" (p. 311). For example, in a History class students may study the effects of Second World War, the profile of Hitler, or the "secret school', a supposed underground school for teaching the Greek language and Christian Orthodox religion under Ottoman rule in Greece between the 15^{th} and 19^{th} centuries. How critically and reflectively could the students be involved in such contexts? According to Angeli et al. (2011), they could, given that an aporetic element of critical thought, that is, "one's tendency to question the given or ready-made contextualization of an idea and to ask for more information, more dialogue and more complexity, that is, in a way, to ask for more contextualization" (p. 312), is developed. In that sense, placing emphasis on teaching thinking skills comes along with a transition from mere subject-centered instruction to learner-centered instruction since the latter focuses on enhancing the learning process by challenging and requesting students to think, and more specifically to interpret, analyze, evaluate, infer, explain and even monitor their cognitive activities within such contexts. Simple memorization does not promote higher-order thinking. In this line of reasoning, lessons just aiming at covering the content can be redesigned so that critical-thinking skills and abilities, such as reasoning, can be used as tools of content coverage so that students think their way through the material (Paul, 1992). For example, elementary students can learn various critical concepts like those needed for distinguishing between definitions and empirical statements (Bailin et al., 1999a). In a History class students can, for example, research, gather and organize data and write a dialogue between two imaginary historians, arguing different views of the war (Paul, 1992). And further, in a Language Arts class, students could raise questions about the ideas expressed in different passages so as to reach an informed decision on the degree of their agreement or disagreement with the points of view expressed (Angeli et al., 2011).

Apart from content included in the curriculum, addressing real-world problems, ill-defined ones, may also serve well the purposeful teaching for critical thinking (Angeli & Valanides, 2009; Barak et al., 2007). These problems need critical-thinking skills anyway and they also stimulate and encourage students towards active engagement and involvement (ten Dam & Volman, 2004). A project-based learning environment can be such an instructional choice since it encourages students to judge and use information rather than to simply be taught information (Bryan, 2002). However, the instructional choices incorporating ill-defined problems aiming to engage students in different kinds of learning experiences may differentially affect students' critical thinking (Angeli &

Valanides, 2009). This, of course, applies to all the instructional practices, since similar practices may have differential effects on students (Shim & Walczak, 2012).

Apart from integrating critical thinking into content instruction (Plath et al., 1999; Swartz, 2003; Zohar et al., 1994), teaching needs to be purposeful so as to enhance students' critical thinking (Barak et al., 2007). Purposeful instruction needs to be explicit so that critical-thinking skills and abilities are developed (Abrami et al., 2008; Bensley et al., 2010; Dewey & Bento, 2009; Facione, 1990a; Halpern, 1998; Marin & Halpern, 2011; Newmann, 1991; Paul, 1992). What is important is that teachers design instruction explicitly to help students acquire and use in-depth knowledge, skills, and dispositions of thoughtfulness in class, so as to solve higher-order tasks and challenges (Newmann, 1991). To achieve that aim, teachers need to use a variety of teaching strategies. According to the review of Tiruneh et al. (2014), who systematically examined empirical evidence on the effectiveness of instructional interventions in fostering university students' critical thinking, teaching strategies can be categorized into direct and implicit. As they explain, the direct teaching category refers to explicit explanation of critical-thinking procedures at the early phase of instruction followed by a combination of teaching activities (e.g. teacher modeling, scaffolding, role playing), while the implicit teaching category refers to the use of various teaching strategies that embed critical thinking without any explicit emphasis on critical-thinking skills. According to their results, the effectiveness of implicit teaching strategies is inconclusive, while direct instruction in thinking skills combined with certain teaching strategies (e.g. teacher modeling, scaffolding, coaching) appear to consistently result in greater effects on students' critical thinking compared to implicit teaching strategies (Tiruneh et al., 2014). Similarly, Marin and Halpern (2011) encourage the explicit instruction of critical-thinking skills (in high school and by extension post-secondary education) since the results of their study revealed that high-school students receiving explicit instruction showed much larger gains in their ability to transfer critical thinking to a variety of everyday situations than those in the imbedded (implicit) instruction group. Bensely et al. (2010), through the results of their study, also supported the effectiveness of explicitly teaching critical-thinking skills infused directly into regular course instruction.

In accordance to that, when teachers use direct explicit teaching strategies, it is important to stress the language of the thinking process (e.g. helping the students to reconstruct arguments by identifying their premises, conclusions and assumptions) by using explicit prompts and critical concepts in their language (Bailin et al., 1999a; Swartz, 2003). For students, learning critical concepts is not essentially a matter of acquiring new terminology, but rather a matter of learning to make appropriate distinctions (Bailin et al., 1999a) so as to monitor their thinking. Therefore, teaching and modelling discrete thinking-skills processes to students in an explicit manner (e.g. thinking diagrams; ‘think aloud’ technique) would contribute towards that end (Dewey & Bento, 2009). For example, students can use graphic organizers to facilitate appropriate distinctions in their thinking, while these can serve as student prewriting given that thinking is visually represented (Bean, 2011; Swartz, 2003). And further, students can be asked to describe their reasoning processes (McTighe, 1987), while teachers can make their reasoning visible to students, that is, to model their own thinking process (Bean, 2011; Lai, 2011). In that sense, the ‘think aloud’ technique can be used by both students and teachers. The bottom line is that students need to become aware of the thinking (strategy) their learning involves and think their way through the material (Paul, 1992) by being explicitly taught about thinking (Dewey & Bento, 2009; Swartz, 2003; Zohar et al., 1994). Students should be able to talk about their thinking processes (McGuinness, 1999) so as to be systematic and reflective in their learning. This delineates metacognition at the core of critical thinking (Dewey & Bento, 2009). Nevertheless, teachers need to teach in ways that would help students internalize and follow strategies for skillful critical-thinking performances when it is appropriate to do so (Prawat, 1991; Swartz, 2003), while this kind of teaching should not take place, of course, in adulthood or college years but rather start from a younger age (Bailin et al., 1999a; Facione, 1990a; ten Dam & Volman, 2004; Willingham, 2007).

What seems to be important is a systematic development and improvement of students’ critical thinking, which cannot, of course, be ensured only through teacher questioning even if that elicits different levels of thinking (McTighe, 1987). Conversely, teachers need to purposefully design and teach for critical thinking (e.g. Barak et al., 2007) by engaging students in challenging tasks and guided and rich critical-thinking activities within certain content in which students explicitly think about their thinking (e.g. Paul, 1992; Swartz, 2003; Torff & Warburton, 2005). Based on the idea that what learners actively gain for themselves is more fully possessed than what is given to them (Bryan, 2002; Ruggiero, 2003), it is vital to teach students to use critical-thinking skills in the performance of certain structured challenging thinking tasks (Papastephanou & Angeli, 2007). And further, critical thinking should be developed through continuous training and practice (Scriven & Paul, 1987). In fact, one of the six lessons that van Gelder (2005) draws upon is that practice in critical-thinking skills improves skills themselves while, as Nickerson (1984) argues, it makes them more readily accessible for application in other contexts in which they might be needed. Besides, ‘practice produces proficiency’ (Flores et al., 2012, p. 222).

Thus, if critical thinking involves argumentation, then practice should involve practice in argumentation (Yeh, 2001). Educators, for example, tend to say that students have poor critical-thinking skills when reasons are poor or counterarguments are not addressed (Yeh, 2001). Therefore, a simple way to improve critical thinking is to guide and teach students to provide good reasons and consider counterarguments (Yeh, 2001). Besides, argumentation skills exist within students in a latent state and, given minimal guidance at schools, students are able to improve the quality of their argumentation (Kuhn, 1991). Poor thinking can be at least partially remedied by appropriate practice (Fisher, 2001).

Under this framework, a person learns to think critically in the ways in which he/she practices thinking critically (Willingham, 2007), since critical thinking is that mode of thinking about any subject, content or problem in which the thinker improves the quality of his/her thinking by skillfully reflecting upon the structures inherent in thinking and applying intellectual criteria upon them (Scriven & Paul, 1987). In accordance to that, teaching for critical thinking means improving the quantity and quality of meaning that students derive from what they read and perceive and that they express in what they write and say (Lipman, 1988). Therefore, unless the students are actively doing the thinking themselves and not just being exposed to examples of critical thinking, they will never improve (Plath et al., 1999; Swartz, 2003; van Gelder, 2005). As Paul et al. (1997) argue, even if active engagement is essential to critical thinking, what matters is how the learner is engaged, since one can be actively engaged and not think critically. Therefore, students need to identify their learning and the critical-thinking principles and skills they and other students are applying (Plath et al., 1999; Swartz, 2003; van Gelder, 2005) since the more supported and challenged students are to practice the critical-thinking skills, the stronger these skills become (Keeley et al., 1982; Insight Assessment, 2015). Under this framework, the teaching for critical-thinking skills should be transparent and followed by guided practice and use in a range of contexts (Dewey & Bento, 2009) where teachers should have a coaching role (McGuinness, 1999).

Despite its importance, practice or repetition is not enough, since practice should take place in the context of judgment, which is involved in all aspects of critical thinking through applying this knowledge in a variety of contexts and content areas (Bailin et al., 1999b; Facione, 2000) with guidance from an effective instructor (Facione, 2000; Willingham, 2007). In that vein, whatever the "content" to be learned is, teachers need to encourage students to approach critical-thinking rich activities or tasks in the spirit of "I can figure this out," or "I can use my mind and thinking to understand this." (Elder and Paul, 2010). In that vein, the simple student performance of certain procedures identified in descriptive terms (e.g. thinking of reasons for and against a position, brainstorming alternatives) is insufficient to ensure that what students have done counts as critical thinking (Bailin et al., 1999b). On the contrary, teachers interested in teaching students to become better at critical thinking cannot actually teach mere (mental) processes, since these are non observable and can be identified only via their products (Bailin, et al., 199b). Instead, they need to rather stress the cognitive processes of using knowledge, that is, the critical-thinking skills, and orient them and motivate students to, for example, notice fallacies or look for invalid arguments, through purposefully selected teaching material (Bailin et al., 1999b; Newmann, 1991). Besides, the only way we can describe what one is able to do in thinking is by assessing the outcomes generated by the thinking (Bailin et al., 1999a). In this respect, teachers need to provide clear feedback to the students concerning their demonstration of particular critical-thinking skills (Ennis, 2011; Keeley et al., 1982). Besides, practicing critical-thinking skills is not simply a matter of continually repeating them in the same manner or context, but rather of being alert to and attempting to correct possible mistakes and continually striving for improvement according to the relevant standards of adequacy and quality performance (Bailin et al., 1999b). The pedagogical focus then shifts to the question of what the learner needs to understand so as to meet the criteria of good thinking in particular contexts (Bailin, 2002). Therefore, the educational goal should be to teach students to do such tasks well by sharpening students' critical judgment by reference to criteria and standards that distinguish, for example, thoughtful evaluations from messy ones (Lipman, 1988). In that vein, teachers should be more interested in the characteristics or demands of tasks (e.g. whether tasks require compare and contrast) rather than on the types of tasks (e.g. writing, presentation) and to integrate analytic components into each class assignment in order to enhance students' critical thinking (Shim & Walczak, 2012). As Willingham (2007) aptly puts it, *"teaching students to think critically probably lies in small part in showing them new ways of thinking, and in large part in enabling them to deploy the right type of thinking at the right time"* (p.15).

From another point of view, it is also important to empower students to become reflective, that is, to be able to consider and question the appropriateness of the critical-thinking tasks and their context, the consolidated criteria, practices and idea(l)s (Papastephanou & Angeli, 2007). Therefore, having students consciously reflect on their core ideas and encouraging them to analyze these ideas by asking them for examples, similarities, assumptions, inconsistencies and alternatives, or even challenging their ideas by facilitating them to generate hypotheses and interpret information or data, can enhance their thinking skills (Pither & Soden, 2000). Besides, asking students to, for example, assess the reliability of sources to make informed critical judgments is completely different from just asking them to read the text and get the facts (Swartz, 2003), which is a low-CT activity, according to Torff & Warburton (2005), who used such prompts for assessing teachers' beliefs about classroom use of critical-thinking activities. In accordance to that, Paul (2005) contends that *'a person is a critical thinker to the extent that he or she regularly improves thinking by studying and critiquing it'* (p. 28). Similarly, McKendree et al. (2002) contend that *'students need to understand that such 'questioning the question' is sometimes a very good thing to do'* (p. 64). Besides, making inferences from reading passages and critiquing arguments are core topics in critical-thinking based instruction (Marin & Halpern, 2011).

Transferability of Critical-Thinking

Another question with regard to the teaching for critical thinking is whether and under what conditions critical-thinking skills transfer from one context to another. For, in a critical-thinking based instruction, the goal is not for students to merely understand and use particular skills when they are taught but also to be able to recognize when those skills are needed for use in a novel situation, across domains and/or in real-life situations (Halpern, 1988, 1998, 2001, 2002; Tiruneh et al., 2014). In this respect, transferring critical-thinking skills concerns the carry-over and use of those skills and principles to contexts other (i.e. curriculum subjects, real-life situations) than the ones in which they were initially taught (Kennedy et al., 1991). In particular, transfer can mean transfer across subject areas in school curriculum, transfer from one task or situation to another within a particular subject area or transfer from the school subjects to the real out-of-the-school life of students (Kennedy et al., 1991). However, many studies conclude that any transfer usually occurs within the domain in which the thinking was learned (Pithers & Soden, 2000). Their main argument derives from the subject-specificity view on critical thinking that holds that critical-thinking skills are domain-specific, that is influenced by the content of the domain and thus they are unlikely to transfer to other domains (e.g. Glaser, 1984). Despite the argumentation put forward, the social constructivist educational paradigm stresses the importance of the transferability of critical-thinking skills to real-life and out-of-the-classroom situations (ten dam & Volman, 2004). In that sense, learning in individual fields may guarantee transfer of critical-thinking skills to daily life since there are many interfield commonalities in critical thinking, that is, a common set of basic principles that applies in most fields (Ennis, 1989, 1997).

According to Halpern (2002), teaching in ways that help students to become better thinkers and to transfer these skills to novel situations is possible when teachers teach specifically for transfer. In particular, critical-thinking skills are enhanced and are more likely to transfer to novel situations when they are explicitly taught and practiced through a variety of problems or contexts (Dewey & Bento, 2009; Halpern, 2002). Halpern (1998) even proposed a model for teaching thinking skills so that they are transferred across domains of knowledge. The model consists of four parts: (a) dispositions for effortful thinking and learning, (b) instruction and practice of critical-thinking skills, (c) training activities designed to facilitate transfer across contexts, and (d) metacognitive monitoring for directing and assessing thinking. In her model, Halpern (1998) stressed the need to encourage students to practice with different examples and problems that have the same structural aspects so that they can become aware of the skills and strategies they use and consequently be able to apply them in new situations. As McTighe (1987) also asserts, deliberate instruction placing emphasis on the enhancement of students' metacognitive skills can be helpful in promoting transfer.

Under this framework, when teaching aims to transfer, it is important to design learning activities through which the skills can be encoded in a way that will facilitate their triggering and recall in novel situations (Halpern, 1998, 2002). These activities should enable learners to focus on the structural characteristics of the tasks/problems (Halpern, 1998, 2002). Similarly, Willingham (2007) contends that transfer of skills, such as solving a problem, occurs only when the learner gets more familiar with the deep structure of the problem (e.g. mathematical skills required to solve a problem) rather than its surface structure (e.g. the scenario that the problem describes), and becomes aware that he or she should look for it in every case. In addition, if the learners realize that the problem they are working on is best represented in a particular way, this might be helpful for identifying the important aspects of the problem (McKendree et al., 2002) which they may encounter in other similar problems. Therefore, repeated exposure to similar problems with different surface structures but a same deep structure is needed for the transfer of skills to take place. And further, according to ten dam and Volman (2004), if students' critical-thinking skills are enhanced through meaningful domain-related topics connected with current and future situation(s), then it is more likely for the transfer of skills to occur. In this respect, it seems that success of any transfer method depends on what is being taught and how it is being taught (Nickerson, 1988). As Nickerson (1988) concludes, there is perhaps a need both to teach thinking in a content-free way, so as students become aware of the specific aspects of thinking on which instruction is targeted, and also to teach subject-matter courses in such a way so as to clarify the applicability of good thinking in those contexts and to provide opportunities for training there.

Nevertheless, general critical-thinking skills do not readily transfer (Prawat, 1991), and thus their transfer cannot be always guaranteed (Angeli & Valanides, 2009). In fact, transferring knowledge and skills learned in one context into a new one is not an easy task for students, especially for elementary students, who, according to the theory of Piaget, cannot generalize or handle abstract ideas. However, teachers cannot just rely on Piaget's theory, waiting for transfer to automatically occur, since, although the particular theory had an important impact on education, it is questioned by recent research and theory (i.e. neo-Piagetian theories, theory of mind). Specifically, research has shown diversity in children's thinking across cognitive tasks. In fact, Piagetian levels and estimates of abilities typically confound knowledge and reasoning since children may possess many of the abilities at an earlier age than Piaget described (Brown, 1997). In addition, transfer of skills varies with the type of students since some students usually transfer skills without being taught, while other students rarely do it even if they are taught (Ennis, 1997). What's more, the fact that transferring critical-thinking skills and dispositions is not an easy task does not mean that teachers need to abandon it since transfer to other types of material and context is an important goal of a critical-thinking based instruction (Halpern, 1998).

Assessment of Critical Thinking

Given that critical thinking is a complex concept (e.g. Abrami et al., 2008; Bangert-Drowns & Bankert, 1990; Brookfield, 2003; Fasko, 2003; Nieto & Saiz, 2008; Niu et al., 2013; Pithers & Soden, 2000; ten Dam & Volman, 2004), critical thinking assessment, albeit difficult to do well, is possible (Blattner & Frazier, 2002; Ennis, 1993). Like other assessments of educational outcomes, there is a need for tests or other measures that are sensitive enough to pick up subtle changes in students' thinking abilities' (Halpern, 2001, p. 273). In this line of reasoning, a quality assessment of student critical thinking has a twofold aim: Firstly, to address the dual problem of whether students can think (more) critically and, if they can, whether they can actually use their critical-thinking skills without specific prompting (Halpern, 2001).

As Ennis (1993) asserts, the format used, as well as the purpose of critical thinking assessment is what makes the difficulties vary. With regard to the main purposes for critical thinking assessment, these concern: i) diagnosing the level of students' critical thinking performance in terms of weaknesses and strengths, ii) giving students feedback about their critical-thinking performance, iii) motivating students to be better at critical thinking, iv) informing teachers about the success of their teaching approaches for enhancing students' critical thinking, v) doing research on critical-thinking instructional questions and issues, vi) providing help in deciding whether a student should enter an educational programme, and vii) providing information for holding schools accountable for the critical-thinking prowess of their students (Ennis, 1993). In fact, researchers can fall into traps if they are unaware of the purpose for which a critical-thinking test will be used (Blattner & Frazier, 2002; Ennis, 1993). However, as Blattner and Frazier (2002) claim, these purposes, especially the last two higher stakes purposes, cannot be fully addressed through the administration of multiple-choice tests since, as Ennis (1993) further explains, the diagnosis would possibly be less comprehensive. In addition, there is evidence showing that evaluation of the effectiveness of instruction can be influenced by the type of critical thinking assessment and measures employed (Tiruneh et al., 2014). For instance, in two studies comparing explicit and imbedded instructional modes, Marin and Halpern (2011) found that both modes of instruction showed significant gains in student's critical thinking, even if the explicit mode had a larger effect. This could be attributed to the fact that in their studies they had particularly included instruction on topics (e.g. argument analysis) particularly addressed by the Halpern Critical Thinking Assessment Instrument they had used for pre- and post-test assessment (Marin & Halpern, 2011).

As the format chosen for critical-thinking assessment, the most known method is the use of multiple-choice tests. Nevertheless, multiple-choice tests usually require one right answer and do not necessarily encourage critical thinking that seeks multiple answers or solutions (Paul, 1992; Savage, 1998), nor do they reflect test takers' ability to think critically under unprompted situations (Ku, 2009). In addition, multiple-choice tests do not reveal individuals' underlying reasoning for choosing a particular answer (Ku, 2009). And further, questions that require one right answer do not encourage critical thinking, which is an open-ended activity (Ennis & Weir, 1985) seeking multiple answers/solutions (Paul, 1992; Savage, 1998). Therefore, there are times when multiple-choice tests may not be the most appropriate way to evaluate students' critical-thinking performance (Staib, 2003), such as when students are asked to analyze an idea, identify and choose among alternatives and counterarguments, and provide a rationale for drawing a certain conclusion. Under this framework, multiple-choice tests tend to have problems with validity, as Halpern (2001) comments. Still, research on psychological and educational testing indicates that well crafted multiple choice tests can validly and reliably measure higher order cognitive skills (Haldyna, 1994, cited in Facione, 2000, p. 72).

Other viable alternative ways for critical thinking assessment include the addition of justification requests to multiple-choice items, and essay testing with varying degrees of structure (i.e. high, medium and minimal structure) (Ennis, 1993). As Torff (2005, 2006) comments, an analytic essay, as a task, poses greater critical-thinking challenges (e.g. children do not only need to recall scientific knowledge but also to reason as scientists do) in relation to other formats featuring only multiple choice questions. According to Ennis (1993), a critical-thinking essay test can be a good option for critical thinking assessment since it focuses on more comprehensive testing than the others. The essay can be argumentative in nature requesting students to incorporate source material (e.g. real-life scenarios) into their writing to support their point of view in a controversial issue. In terms of structure, it can vary considerably since it can be of high structure (i.e. providing an argumentative text asking students to appraise the thinking in each paragraph and defend their appraisals with scoring guide), medium structure (i.e. providing an argumentative text and asking students to argue on the main point of view with either a holistic or analytic scoring based on criteria) and minimal structure (i.e. providing only a question to be answered or an issue to be addressed with either a holistic or analytic scoring based on criteria) (Ennis, 1993). Nevertheless, researchers need to take into account that certain contextual variables (e.g. the level of substance and/or consistency of source material/text, lack of contradictions within the source material/ text) may affect the quality of one's critical thinking and consequently the testing results (Fischer et al., 2009). And further, open-ended verbal and written examinations are not the one and only alternative solution since, as Halpern (2001) claims, these tend to have problems with reliability; researchers have to keep in mind that no assessment can be valid for any purpose if it is not reliable. Other methods, such as attitudinal inventories, case study analyses and theoretical debates can be used for critical-thinking assessment as well (Facione & Facione, 1994).

Along this line of reasoning, multiple methods of assessment are preferable for a thorough critical-thinking assessment plan (Blattner & Frazier, 2002; Facione & Facione, 1994; Yeh, 2002). Contemporary critical-thinking testing procedures increasingly require performance assessment emphasizing critical-thinking skills with varying degrees of structure (Ennis, 1993; Yeh, 2002). What so ever, several tools can be used to assess students' critical-thinking skills while correlations can also be found out, something that Blattner & Frazier (2002) did in their study. For example, the multiple-choice tests can be used for various purposes, that is, diagnosis, feedback, motivation, impact of teaching and research (lower stakes purposes) given that judgment is necessary (Ennis, 1993). However, the use of a multiple-choice test can be one method of gathering useful data regarding critical-thinking outcomes (Facione & Facione, 1994). Other methods, such as attitudinal inventories, essay tests, case study analyses, theoretical debates, role playing or talk aloud exercises can provide opportunities for critical-thinking assessment as well (Facione & Facione, 1994). Indeed, for comprehensive assessment, unless appropriate multiple-choice tests are used, open-ended assessment techniques are probably needed (Ennis, 1993). Alternatively, a multi-response format assessment of critical thinking could be preferred (Ku, 2009). For instance, the Halpern Critical Thinking Assessment Using Everyday Situations (HCTA; Halpern, 2007) is a recent attempt that uses both multiple-choice and open-ended response formats into a single measurement tool. As Halpern (2010) explains in the test manual, the HCTA consists of 25 everyday scenarios, each of which is briefly described and presented using common language. For each scenario, there is an open ended (i.e. constructed response) question, which is followed by a forced choice question (e.g. multiple choice, ranking, or rating of alternatives) such as select the best alternative, rate each of the alternatives in terms of their relevance, or decide which of the alternatives presented indicates a good response. However, performance assessment requires considerable expert time devoted to each student and varies in degree of structure, namely minimal structure (e.g. naturalistic observation as in case study taking notes and interpreting descriptions), medium structure (e.g. assessing a student's portfolio of work) and high structure (e.g. making an exploratory assessment effort using a certain task which is designed to assess certain things of interest) (Ennis, 1993).

Critical thinking assessment requires that we have a clear picture about what we want to assess (Ennis, 1993). For instance, Ennis (1993) lists ten abilities and dispositions based on which critical-thinking testing can be guided, such as judging the credibility of sources, identifying conclusions, reasons, and assumptions, judging the quality of arguments, developing positions of an issue, asking appropriate questions for clarification, planning experiments and judging experimental designs, defining terms appropriate for the context, drawing conclusions when warranted, and being open-minded and well-informed. In that sense, in every study, the way critical thinking is conceptualized, such as, for example, critical dialogical exchanges (e.g. Daniel et al., 2005), informal reasoning (e.g. Sadler & Zeidler 2004), argumentation skills (e.g. Zohar & Nemet, 2002), reasoning and problem solving (e.g. Shim & Walczak, 2012) and so on, guides the method and the format of assessment. Most of the times, educational studies incorporate assessment methods relevant to a set of certain critical-thinking skills the researchers choose to examine. For example, Angeli and Valanides (2009) have chosen to use the CCTST (Facione, 1990) along with measuring students' critical-thinking performance reflected in the written work using a rubric for assessing five general critical-thinking skills, namely: (a) analyze the problem, (b) generate solutions, (c) develop the reasoning for each solution, (d) decide which is the best solution, and (e) use criteria to evaluate one's thinking. These were chosen, as Angeli and Valanides (2009) explain, because they reflected the conceptualization of critical thinking as given in the Delphi report (Facione, 1990). Similarly, Malamitsa et al. (2009) have chosen to use the 'Test of Everyday Reasoning' (TER), which targets the core critical thinking skills identified in the Delphi Report' consensus focusing, in particular, on the skills of categorizing, examining ideas, identifying and analyzing arguments, assessing claims, drawing conclusions and justifying procedures. Some studies (e.g. Angeli & Valanides, 2009; Halpern, 2002; Shim & Walczak, 2012) go even further by administering evaluation questionnaires to students so as to analyze their understanding of critical thinking. However, self-reports and self-assessment of how well students can think may provide weak data since the belief that one can think well is not always correlated with actual critical-thinking performance (Halpern, 2002; Shim & Walczak, 2012). Still, it is good to know whether students believe that their thinking has been improved or not, after an instruction designed specifically to improve students' critical thinking (Halpern, 2002).

With regard to the measures for critical thinking, these are as varied as the constructs of critical thinking (Edman, Robey, & Bart, 2002; Shim & Walczak, 2012). Although there is a number of published critical-thinking tests, only a few have actually critical thinking (or some aspect of critical thinking) as their primary concern, while is difficult to find tests for students below fourth grade (Ennis, 1993). Most of the available published critical-thinking tests are general critical-thinking assessments rather than subject-specific (Ennis, 1993; Lai, 2011). According to Ennis (1989), if tests measuring critical thinking are specific to school subject-matter areas, then these tests presumably would not test for transfer of critical thinking instruction to real life, which is a goal for schools. Arguably, *'there is a large gap between the ability to apply critical thinking in fairly trivial, highly structured, and usually multiple-choice tests, on the one hand, and in one's everyday life, on the other'* (Sternberg, 1986, p. 27). As Ennis (1993) further argues, general-content-based critical thinking tests are needed so as to check transfer of critical thinking skills to real-life situations; regardless of whether critical-thinking based instruction is infused in subject matter instruction or whether it is offered separately, or some combination of the two. Some of these tests aim at measuring a single aspect of critical thinking (e.g. *'Cornell*

Class Reasoning Test' for a variety of forms of deductive class reasoning, 1964, by R.H. Ennis, W.L. Gardiner, R. Morrow, D. Paulus, and L. Ringel, Illinois Critical Thinking Project, University of Illinois, aimed at grades 4-14) while others cover more than one aspect of critical thinking (e.g. *'California Critical Thinking Skills Test'*, CCTST, 1990, by P. Facione) (Ennis, 1993). Other widely used critical-thinking instruments are the Ennis–Weir Critical Thinking Essay Test (EWCTET) (Ennis & Weir, 1985), and a more recent one, the Halpern Critical Thinking Assessment Using Everyday Situations (HCTA) (Marin & Halpern, 2011). Many of these tests contain a large amount of reading text. Most of the items are based on analyzing the written discourse to make inferences and judgments, while test takers need to go through a process of questioning, judging relevance and importance of data so as to make inferences or draw conclusions.

Although there are many popular critical-thinking instruments, there has not been a consensus on how critical thinking should be best measured since even if these instruments share common aspects, they vary in their purposes, formats, and contexts (Ku, 2009; Shim & Walczak, 2012). And further, all commercial instruments available to measure students' critical thinking abilities have potential difficulties (Staib, 2003). In that sense, objective tests that have been ranked according to established norms cannot easily evaluate critical thinking, which is unpredictable (Savage, 1998), even if these tests are widely used. For example, several purposes of critical thinking, such as diagnosing strengths and weaknesses of students' critical thinking abilities, providing feedback to students about their critical-thinking skills, challenging students to improve their critical thinking abilities, and informing teachers about students' critical-thinking skills and how the instruction in their classrooms might have contributed to their development, as defined by Ennis (1993), cannot be addressed through the administration of multiple-choice tests that do not even require discipline specific knowledge (Blattner & Frazier, 2002).

Nevertheless, selecting validated measurement is important so as to ensure the rigor of critical thinking research (Niu et al., 2013). In a recent review Ku (2009) focuses on existing tests of critical thinking that are made compatible to reflect both cognitive and dispositional components of the conceptualization of critical thinking. As she states, tests specifically developed to tap the cognitive factor of critical thinking include CCTST (Facione 1990), WGCTA (Watson & Glaser, 1980), and Cornell Critical Thinking Test (CCTT; Ennis, Millman, & Tomko, 1985). These are the multiple-choice tests mainly tapping the cognitive component of critical thinking, with the dispositional component incompletely revealed, since recognizing a single right answer of multiple-choice items cannot reflect the test-takers' inclinations to engage in critical thinking (e.g. Halpern, 2001;

McMillan, 1987). Conversely, as Ku (2009) explains, open-ended tests allow test-takers to demonstrate their cognitive skills as well as their inclination to engage in careful thinking. One such test is the Ennis–Weir Critical Thinking Essay Test (EWCTET; Ennis & Weir, 1985), in which test-takers are asked to make and evaluate argument (Ku, 2009). Even if nothing in the Ennis-Weir test or manual indicates that it was initially designed to explicitly test for disposition, as Taube (1995) explains, in his study, confirmatory factor analysis confirmed the plausibility of a two-factor model of critical thinking, and scores on the Ennis-Weir test loaded significantly on both the ability (0.41) and disposition (.20) factors. Nevertheless, the highly specific context and strict structure of the Ennis-Weir test may restrict the test-takers' responses, and thus the effects of disposition on thinking performance could be greater in less-structured written measures of critical thinking, such as the Illinois Critical Thinking Essay Test (Finken & Ennis, 1993), as Taube (1995) comments. But again, both conclusions seem arbitrary since there aren't enough data, on the one hand, while there isn't any clarification of the quality of disposition, on the other, especially if we take into consideration that the dispositional domain concerns several dimensions. However, there are also tests that have been developed specifically to measure the dispositional domains of critical thinking. Some of these tests are: the CCTDI (California Critical Thinking Disposition Inventory, Facione & Facione, 1992) and the CM3 (California Measure of Mental Motivation, Giancarlo & Facione, 2000). Nevertheless, there are theorists who claim that measuring the dispositional factor of critical thinking using a separate measure is unlikely to fill the gap between what individuals claim they would do (in self-reported dispositional measures) and what they actually do (in an actual test of critical thinking skills) (Ku, 2009).

California Critical Thinking Skills Test (CCTST)

The conceptualization of critical thinking given by the two-year Delphi research project sponsored by the American Philosophical Association forms the conceptual basis of the CCTST (Facione, 1990a; Facione & Facione, 1994). The CCTST was constructed using a bank of 200 multiple choice items of which only 34 were finally selected and designated Form A after a set of tryouts, item analysis, and revision (Facione, 1990b; Jacobs, 1995). The CCTST resulted in being a standardized, 34-item multiple choice test (19 four-option multiple-choice items and 15 five-option multiple-choice items), and non discipline-specific, targeting core critical-thinking skills. As an ability measure, the CCTST has correct and incorrect answers. The CCTST score is the simple sum of the correct items

(Jacobs, 1995). However, the CCTST reports six scores: An overall score on one's critical-thinking skills and five scores on subscales, which are (a) analysis; (b) evaluation; (c) inference; (d) deductive reasoning and (e) inductive reasoning. More specifically, the 34 items can be scored to yield three subscores, that is, analysis (9 items), evaluation (14 items), and inference (11 items), or 30 of the 34 items can be scored to yield two subtest scores, termed deductive reasoning (16 items) and inductive reasoning (14 items) (Jacobs, 1995). The CCTST has an equivalent form, Form B, which was developed by rewriting 28 of the 34 items of Form A, by substituting different terms, names, concepts, and contexts in an effort to maintain the type of topic or problem involved, and the specific critical thinking skill assessed by the original item (Jacobs, 1995).

With regard to the test-takers' age, the California Academic Press aimed initially at college students but recently modified the test so as to make it usable with elementary and high school students, incorporating interpretation, argument analysis and appraisal, deduction, mind bender puzzles, and induction (CCTST-MIB). The item pool for the CCTST in all of its forms and versions including the M-Series has been growing for more than 40 years and continues to evolve, as commented in the updated Manual of the CCTST of 2015.

As referred to the updated Manual of the CCTST of 2015, the validation studies of the first generic forms of the CCTST were conducted using a case-control methodology in college-level institutions in California, leading to the first publication of the generic CCTST. Specifically, four experiments were conducted at California State University in Fullerton during the 1989/90 academic year and involved 1169 college students, five courses, three departments, 20 instructors, and 45 sections (Facione 1990b). In the first experiment, where 945 students of general education critical-thinking courses participated in pre- and post-test groups, the resulting statistics ($t=2.44$, statistically significant at $p<.0075$ for the one-tailed test) confirmed that the CCTST was sensitive enough to detect the growth in students' critical-thinking skills (Facione, 1990b). In the consequent experiments, results were about the same, since the null hypothesis that the instrument would fail to detect statistically significant differences between students who have and have not completed an approved college level critical-thinking course was rejected (Facione, 1990b). For the concurrent validity of the CCTST, regression models for predicting CCTST results were performed (Facione, 1990c). In specific, CCTST pretest results were significantly correlated with seven factors including college GPA ($r= .20$, $p < .000$), Scholastic Aptitude Test (SAT) Verbal Score ($r= .55$, $p<.000$), the SAT Math Score ($r=.44$, $p<.000$), the University's English Placement Test (EPT) ($r =.48$, $p<.000$), the University's Entry Level Mathematics Test (ELM) ($r=.13$, $p=.025$), the number of semesters of high school preparatory English (r=.16, p=.002) and the number of semesters of high school preparatory Math (r =.10, p=.039) (Facione, 1990c). All seven significant correlations discovered to apply to the February 1990 pretest were found to be significant on the May 1990 posttest.

Despite the validation studies recorded by Facione (1990b), Jacobs (1995, 1999) questions the equivalence of the CCTST Form A and B with respect to difficulty and therefore the comparability of scores from Forms A and B, arguing that the modifications made on Form A items to transform them into Form B items made the items more difficult. More specifically, analyzing mean scores based on the 28 modified items on Form A and Form B from data collected from 684 undergraduate students, who completed Form A, and 692, who completed Form B, using a one-way analysis of covariance, with scores based on the six common items as the covariate, Jacobs (1995) found that the mean for Form A, based on the 28 modified items, was significantly higher than the mean for Form B ($F(1,373)= 6.30$, $p < 0.01$). And further, examining the item-total test score correlations, Jacobs (1995) found that some items in both forms show low correlations with total test score, something that has a negative effect on alpha reliability. Jacobs (1995) further argued that the tests appear to be factorially complex with the complexity to differ between forms since, based on the exploratory principal components analysis, 14 independent clusters of linearly combined items with eigenvalues greater that 1.00 were produced, accounting for just over 50% of the variance in CCTST scores. Based on the findings of his study, Jacobs (1995) concluded that the CCTST can be used for research purposes as blocking variable or covariate but not for decision making concerning students' gains in critical-thinking, since the extent to which CCTST scores can detect changes brought about by instruction designed to improve students' critical-thinking skills is still undetermined.

Watson-Glaser Critical Thinking Appraisal

The Watson-Glaser Critical Thinking Appraisal (W-GCTA) is the oldest critical-thinking measure, while it is among the most widely used and studied critical-thinking measures. The WGCTA, as most of the major critical-thinking skill standardized tests, is marketed and used as a predictive measure in a wide variety of educational and vocational contexts (Bernard et al., 2008). It was initially developed in the 1920s and in 1964 two parallel forms (Y and Z) of 100 items each were published under the name Watson-Glaser Critical Thinking Appraisal in the USA (Watson & Glaser, 1964). These forms were revised in 1980 to update the language, improve clarity and eliminate racial and gender stereotypes

(Watson & Glaser, 1980). The new forms, A and B, were shorter at 80 items but kept the basic test structure. The first UK adaptation – Form C (Watson & Glaser, 1991) was based on the US Form B. American-English vocabulary and usage was replaced and content changed where not appropriate for a UK test taker. In 2000, minor revisions were made to Form C and an extensive UK norming and standardisation exercise was also undertaken. The result was the 80 item WGCTA^{UK} (Watson, Glaser & Rust, 2002).

With more demand for the test around the world and shorter forms, two parallel short forms were developed. Form D is a development of the original Short Form S (Form S was composed of 16 scenarios and 40 items selected from the 80-item Form A; it was developed in 1994) with items chosen to be internationally appropriate and amenable to translation into other languages. A parallel 40 item version, Form E, was developed from the original form B test for use in the USA. With regard to Form S, results obtained by the study of Loo and Thorpe (1999), who evaluated its psychometric properties and factor structure, provided only limited support for Form S. For there were poor to moderate internal-consistency reliabilities for scores on the five subscales and poor to moderate recovery of the five subtests underlying the critical thinking construct in the confirmatory factor analysis and principal components analysis.

The W-GCTA was initially designed to measure different, though interdependent, aspects of critical thinking, namely, recognition of assumptions, inference, deduction, interpretation, and evaluation of arguments (Bernard et al. 2008; El Hassan & Madhum, 2007). Importantly, the five subscales contribute to the composite of the W-GCTA, but separately, the subscales are insufficient measures of critical thinking (Bernard et al., 2008; Loo & Thorpe, 1999) since *“it is the composite of these subtests that yields a reliable measure [sic] of critical thinking ability”* (Watson & Glaser, 1994, p. 10). In its latest revised version, the W-GCTA is theoretically based on a three-factor model (Watson & Glaser, 2009) since exploratory factor analyses, follow-up analyses, as well as confirmatory factor analysis, showed that inference, interpretation and deduction loaded onto one factor, namely, drawing conclusions. Therefore, a three-factor model was confirmed as the optimal model for the W-GCTA, with the factors being recognizing assumptions, evaluating arguments and drawing conclusions.

The W-GCTA is composed of short reading passages or scenarios including problems, statements, arguments, and interpretations of data similar to those that one can encounter on a daily basis at work, in study and in newspaper or magazine articles. The content requires critical evaluation and cannot necessarily be accepted unquestioningly. Each scenario is accompanied by a number of items to which the participant responds (user guide-manual, 2012).

In their study, Bernard et al. (2008) investigated the psychometric properties of the W-GCTA subscales in two different ways, on the one hand to determine if there are separate and identifiable subscales and, on the other, to determine if the test is best scored and interpreted as a general measure of critical thinking. In particular, they analyzed the inter-correlation matrices for the five subscales contained in 13 published studies of the WGCTA. Their results indicated that each of the 10 pairs of average correlations (i.e. each subscale paired with the others) was significant, but that all but one average correlation violated the assumption of homogeneity of correlation. In addition, they found that no clear subscale structure is discernable by analyzing 60 sets (data from pre-tests and post-tests) of subscale means contained in 60 studies. Exploratory factor analysis yielded one (critical-thinking) factor, which confirms the unidimensional structure of the WGCTA, for which other researchers (e.g. El Hassan & Madhum, 2007) argue as well.

Cornell Critical Thinking Test

The Cornell Critical Thinking Test (CCTT) was firstly developed back on the 70s by Robert H. Ennis when at Cornell University and the University of Illinois. Its conceptual framework relies on the "Cornell/Illinois model," according to which critical thinking is a reasonable and reflective thinking focused on deciding what to believe or do (Ennis et al., 2005, 2004, 1985, 1989, 1991). It has two levels, CCTT - Level X and CCTT - Level Z (Ennis et al., 2005, 2004, 1985). Level X is aimed at students in grades 4-14 (age 9-18+) and Level Z is aimed at advanced and gifted high-school students, college students, graduate students, and other adults. Both general-content, multi-aspect critical-thinking ability tests, levels X and Z, cover three types of inferences, namely, induction, deduction, value judging, and four types of bases, namely, the results of other inferences, observations, statements made by others and assumptions (Ennis et al., 2005, 2004, 1985). However, some skills, which are considered relatively sophisticated, such as dealing with meanings, are given heavier weighting in Level Z than in Level X while induction, deduction, and assumption identification are strongly weighted in both tests (Ennis et al., 2005, 2004, 1985). As Ennis et al. (2005, 2004, 1985) admit, listing separately the skills along with the numbers of items intended to contribute to the testing of each skill may be an oversimplified task, especially when there is proof that the different aspects of critical thinking are interdependent and do not operate separately but rather complementarily

(Bailin et al., 1999a; Bernard et al., 2008; Ennis, 1991; Ennis et al., 2005, 2004, 1985; Facione, 2000; Facione & Facione, 1996; Swartz, 2003; Zohar et al., 1994).

Level X is a 71-item and Level Z is a 52-item multiple choice test while each is intended to be taken within a 50-minute period (except for the use of Level X in the elementary school) (Ennis et al., 2005, 2004, 1985). For use of Level X with elementary students, the reading aloud of all instructions and sample items, and the soliciting of questions about each set of directions need to be added and the test developers recommend a relaxed atmosphere for administering the test to children of this age (Ennis et al., 2005, 2004, 1985). Each item on each test has three choices and one keyed answer (Ennis et al., 2005, 2004, 1985). For scoring the tests, two formulas can be used, that is, the "correction for-guessing" (R – W/2) method (rights minus one-half the number wrong) or the "rights only" method (Ennis et al., 2005, 2004, 1985). With regard to reliability estimates, these range from 0.67 to 0.90 on Level X and 0.49 to 0.87 on Level Z (Ennis et al., 2005, 2004, 1985).

With regard to the validity of the CCTT, Ennis et al. (2005, 2004, 1985) have organized the discussion of the validity of Level X and Level Z into three categories, that is, "content related evidence of validity," "criterion related evidence of validity," and "construct validity," with the first two being relevant to the third. However, they argue there is not enough information to make a construct validity judgment with justified confidence since, as they characteristically say, *'after forty years of use in various ways, there is still not enough evidence to declare unequivocally that these are valid tests. We feel instead that it is likely that they are substantially valid'* (Ennis et al., 2005, p. 20). Nevertheless, Ennis et al. (2005) attempted in the updated manual of CCTT-Level X and Z to prove the construct validity of the test by referring to eleven relevant pieces of information: 1) the rationale upon which the tests are built, 2) the degree to which the tests appear to cover the items in the rationale, 3) reasonable judgments about the acceptability of the answers, 4) simple internal statistical analyses, such as item analyses and internal consistency indices, 5) consistency of test results over time for individuals (including test-retest consistency), 6) the reasonable correlations with other critical thinking tests, 7) correlations between the test and assorted other variables (i.e. gender, scholastic aptitude, academic performance, age, and socio-economic status, 8) consistency across groups or settings (generalizability), 9) the loosely expectable results of experiments in which people tried to teach critical thinking ("loosely" because it is not sufficiently clear what transpired in these experiments), 10) the inconclusiveness of the factor analyses, and 11) the Level-X-enabled knowledge of the relationships between critical thinking abilities and other factors. Despite these eleven pieces of information, Ennis et al. (2005) report an overlap between the critical-thinking skills measured by the Cornell Critical Thinking Tests in the fifth edition of their manual when presenting the findings of their tests' validity. The argument of overlapping among critical thinking skills in relation to the items that represent them in a test is usually used by researchers to explain and justify the results of their attempts to examine the construct validity of tests developed within their studies that reflect the difficulty to identify the unique effect of each skill separately (e.g. Zohar et al, 1994).

Teachers' Conceptions of Critical Thinking

As Kember (1997) points out, teachers' conceptions of teaching influence teaching approaches, which in turn have an effect on student learning outcomes. Therefore, any measures to enhance the quality of teaching (i.e. teachers' empowerment from teaching for critical thinking) should take into account the teachers' conceptions so as to be effective, since teaching approaches are strongly influenced by the underlying beliefs and conceptions the teacher holds (Kember, 1997).

With regard to critical thinking, there are researchers who believe that teachers in general do not effectively teach for critical thinking nor are they able to design instructional environments promoting critical thinking as a result of their own vague conception of critical thinking (Barak et al., 2007; Paul, 2005; Paul et al., 1997; Stapleton, 2011). This ascertainment is in line with the findings of a longitudinal case-study made by Barak et al. (2007), who found that only 20% of the interviewed high-school teachers who claimed to promote higher-order thinking among their students in certain ways were actually purposefully integrating teaching strategies for promoting higher-order thinking skills, while their students had a significant pre-post improvement on their critical-thinking skills. Similarly, Paul et al. (1997), in a study with faculty members from thirty eight public and twenty-eight private colleges and universities (teacher education programmes), who were interviewed about critical thinking and asked to provide the researchers with self-reported information on course designs and teaching strategies they use for promoting critical thinking, found a lack of understanding, practice, and teaching of critical thinking. For example, even if most of the participants (89%) claimed that critical thinking was a primary goal in their instruction, only 19% could clearly formulate a meaning for critical thinking, while only 9% were clearly teaching for critical thinking on a typical day in class. Results indicate that most of the faculty participants had a vague and/or internally incoherent conception of critical thinking (Paul et al., 1997). Investigations of the faculty's conceptions of critical thinking and consequently instructional processes at the university level appear to need more research (e.g. El Hassan & Madhum, 2007; Gul, Khan, Ahmed, Cassum, Saeed, Parpio, Profetto-McGrath, & Schopflocher, 2014). In another study of Stapleton (2011), 72 high-school teacher participants also presented a narrow understanding of critical thinking while they expressed the need for training and support.

From another perspective, as Onosko (1991) argues, teachers who can articulate their conceptions of critical thinking and claim to be skilful at it, consistently incorporate critical thinking into their teaching (e.g. Onosko, 1991). However, this is not always the case. For instance, teachers may claim that their teaching is based on student-centered educational theories and methods that facilitate understanding and promote critical thinking, but instead they may behave didactically in class. In that vein, teachers may claim to teach their students how to think critically although they are actually only concerned with teaching content (Fisher, 2001). This can be attributed to at least four reasons: a) Teachers' emphasis on covering the curriculum which they consider more important rather than spending time addressing the teaching of thinking (e.g. Astleitner, 2002; Dewey, 1933; Kennedy et al., 1991; Koutselini, 2006, 2008a, 2008b, 2013; Onosko, 1991); b) Teachers' confidence in didactic teaching that supports knowledge transmission (e.g. Barnes, 2005; Onosko, 1991; Paul 1995, 2005); c) Teachers' insufficiency to be critical thinkers themselves (e.g. Paul et al., 1997); d) Teachers' lack of knowledge and anxiety about having to teach something that is complex to define while they have not even been trained to teach (e.g. Astleitner, 2002; Niu et al., 2013; Paul et al., 1997; Ruggiero, 2003; Savage, 1998) and thus being inapt to invest any time or effort (Tsui, 2001). In fact, with regard to the latter, as Marin and Halpern (2011) comment, it is hard to find any coursework in the instruction of critical thinking (explicit or otherwise) designed for the practicing or future teacher. In fact, there are studies that confirm that teachers at any level of education have no formal preparation (course, seminar, or workshop) in critical thinking (e.g. Gul et al., 2014; Zygmont & Schaefer, 2006) before their participation in a formal training offered by the research studies, in which participated. Other barriers to teaching for higher order thinking, identified by Onosko (1991), concern teachers' lack of planning time, a culture of teacher isolation that does not encourage collective action in similar instructional concerns, and teachers' low expectations of students. With regard to the latter, findings from the studies of Torff and Worburton (2005) are rather insightful as to how the "advantage characteristics" (i.e. academic ability, prior knowledge, and motivation) teachers consider in attribution of a learner as high advantage or low advantage intertwine with the critical-thinking-use beliefs they hold, as well as with teachers' observed classroom practice.

Although in the field of critical thinking there are studies dealing with 'what teachers think', namely, dealing with teachers' conceptions of critical thinking (e.g. Barak et al., 2007, Paul et al., 1997; Stapleton, 2011) or teachers' beliefs about high-critical thinking and low-critical thinking activities for high-advantage and low-advantage learners (Torff & Warburton, 2005), direct observation of teaching practices or classroom observations during teachers' empowerment and training on teaching for critical thinking are not included in most of the studies (e.g. Dewey & Bento, 2009; Zohar et al., 1994). In fact, a lot of the studies that examine classroom practice tend to rely on self-reported data (either by teachers or students) rather than observational data (Tsui, 2002). A relevant study was that of Shim and Walczak (2012), which used college students' self-reported gains in critical thinking in order to examine the impact of certain instructional practices of the faculty to the development of students' critical thinking abilities and made no class observations. Even if their results from multinomial logistic regression and OLS regression analyses showed that certain instructional practices (e.g. asking challenging questions) increased students' self-reported critical thinking abilities, the concern of whether self-report measures are valid or not remains (Halpern, 2001). And that is because, as Shim and Walczak (2012) themselves admit, students' self-reports may reflect students' satisfaction with teaching experiences or their own perception of their developmental levels and not an accurate standardized measurement of their actual critical-thinking ability level. To minimize the risk, Shim and Walczak (2012) used direct measures of critical thinking (i.e. the Collegiate Assessment of Academic Proficiency) as well, but again actual teaching was not recorded nor was an enhancement of faculty's instructional practices attempted. In a similar vein, while Zohar et al. (1994) found that students who participated in the Biology Critical thinking Project improved their critical thinking skills compared to their initial level and compared to their counterparts in the control group, classroom observations were not reported. Instead, Zohar et al. (1994) asked teachers of the experimental and control group to report one lesson per week so as to examine whether the teaching strategies used in the Biology Critical Thinking Project influence the learning environment. But again, only self-reported data are discussed, which could have been more valid if classroom observations had taken place as well. Along this line of reasoning, *educational change does not depend only on what teachers think but also on what teachers do* (Koutselini, 2008b, p. 31). From another perspective, in the study of Gul et al. (2014) classroom observations indeed took place while teacher participants' reflections, especially with regard to the obstacles they may have faced in promoting critical thinking were also obtained. Nevertheless, the study of Gul et al. (2014) did not examine whether the recorded improvement in educators' level of questioning, teaching strategies, and facilitation skills actually impacted on students' critical thinking. Researchers themselves admit that improvement of these particular instructional variables *"could have impacted students' critical thinking"* (p. 41), but there isn't any proof. And further, while Gul et al. (2014) mention that teachers' understanding and misperceptions of critical thinking were explored during the first training workshop, these are not thoroughly presented and discussed or somehow related to their reflections at the end of the training.

Teacher Professional Development

"Professional development consists of all natural learning experiences and those conscious and planned activities which are intended to be of direct or indirect benefit to the individual, group or school, which contribute, through these, to the quality of education in the classroom. It is the process by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purpose of teaching; and by which they acquire and develop critically the knowledge, skills and emotional intelligence essential to good professional thinking, planning and practice with children, young people and colleagues throughout each phase of their teaching lives" (Day, 1999, p. 4).

Unpacking Day's (1999) definition on professional development, one can understand that the ultimate goal of teacher professional development concerns improving student learning outcomes through improving the quality of teaching (Creemers et al., 2013; Desimone, 2009; Guskey, 2003; Kyriakides et al., 2017a; Munro, 1999). Research findings reveal that teachers can improve their teaching skills and have a significant impact on student achievement, given that they undergo appropriate treatment and participate in effective professional development programmes (Antoniou et al, 2011; Desimone, 2009; Munro, 1999). Even more, teachers themselves appear to link in-service training and professional development to the improvement of school practice (Karagiorgi & Symeou, 2007). In that sense, helping teachers to understand (more) deeply the content they teach, as well as the ways students learn and use that content, appears to be a vital dimension of effective professional development (Desimone, 2009; Guskey, 2003). However, what constitutes effective professional development is questionable, since there is a range of learning experiences that could potentially increase and improve teachers' knowledge and skills, from formal structured topic-specific in-service seminars to everyday, informal "hallway" discussions with other teachers about teaching techniques and practices (Desimone, 2009). Therefore, whether and how the quality of teaching and teacher pedagogical knowledge can be improved depends on the type of approach to professional development used to facilitate any change, as well as on its duration (Creemers et al., 2013; Desimone, 2009).

The two dominant approaches to teacher training and professional development are the competency-based approach and the holistic approach (Creemers et al., 2013). Based on the competency-based approach, clear goals are defined in terms of effective skills and behaviors, which teachers should gradually acquire at the end of a course of study in order to improve student learning (Creemers et al., 2013; Guskey, 2003). The courses are enacted as modules of instruction that are developed to train teachers in each of the specific skills that have been identified by research findings as teacher competencies that have an impact on student achievement (Creemers et al., 2013). A course is classified as competency-based when specific competency-based material and training guidelines are designed to be used as part of the programme (Creemers et al., 2013). The competency-based approach has both strengths and weaknesses. Its strengths mainly concern the reliance on clear objectives, the clarity of the competencies to be acquired and the application of certain criteria to evaluate each teacher participant's ability to perform the set of competencies under focus (Creemers et al., 2013). Its weaknesses mainly concern the rather "technocratic" way the teacher is "treated" and evaluated, as if the effective teacher can be described in terms of fragmented competencies which can be learned in a series of training sessions (Creemers et al., 2013). In addition, in the delivery of such programmes, teachers' critical or creative thinking is not expanded since they are not engaged in reflective thinking procedures to produce knowledge; they are rather learning knowledge that they try to enact in class (Creemers et al., 2013).

On the other hand, there is the holistic approach, which is based on the reflective practitioner paradigm (Creemers et al., 2013; Koutselini, 2008b). Based on its theoretical origins, the reflective practitioner paradigm *"demands a dialectic relationship between teachers and students as well as between teachers and their actions, a relationship that holds all the mysteries of unique persons and actions"* (Koutselini, 2008b, p. 35). According to this paradigm, teachers continually reflect upon their teaching by taking into account their students' different needs in order to maximize their learning, especially when teachers become empowered learners. A major influence in the reflective practitioner paradigm traces back to the work of John Dewey, who defined reflective action as an action through which the person actively, persistently and carefully considers beliefs and supposed forms of knowledge in light of evidence and the further consequences to which it may lead. Nevertheless, as Creemers et al. (2013) point out, the concept of reflection remains vague, since different concepts have emerged over time, such as “teachers as researchers”, “teachers as reflective practitioners”, or even “teachers as inquirers”, which has made the concept even more unclear. However, taking the different definitions given to the holistic approach together, one realizes that teachers use different areas of research to inform their ideas of reflection and for doing that they make use of various methods such as journal writing, narratives, action research and stimulated recalls (Creemers et al., 2013). The reflection usually takes place in the micro-level of their class, where teachers can purposefully and contextually reflect upon their practices and perform thoughtful self-evaluation on their teaching quality (Koutselini, 2008b; Koutselini, 2015). Sometimes this process is facilitated by a colleague, that is, a peer friend who can visit the class, listen, observe and give feedback (Creemers et al., 2013). In this respect, Day’s (1999) recommendations for professional development and learning in schools through peer coaching, critical friends and working on tasks together seem to be insightful. Peer and other types of coaching can be done by using several ways and methods such as classroom observation and feedback; joint critique of videotaped teaching practice; paired, small-group, or whole-group meetings; electronic bulletin boards, or chat rooms (Barnes, 2005). In this context, when teachers are engaged in professional development programmes that employ a holistic approach, they are given autonomy to reframe their professional identities and teaching experiences in a reflective situated learning environment so as to achieve their professional development and growth on their own (Koutselini, 2015). For that reason, the holistic approach has been described as a reaction against more centralized policy perspectives in teacher training and professional development (Creemers et al., 2013). However, the holistic or reflective approach has both strengths and weaknesses. Its strengths mainly concern, on the one hand, the encouragement of teachers to reflectively analyze, discuss, evaluate and change their teaching practices, and the respect of professional autonomy that allows teachers to actively take decisions, on the other (Creemers et al., 2013). Its main limitation concerns the lack of a grounded theoretical framework and research evidence upon which specific teaching skills could be developed (Antoniou et al., 2011; Creemers et al., 2013). Its reliance solely on the experiences of teachers, which can be limited, is what makes the holistic approach vague in terms of content (Creemers et al., 2013). In proof of that, the study of Antoniou et al. (2011) revealed that teachers employing a holistic approach to professional development adopted a less focused reflection strategy based on which they could reflect on any aspect of their teaching practice irrespective of the developmental stage, namely needs and priorities, on which they were situated. For example, as Antoniou et al. (2011) pointed out, some teachers employing the holistic approach developed action plans aiming to differentiate their instruction, but their attempts to incorporate differentiation in their teaching were unsuccessful. Teachers might not possess basic skills corresponding to their developmental stage, such as classroom management and structuring, which might be considered as a prerequisite for the differentiation of teaching and learning (Antoniou et al., 2011).

Along this line of reasoning, it seems that there is no definite answer as to which of the two dominant approaches is the most effective one to improve quality of teaching and student achievement. In that vein, by taking into account the strengths and weaknesses of the two approaches, Creemers et al. (2013) explored the possibility of their merging. They considered that critical reflection on the one hand, and a scientific knowledge base on effective teaching skills on the other, should be major elements of effective teacher professional development programmes. In this context, Creemers et al. (2013) suggest the integrated approach to professional development, the major elements of which concern providing teachers with the scientific knowledge base, derived from the educational effectiveness research on the one hand, and encouraging their critical reflection upon that knowledge, that is mainly based on their teaching experiences, on the other. In particular, the integrated approach employs three stages of reflection, the descriptive, the comparative and the critical stage (Creemers et al., 2013). During the descriptive stage, the teacher together with a facilitator or a research team identifies and describes aspects of his/her teaching that would need improvement. At the comparative stage, the teacher applies skills and knowledge received by the programme in class and reflects upon them by analyzing their effects. At the third stage of the integrated approach, the critical reflection stage, the teacher, having implemented the new teaching skills and strategies, evaluates the different choices and alternatives and integrates the new meaningful knowledge with what he/she already knows and performs (Creemers et al., 2013). However, reflection cannot stand alone if a scientific knowledge base is not incorporated in the professional development programme. In proof of that, relevant interventional studies that used the integrated approach (Antoniou & Kyriakides, 2011; Antoniou et al., 2011; Demetriou & Kyriakides, 2012; Kyriakides et al., 2017a) reveal that aiming to empower teachers to take decisions for their improvement strategies which are in line with the knowledge base of educational effectiveness research, can have a positive impact on both the quality of teaching and student achievement. The integrated dimension can be used along different knowledge bases incorporating specific theoretical frameworks. The dynamic approach used for a three-year teacher professional development course on quality of teaching (Kyriakides et al., 2017a) is such an example, since it particularly derives from the grouping of teacher factors included in the dynamic model of educational effectiveness (Creemers & Kyriakides, 2008). Throughout the three years the dynamic approach established training sessions of a similar structure that aimed to support teachers in designing their own action plans with regard to specific teaching skills, implementing and revising them throughout the course of the programme (Kyriakides et al., 2017a). In a similar way, the study of Munro (1999) revealed that a structured professional development that combines aspects of direct instruction, peer coaching and reflection can have a direct impact on the display of effective teaching behaviors and on teachers' personal explicit theory of learning. In particular, the 32 secondary teacher participants in the study of Munro (1999) were engaged in a systematic analysis of their existing knowledge of learning by testing these against empirical data in teaching and against contemporary theories of learning so as to apply them in their classes, which is the key-element of the integrated approach to professional development.

Another issue of concern in the field of professional development pertains to the characteristics of an effective professional development programme. Many theorists and researchers in the field of professional development (e.g. Barnes, 2005; Creemers et al., Day, 1999; Desimone, 2009; Munro, 1999) came to conclusions with regard to those characteristics. From the field of higher education in particular, Barnes (2005) lists some essential components of an effective teacher professional programme model. Those characteristics concern: (a) finding an effective facilitator, (b) selecting participants wisely and involving them in planning, (c) looking into (previous) research learning experiences to develop and implement curricula and processes, (d) implementing peer coaching, (e) ensuring institutional support, (f) evaluating and revising the professional development effort, and (g) re-implementing the curricula and coaching (Barnes, 2005). Similarly, Desimone (2009) concludes with at least five features of professional development, critical to increasing teacher knowledge and skills and improving their practice: (a) content focus, (b) active learning, (c) coherence, (d) duration, and (e) collective participation. In a more concerted way, Creemers et al. (2013) have pointed out the characteristics of an effective professional development programme, which mainly concern: (a) a valid theoretical framework linked to daily teaching and positively related to student progress, (b) needs' assessment of participants, (c) opportunities for teachers' active engagement and feedback on their performance, (d) opportunities for collaboration and networking among the teachers of the same school or class, (e) sufficient duration of the programme combined with sustained follow-up support, and (f) evaluation of the programme's impact on both the teaching quality and student achievement. With regard to the needs' assessment, professional development is likely to be more effective when focused upon teachers' needs (Creemers et al., 2013; Kyriakides et al., 2017a; Linder, 2011; McLaughlin & Talbert, 2006), since that contributes to the enhancement of teachers' knowledge base, professionalism, and ability to (re)act on what they (want to) learn. In that sense, we can – and should – speak about differentiation of teachers' professional development and growth, taking into account that each teacher holds different attitudes, experiences, and knowledge (Koutselini, 2015). Furthermore, with regard to the duration of the professional development, it appears that intellectual and pedagogical change requires time both in terms of time span over which the professional development activities take place and number of hours spent for each activity (Desimone, 2009).

Teacher Professional Development Programmes in Critical Thinking

What the research reveals is that teachers need to receive training and support to substantially understand what critical thinking is all about (Paul, 2005), how teaching is related to the development of critical thinking, and how to design learning environments appropriate for teaching and promoting critical thinking (Dewey & Bento, 2009; Ennis, 1987; Flores et al., 2012; Paul et al., 1997; Shim & Walczak, 2012; Stapleton; 2011). The existing research base appears to record several teacher professional development programmes aimed at having a positive impact both at student and teacher level in terms of promoting thinking skills and critical thinking in class (e.g. Barnes, 2005; Dewey & Bento, 2009; Zohar et al., 1994). These, even though differently designed and enacted and recorded in different levels of education, that is, college, university, high-school or elementary level, indicate a beneficial effect on teachers' conceptual knowledge of critical thinking and ability to integrate thinking skills in class. Despite such positive findings most of these studies involved self-selected samples and self-reported data with no objective measures of change in teaching practice.

In elementary education, there is the ACTS infusion intervention that dealt with activating the thinking skills of elementary students aged between 7 and 9 years (Dewey & Bento, 2009) and engaging teachers in training sessions with regard to the ACTS methodology. The ACTS methodology was based on the taxonomy of thinking from Swartz and Parks (1994), which delineates the thinking skills of critical thinking, creative thinking, searching for meaning, problem solving, and decision-making and metacognition. Teachers were taught the different types of these thinking skills through their participation in training sessions. In particular, teachers participated in a two-day initial training seminar focusing on the taxonomy of thinking and infusion lesson design, and another two review days later on during spring and summer term focusing on metacognition, language, and social collaboration, respectively (Dewey & Bento, 2009). The training encouraged teachers to identify lessons across the curriculum in which they could teach content alongside an emphasis on a specific thinking skill from the taxonomy of thinking from Swartz and Parks (1994). In that vein, the ACTS project did not provide a pre-constructed pack of prescribed lessons but rather involved teachers in the redesigning of existing lessons with an explicit emphasis on thinking skills (Dewey & Bento, 2009). Even though the intervention lasted for two years, it is apparent that the training and support that the teachers were receiving was not ongoing. Nevertheless, the results of the study revealed that ACTS intervention was linked to students' consistent enhanced performance on cognitive ability tests while self-reported data obtained by teacher participants following the first and second year of the ACTS intervention (July 2003 and July 2004) indicated gains in their knowledge and teaching skills (Dewey & Bento, 2009). A limitation of the study was that there weren't any observations focused on the quality of the lessons delivered, something that complicates the discussion of the results since the extent to which teachers were integrating the principles of teaching thinking into all aspects of their practice could not be ascertained, other than by teacher self-reporting.

In secondary education, the 'Biology Critical Thinking Project' in Israel dealt with incorporating into the biology curriculum carefully designed activities for developing specific critical thinking skills (Zohar et al., 1994). According to the design of the project, the teachers of the experimental classes of 7th-grade students (ages 12-13) participated in a preparation course (eight meetings of 3 hours each) that included theoretical (e.g. What is critical thinking? What educational goals can be achieved by teaching it?), and practical issues that focused on how to teach the biology critical-thinking activities (Zohar et al., 1994). The 24-period course was found to be sufficient for preparing teachers to teach those activities, since in Israel preservice teacher education in biology emphasizes teaching by inquiry, and thus most teachers were using this approach anyway in their regular teaching. Therefore, the teachers were familiar with some of the issues discussed in the training course (Zohar et al., 1994). The results of the study revealed that students who participated in the project improved their critical thinking skills compared to their initial level and compared to their counterparts in the control group, while improved critical-thinking skills were observed both in new biological contexts and nonbiological everyday topics (Zohar et al., 1994).

In higher education, a relevant critical-thinking initiative is the Integrated Thinking Skills Project that took place in the early 1990s at the Community College of Aurora, Colorado (Barnes, 2005). According to the project's initiative, an ongoing, comprehensive professional development model was formulated that fully engaged faculty in their own learning and helped them build a learner-centred curriculum infusion process. In that vein, faculty was involved in planning, meaning that those interested were planning the project themselves by contacting those who had already implemented and valuated successful programs so as to integrate successful information and learning experiences in the project. Faculty members were also in charge of facilitating sessions where they could practice using a variety of effective teaching and learning methods (Barnes, 2005). Despite the ardent discourse, Barnes (2005) does not clearly reveal whether and in what ways the project was linked to students' enhanced critical-thinking performances, something that is merely justified, since the relevant chapter mainly aimed at presenting a professional development model for the teaching and learning of critical thinking.

Another initiative in higher education involving teacher training was the interactive teaching experience offered by the "Computer Simulation for Teaching General Critical-Thinking Skills" training Programme to 178 preservice teachers (Yeh, 2006).The guided practice design of the CS-TGCTS consisted of two consecutive simulations with integrated guided practice, each taking about two hours to complete (Yeh, 2006). Results have indicated that teachers with high intrapersonal intelligence and critical-thinking dispositions performed better in teaching skills than those with low intrapersonal intelligence and critical-thinking dispositions (Yeh, 2006).

More recently, the study of Gul et al. (2014) has reported an intervention design incorporating teacher training aimed particularly at determining whether faculty members' pedagogical skills for the promotion of students' critical thinking could be enhanced by providing them with formal training about the ontology and epistemology of critical thinking. In terms of training, faculty members participated in two learning workshops (3-days the first one and 2-days for the second one, with a total of 40 hours of direct contact) that took place 14 weeks apart over a two year period. With regard to the content, which was rather interdisciplinary, the training workshops placed emphasis on critical-thinking skills and dispositions, characteristics of a critical-thinker, challenges and barriers in teaching critical thinking, teaching strategies to promote critical thinking, Bloom's taxonomy, as well as types, quality, and levels of questioning.

Research Agenda

The significance of enhancing students' critical thinking, since they are not learning the critical-thinking skills they need, as well as the fact that teachers are not well-informed and/or resistant to teaching for critical thinking and/or focused on delivering the prescribed curriculum, emphasizes the need for research efforts focusing on examining ways to empower teachers towards teaching for critical thinking. Besides, if we want to transform the way students learn and enhance their critical thinking abilities, we must also help teachers expand their own knowledge, skills and outlook, especially in elementary education where critical-thinking research efforts are lacking. In that sense, the present study emphasized the value of designing a critical-thinking research effort employing teacher professional development in teaching for critical thinking for obtaining empirical support for success in fostering students' critical thinking at the elementary level.

In order to do that, the study drew upon research findings pointing out that teachers need to receive training, support and empowerment to substantially understand what critical thinking is all about (Paul, 2005), how teaching is related to the development of critical thinking, and how to design learning environments appropriate for teaching and promoting critical thinking (Dewey & Bento, 2009; Ennis, 1987; Flores et al., 2012; Paul et al., 1997; Shim & Walczak, 2012; Stapleton; 2011). Even more, the study took into account that discussion still continues about how training participatory interventions can be realized more effectively and how teaching can be improved so as to obtain more satisfying results (Niu et al., 2013; Wolcott et al., 2002). In particular, the fact that it is still unclear under what conditions elementary teachers could be activated on, and supported towards teaching for critical thinking for obtaining gains in student critical-thinking outcomes, was used as a key-element in the study.

Under this framework, the present study has been geared towards developing a concerted and mindful teacher professional development programme in teaching for critical thinking so as to strengthen teachers' knowledge of, commitment to and improvement of, teaching for critical thinking and bring on positive effects on students' critical-thinking outcomes and performance in the subject area of Language Arts. In addition, taking into account that few researchers evaluate the impact of teacher professional development on student learning (Creemers et l., 2013), the present study aimed at empirically examining the effects of the teacher professional development programme on the student critical-thinking outcomes, the quality of teaching and teachers' perceived ability to teach for critical thinking.

CHAPTER III

METHODOLOGY

Chapter III addresses research methodology. The chapter explains the method chosen and contains information on the student and teacher sample and the data collection procedures. Subsequently, the chapter analyzes in depth the intervention, that is, the teacher professional development programme in teaching for critical thinking that was developed within the study, as well as the choice and implementation of data collection methods and instruments. Lastly, the chapter briefly presents the data analysis techniques used for the data obtained in the study.

Introduction

The purpose of the study was to develop a well-planned teacher professional development programme in teaching for critical thinking and to empirically examine its effects on elementary students' critical-thinking as well as to explore the presuppositions, conditions, processes and difficulties in teaching for critical thinking in the subject area of Language Arts. The findings of the study particularly refer to the impact of the intervention, that is, teachers' engagement in professional development in teaching for critical thinking, upon three dependent variables: (a) student critical-thinking outcomes, (b) the quality of teaching consistent with a critical-thinking based instruction, as well as (c) teachers' reflections upon their perceived ability to teach for critical thinking. In particular, the purpose of the present study is achieved by:

a) Designing and implementing the teacher professional development programme in teaching for critical thinking. The programme was explicitly based on a substantive concept of critical thinking (Facione, 1990a) and focused on progressive improvement of instruction through developing teachers' critical thought (Paul, 2005);

b) Examining and comparing the student critical-thinking outcomes within and between the groups (control and experimental) before and after the completion of the intervention – teachers' engagement in professional development;

c) Analyzing the magnitude of the instructional effects on student critical-thinking performance in relation to other teacher background characteristics (e.g. teaching experience) and student background characteristics (e.g. sex, academic achievement);

d) Investigating the contribution of the ongoing teacher professional development in teaching for critical thinking on the quality of teaching and teachers' perceived ability to enhance their students' critical thinking.

Under this framework, the present study falls into the process-product studies that attempt to identify relationships between what teachers do in the classroom (the process) and what students learn as a result of this instruction (the product) (e.g. Hiebert & Grouws, 2007; Kyriakides et al., 2002). Nevertheless, teacher professional development aims to have an effect, in terms of improvement, on both the process (i.e. teachers' practices in class to promote critical thinking) and the product (i.e. student critical-thinking performance). In accordance to that, the study makes a valuable distinction in the types of knowledge or data that is collected to inform practice: (a) knowledge *of practice*, or information about student critical-thinking performance since there is an exploration of connections between teaching practice and student critical-thinking outcomes, and (b) knowledge *for practice*, or information about best practice since observation and reflection on how practice has been successful or has fallen short of expectations take place (McLaughlin & Talbert, 2006). The figure below presents the relationships between the concepts examined in the study:

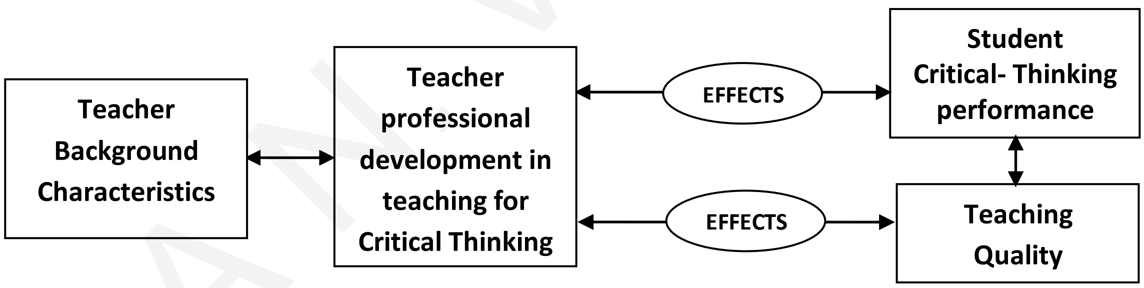

Figure 3.1: Relations between the concepts examined in the study

The relations between the concepts examined in the study are presented to be bidirectional. On the one hand, it is hypothesized that the background characteristics of teachers, that is their educational background, their teaching experience as well as the way they conceive critical thinking, affects their teaching. In addition, teachers' reflections upon their teaching may alter or influence their understanding of critical thinking as well as the quality of their teaching. On the other hand, if teachers are not left alone in their concern about the urgency of teaching for critical thinking but instead are engaged in a well-planned professional development in teaching for critical thinking, then their teaching skills might be improved. Consequently, the development of teaching skills and behaviours consistent with a critical-thinking based instruction can have an impact on student critical-thinking outcomes. For example, students, who are given tasks that call upon them to develop their own categories and modes of classification instead of being provided with them in advance, may develop their critical thinking in an effective way. However, at the same time, student critical-thinking performance may – and should – 'inform' teachers so as to make the appropriate teaching choices and/or change their teaching practices, since the effects of teaching are usually mediated by students' thinking (Hiebert & Grouws, 2007). After all, 'teaching is influenced by students and has a bidirectional quality' (Hiebert & Grouws, 2007, p. 372).

For achieving the aims of the study, advice and recommendations made by meta-analytic studies in the field of critical thinking (e.g. Abrami et al., 2008; Bangert-Drowns & Bankert, 1990; Behar-Horenstein & Niu, 2011; McMillan, 1987; Niu et al., 2013) are taken into account. These mainly refer to the needs of i) adopting a clear operational definition for critical thinking and the critical-thinking skills addressed in a certain content domain; ii) measuring them in the context of everyday problems and decision-making situations; and iii) clearly explaining why particular instructional paradigm(s) and teaching experiences employed should enhance critical thinking in this domain.

With regard to the first point recommended, a clear operational definition for critical thinking is adopted while the critical-thinking skills incorporated are clearly stated since, as Ennis (1991) asserts, *"clarity of justified goals is required before we can confidently make decisions about curriculum, instruction and assessment"* (p. 22). In fact, as Halpern (2001) stresses, any assessment of student gains in critical thinking needs to be based upon an operational definition. In this respect, in the present study, the definition of critical thinking given by a cross-disciplinary international panel of 46 expert theorists in thinking, who participated in a two-year Delphi research project under the sponsorship of the Committee on Pre-College Philosophy of the American Philosophical Association back in 90s (Facione, 1990a), is adopted, since that was an effort to define and measure critical thinking in a coherent way, taking into account both its normative and descriptive conceptions. According to the definition, critical thinking is a purposeful reflective process (Facione, 1990a) during which a person forms a self-regulatory judgment in order to decide what to believe or do in a given context, and, in doing so, that person uses a set of cognitive skills, namely, analysis, interpretation, evaluation, inference and explanation, as well as self-regulation processes (Facione, 1990a; Facione & Facione, 1994). In that sense, the student critical-thinking performance, which is measured in the study, is determined by the competence of the student to use the critical-thinking skills of analysis, interpretation, evaluation, inference, explanation and self-regulation for deriving from what he/she reads and perceives and expressing in what he/she writes and says quantity and quality of meaning (Bean, 2011; Lipman, 1988; Paul, 2005).

With regard to the second point recommended, the critical-thinking skills addressed in the study are measured in the context of everyday problems and decision-making situations, meaning that the main Critical-Thinking Instrument developed within the study for assessing the student critical-thinking performance incorporates real-life source material, both in terms of kind (i.e. text article) and content (i.e. interesting and challenging for students). And further, there was an effort for the instrument(s) to be sensitive enough to stimulate students to exhibit certain critical-thinking skills incorporated in the operational definition of the study and to pick up subtle changes in students' thinking abilities so as to assess the educational outcomes of the intervention (Halpern, 2001).

With regard to the third point recommended, teacher participants engaged in the professional development programme in teaching for critical thinking were empowered towards certain principles of a critical-thinking based instruction. These principles, which were employed and clearly stated within the programme, briefly concerned: (a) the explicit teaching of critical thinking (Bensley et al., 2010; Ennis, 1989; McGuinness, 1999; McTighe, 1985; Swartz, 2003; Zohar et al., 1994); (b) the integration of critical thinking into content instruction (Plath et al., 1999; Swartz, 2003; Zohar et al., 1994); (c) the setting of a certain context (i.e. material understanding, making an evaluative judgment, solving a problem or making a decision) under which one would engage in critical thinking (e.g. Ennis, 1989, 1991; Facione, 2011; Fischer et al., 2009; Shim & Walczak, 2012); (d) the use of strategies for skillful critical-thinking performances, when appropriate (Swartz, 2003; Willingham, 2007); (e) the practice of critical thinking in critical-thinking rich activities and structured challenging tasks (Plath et al., 1999; Swartz, 2003; van Gelder, 2005); and (f) building a learning environment of thoughtfulness and self-reflection (Newmann, 1991; Papastephanou & Angeli, 2007; Plath et al., 1999; Swartz, 2003).

Design: Justification of the Method Chosen

According to Cohen, Manion & Morrison (2008), researchers need to make decisions on various issues when designing their research that mostly concern four main aspects: a) research orientation, b) research methods, c) data analysis and d) presentation of the research results. These decisions become easier when the relevant theory and research in the field has been thoroughly studied, the research problem has been clearly defined and the research questions and purposes have been clearly determined (Cohen et al., 2008).

Under this framework, the present study adopts a quasi-experimental research design since teacher participants volunteered to participate in the study after they had positively replied to the call for teacher professional development in teaching for critical thinking that was launched at the beginning of the school year 2016-2017. Therefore, the quasi-experimental research design was chosen as the most appropriate one to empirically examine the effects of the intervention, that is, teachers' engagement in professional development in teaching for critical thinking (programme developed within the study), on elementary student critical-thinking outcomes, as well as on the quality of teaching. In that sense, the research was a between- and within-groups design in which a range of data were obtained from the two groups, the experimental and the control group. The assessment of the student critical-thinking performance at the beginning (pre-test) and the end of the intervention (post-test) allows the researcher to address internal validity threats and establish causal relationship between intervention and changes in student learning outcomes (Behar-Horenstein & Niu, 2011; Cohen et al., 2008).

To reach the aims of the study, both quantitative and qualitative methods were used. To this end, the study employs the mixed-method research model, which incorporates both quantitative and qualitative methods and elements in the analysis and interpretation of data (Johnston & Onwuegbuzie, 2004; Cohen et al., 2008). The mixed-method research model is widely used by researchers in the field of education and teaching for critical thinking in particular (e.g. Barak et al., 2007). Besides, both qualitative and quantitative approaches are necessary to assess changes in student critical thinking performance (Behar-Horenstein & Niu, 2011), since the qualitative ones reveal what is possible, while quantitative ones can demonstrate what is probable (Hiebert & Grouws, 2007).

In particular, teachers' reflections upon their professional development experience and the effectiveness of the programme as well as the reflective journal of the principal researcher were used to obtain the qualitative data of the research. With regard to the quantitative data of the research, at the level of the student, these were obtained by the Student Critical-Thinking Instrument administered at the beginning (pre-test) and the end (post-test) of the school year, the Student Reasoning Essay administered as an interim-testing as well as the Student Demographics' Questionnaire, all three of them developed within the study. At the level of the teacher, quantitative data were obtained by the Critical-Thinking Observation Tool and the Teacher Demographics' Questionnaire. The mixed-method research model has benefits since using one method alone cannot contribute in the same way, whereas many sources of data are better than a single source because multiple sources lead to a fuller understanding of the goal in the context of the study (e.g. Bogdan & Biklen, 1992). Findings are mixed or integrated at some point in the research, since a qualitative phase, for example, notes taken in the reflective journal or even classroom observations, is conducted to inform a quantitative phase, that is, the assessment of the student critical-thinking performance, sequentially, to gain additional insights. In case the quantitative and qualitative phases are undertaken concurrently the findings are, of course, at a minimum, integrated during their interpretation (Johnston & Onwuegbuzie, 2004). In this line of reasoning, the mixed-methods research model strengthens and validates the results and conclusions of the study through the triangulation of data and the triangulation of methodologies (Cohen et al., 2008).

With regard to the duration of the research, the study employs characteristics of both cross-sectional and longitudinal research. The research is cross-sectional since different elementary students are compared at the beginning and at the end of the school year (Cohen & Manion, 1994). However, the research employs a key-characteristic of longitudinal research, that is, the repeated data collection from the same subjects (teachers and students) in different times (i.e. a three observations for each teacher, once per 1,5 month, and pre-test, interim, and post-test for students). Based on that, the research can be considered as a cohort research or follow up study (Cohen et al., 2008; Cohen & Manion, 1994, p. 68) since factors affecting progress can be identified. The combination of characteristics of both cross-sectional and longitudinal research is chosen so as to make good use of their advantages on the one hand, and limit their disadvantages on the other, since the advantages of the one are the disadvantages of the other (Cohen et al., 2008).

Participants

A total of 23 teachers and 395 students of 5^{th} (n=296) and 6^{th} (n=99) grade from 14 elementary schools volunteered to participate in the study. The 14 schools were equally divided into two groups, the control and the experimental, and thus automatically the teachers and their students were randomly assigned into these groups. In that vein, there was a randomization of the participants at the school level. In particular, 12 teachers and 205 students (from 7 elementary schools) constitute the experimental group while 11 teachers and 190 students (from 7 elementary schools) constitute the control group. The 12 teachers of the experimental group were trained, empowered and supported towards teaching for critical thinking in the elementary Language Arts course by being engaged in a well-planned professional development programme. Teachers of the control group did not receive any kind of training or support in teaching for critical thinking. Nevertheless, from an ethical perspective, teachers of the control group were given confirmation that they would receive the instructional material of the intervention after the completion of the research since they did not participate in the intervention. The present study considered having a control group important so as to empirically examine the effects of the intervention mainly through the comparison of student critical-thinking outcomes within and between the groups. The study took into account the recommendation made by many researchers in the field of critical thinking, who discourage the use of an experimental design that does not include a control group (e.g. Ennis et al., 2005) or at least a wait list control group (e.g. Dewey & Bento, 2009; Marin & Halpern, 2011).

With regard to the teacher sample, all are females and work in public elementary schools in two provinces of Cyprus, Nicosia and Larnaca. Six out of the 23 teachers, three in the experimental and three in the control group, were in charge of 6th grade (99 students = 48 in the experimental & 51 in the control) while the remaining 17 were in charge of 5th grade (296 students = 157 in the experimental & 139 in the control). Teacher participants' age ranged from 32 to 50 years with a mean age of 44.4. In keeping with teacher-expertise benchmarks set out by Berliner (1992), something that Torff & Warburton (2005) also did, participants had a minimum of 5 years of teaching experience, which ranged from 10 to 30 years with an average of 22.3 years. All of them positively replied to the call for teacher professional development in teaching for critical thinking that was launched at the beginning of the school year 2016-2017.

With regard to the student sample, the initial total of the student sample was 448. The 53 students, who did not eventually participate in the study, were students of special education, students whose parents did not give them the permission to participate in the research, students who partly participated in the research procedure (completing either the pre-test or the post-test only), and students who did not speak and/or understand Greek well. Emphasis was given to data obtained by students who could not speak and/or understand Greek well, as indicated by their teachers. Those students were not able to handle the Greek language as a thinking tool and had trouble in taking the test(s); thus they were accordingly treated, that is, excluded from the analysis, since students' level of literacy is significantly linked to critical thinking ability (Marin & Halpern, 2011; Paul, 1992, 2005). From the 395 students, 173 are males and 222 are females. In particular, in the experimental group of the 205 students, there were 91 males and 114 females while in the control group of the 190 students there were 82 males and 108 females (see Table 3.1).

Table 3.1

Student and Teacher Sample

	Schools	Teachers	Initial student total in each class	Final student total (Participants)	Student participants	
					Males	Females
Experimental Group	S1	T1	20	19	9	10
	S2	T2	19	17	7	10
	S3	T3	16	12	7	5
	S3	T4	15	13	4	9
	S4	T5	18	16	9	7
	S4	T6	15	12	3	9
	S5	T7	22	22	13	9
	S5	T8	22	20	8	12
	S5	T9	20	18	8	10
	S6	T10	19	16	7	9
	S7	T11	20	17	8	9
	S7	T12	23	23	8	15
Total	**7**	**12**	**229**	**205**	**91**	**114**
Control Group	S8	T13	21	19	11	8
	S8	T14	20	17	8	9
	S9	T15	18	15	7	8
	S10	T16	15	11	5	6
	S11	T17	21	21	6	15
	S12	T18	18	11	2	9
	S12	T19	20	20	9	11
	S13	T20	20	17	5	12
	S9	T21	22	19	8	11
	S9	T22	23	19	9	10
	S14	T23	21	21	12	9
Total	**7**	**11**	**219**	**190**	**82**	**108**
Experimental Group	7	12	229	205	91	114
Control Group	7	11	219	190	82	108
TOTAL	**14**	**23**	**448**	**395**	**173**	**222**

With regard to age, students aged 10-11 years (5th and 6th grade in Cyprus elementary school) were the age-group chosen to form the student sample for three reasons: a) Firstly, although students of any age can understand and use critical thinking, they differ in the kinds of challenges they are able to master; older students seem to perform better in more complex and challenging tasks (Kennedy et al., 1991; Newmann, 1991); b) Piaget's theory, as well as neo-Piagetian theories of intellectual development, stress that thinking becomes progressively more systematic and logical as the working memory increases, something that correlates with age and the thinking experiences provided (e.g. Case, 1978); and c) according to the findings of the meta-analysis of Bangert-Drowns and Bankert (1990), elementary students seem to have benefitted more from explicit critical-thinking based instruction (effect size 0.5) than did students of high school or college. Similar findings were discussed in other meta-analyses as well (e.g. Niu et al., 2013).

Data Collection Procedures

The research procedures took three years to be completed. During year one the method design of the research was chosen and the research materials (i.e. student critical-thinking instrument(s), student and teacher demographics' questionnaires, the critical-thinking observation tool, teacher reflections' questionnaire) were developed and pilot-tested. In addition, during year one, all the necessary procedures took place for obtaining permission to conduct research. In Cyprus, pre-primary, primary, and secondary education are under the authority of the Ministry of Education and Culture, which is responsible for the educational policy making, the administration of education and the enforcement of educational laws. Therefore, a written permission to conduct research in public elementary schools was obtained by the Cyprus Ministry of Education and Culture after a relevant research application was submitted to the Centre of Educational Research and Evaluation of the Cyprus Pedagogical Institute. During year two, the actual research took place, while during year three data analysis and comparisons between quantitative and qualitative data were completed, something that allowed for concrete research conclusions.

In particular, during year one, the Student Critical-Thinking Instrument was pilot-tested in a sample of 120 10-11 year-old students. After the pilot-testing, the meaning of certain expressions in some questions was clarified while some questions were totally removed from the Instrument since they were considered rather difficult and/or hard for students to understand. Along with the Student Critical-Thinking Instrument, the interim-test, that is, the Reasoning Essay, was pilot-tested. Of the 120 students, data obtained from 20 of them, who were administered the Reasoning Essay, were used in order to clarify the meaning of expressions used in the essay. In addition, the pilot-testing of both research materials allowed the determination of the research procedures' duration. On the other hand, the Critical-Thinking Observation Tool was pilot-tested by the researcher and another observer, who was purposefully trained (before the programme). The tool was used twice in two different classes so as to edit statements and check whether the selected dichotomous scale (0=no, if not observed, 1=yes, if observed) was working. In addition, the pilot-testing of the observation tool revealed that there was a need to record the frequency of the teaching criteria observed (e.g. how many times or for how long observed) and thus a relevant scale was added. After the pilot-testing, some statements were edited so as to become more specific and consistent with a critical-thinking based instruction while some others were removed. During year two, the actual research took place. It lasted for a school year and there were five phases or rounds of data collection. These are briefly elaborated below.

Round 1 (September 2016): Call for Teacher Professional Development and Teachers' Assignment in Experimental and Control Groups. In the first round of data collection a call for teacher professional development in teaching for critical thinking was launched at the beginning of the school year 2016-2017 in 50 public primary schools in Nicosia and Larnaca. The cities of Nicosia and Larnaca were chosen due to their distance from the University of Cyprus, where the principal researcher was working. The call was specific and provided clear information on the purpose of the programme and its duration, the way the programme was to be enacted as well as the presuppositions of the programme. The presuppositions of the programme particularly concerned collaboration and support from the institution, that is, the school principal, three classroom observations, students' participation and involvement in the research procedures and, most importantly, teacher commitment and active involvement in the programme. That, of course, meant that teachers needed to design their lessons accordingly so as to gradually integrate critical-thinking based instruction principles into their teaching. By the end of September 2016, 23 teacher participants from 14 different public primary schools in Nicosia and Larnaca showed an interest and volunteered to participate in the programme. From the very beginning, teacher volunteers were further informed about the purpose of the study and the research procedures so as to assure that only those who shared the same interest with the principal researcher with regard to teaching for critical thinking, would participate. Their willingness to participate assured that they were truly interested and sympathetic to teaching for critical thinking and willing to (learn how to) do so (Barnes, 2005; Ennis, 1997). And further, it proved that they were positively disposed towards professional development and self-direction of change and development in practice, something that would provide an impetus for their involvement in the programme (Barnes, 2005; Karagiorgi & Symeou, 2007; Munro, 1999). After the initial contact, where teacher participants received tangible evidence that the school and the school principal would support and value their effort (Barnes, 2005), the 14 schools were equally divided into two groups, the control and the experimental, and thus teachers were randomly assigned. All teacher participants were given explanations about the research design and the random assignment. And further, as from an ethical perspective, teachers of the control group were given confirmation that they would be provided with the training and instructional material of the programme after its completion, since they did not actually participate in the intervention. This confirmation acted as an external motive as well that prompted their involvement until the end of the research. In addition, teacher participants in both groups were provided with the written explanatory consent letters that students' parents needed to sign, since their students' involvement in the study was a necessary research condition.

Round 2 (October 2016): Student Critical-thinking Assessment (Pre-testing). In the second round of data collection the critical-thinking performance of all student participants (control and experimental) was assessed in a reliable way through the student Critical-Thinking Instrument that was developed within the study (pre-test). The Student Critical-Thinking Instrument was administered as a paper-pencil test and lasted for 80 minutes. Students had to read a short article retrieved by a children's educational magazine (titled "Dog, a man's best friend") and work on 21 items, 9 multiple-choice and 12 open-ended items. The instrument was well-constructed and had instructions that permitted the researcher to maintain a standardized administration between one testing session, in a class, and the next, in another class. This was particularly taken into account since varying the instructions between one administration and the next can alter the types and the quality of responses the students make, thereby compromising the test's reliability (Groth-Marnat, 2009; Cohen et al., 2008). In addition, there was an effort to ensure adequate lighting, quiet, no interruptions, and good rapport in each testing session. After the completion of the Critical-Thinking Instrument, student participants were administered the short Demographics' Questionnaire, which they needed another 10 minutes to fill in. Students participated anonymously and used code numbers while completing the instrument and the

Demographics' Questionnaire. Before the administration of the instrument(s), signed consents were requested from each student's parents or guardians, who were informed accordingly about the purposes of the research, as well as the voluntary and anonymous participation of their children through an explanatory letter.

Round 3 (November 2016-May 2017): Teacher Professional Development Programme and Classroom Observations. In the third round of data collection, the intervention, that is, the teacher professional development programme in teaching for critical thinking took place. In particular, teachers of the experimental group were asked to engage in a teacher professional development programme where situated learning and reflection aimed to support and empower them towards teaching for critical thinking. To this end, as from November 2016, teachers in the experimental group participated in 24 80-minute training meetings – sessions of initial, interim and ongoing training during which they were given continuous support on how to enhance their students' critical thinking in the elementary subject area of Language Arts. These training sessions took place on a school basis. Meanwhile, teachers of the control group did not receive any kind of training in teaching for critical thinking. The detailed description of the teacher professional development programme in teaching for critical thinking (intervention) follows in the chapter. And further, during the same period, the principal researcher took notes in her reflective journal so that she could address the teacher participants' needs, namely, their misconceptions, deficiencies and/or difficulties in teaching for critical thinking, as well as explore the presuppositions of teaching for critical thinking in elementary classes.

At the same time, as from mid November 2016, three observations of Language Arts lessons were carried out for each teacher participant, that is, a total of 69 observations (23 teachers x 3 times). Each observation lasted for 80 minutes, while all the observations were carried out by the principal researcher, who used the Critical-Thinking Observation Tool. The observation tool was developed within the study and included statements, that is, teaching criteria (qualities of teaching) that were consistent with a critical-thinking based instruction. The observations were spread out over the period that the professional development programme in teaching for critical thinking took place (November 2016, February 2016 and April/May 2016). In addition, observations were spread out over different themes/units within the curricular subject of Language Arts so that teachers of the experimental group would be given space and time to filter and apply all the knowledge base received by the professional development programme. To address the comparison purposes required by the research design, teachers in the control group were also observed in class three times each over the same period (November 2016, February 2016, and April/May 2016).

Round 4 (February/March 2017): Student Critical-Thinking Assessment (Interim Testing). In the fourth round of data collection, an interim assessment of student critical-thinking performance took place. For that reason, all students (control and experimental) were administered a Reasoning Essay, which was used as a midway point between the pre- and the post-test. The Reasoning Essay was administered again as a paper-pencil test and lasted for 30 minutes. Students had to read a school-based scenario, regarding different proposals for punishment after the termination of a basketball game due to disorders, and reach an informed decision by reasoning within a point of view. The instrument was again well-constructed and had instructions that permitted the researcher to maintain a standardized administration between one testing session and the next. In addition, there was an effort to ensure adequate lighting, quiet, no interruptions, and good rapport in each testing session. Students were again asked to use the same code numbers they had used while completing the main Student Critical-Thinking Instrument.

Round 5 (May/June 2017): Student Critical-Thinking Assessment (Post-testing) and Teacher Reflections' upon the Programme. In the fifth round of data collection, after the participatory intervention study was completed, all student participants (control and experimental) were again administered the Critical-Thinking Instrument (post-test). Again, the student critical-thinking instrument was administered as a paper-pencil test and lasted for 80 minutes. The researcher used the same instructions so as to maintain a standardized administration between one testing session, in a class, and the next, in another class. In addition, there was an effort to ensure adequate lighting, quiet, no interruptions, and good rapport in each testing session. At the same time, teachers in both the experimental and the control group were asked to give an academic grade for each of their students' academic achievement using the rating scale 1-20, so that it could be used as a student background characteristic that could predict or contribute to students' critical-thinking performance. Furthermore, after the teacher professional development programme in critical thinking came to an end, teachers in the experimental group were administered a short Teacher Reflections' Questionnaire through which they were asked to reflect upon the effectiveness of the programme. All teachers in the experimental group sent the questionnaire via email two weeks after the completion of the programme. During the same period, teachers of the control group were provided with all the critical-thinking material developed within the teacher professional development programme, as promised.

According to the five rounds of data collection, which are briefly presented in Table 3.2, the study aimed to examine whether and to what extent teachers' empowerment on teaching for critical thinking could expand their scientific knowledge base and encourage their critical reflection upon that knowledge (Creemers et al., 2013; McLaughlin & Talbert, 2006), improve and orient their teaching towards the critical-thinking objective and consequently have an effect on student critical-thinking outcomes.

Table 3.2

The Study's Five rounds of Data Collection

Round	Month	Procedure
1st	September 2016	Call for Teacher Professional Development Teachers' Assignment in Experimental & Control Groups
2nd	October 2016	Student Critical-thinking Assessment (Pre-testing)
3rd	November 2016 - May 2017	Teacher Professional Development Programme Classroom Observations
4th	February / March 2017	Student Critical-thinking Assessment (Interim Testing)
5th	May/June 2017	Student Critical-thinking Assessment (Post-testing) Teacher Reflections' upon the Programme

Intervention Study: The Teacher Professional Development Programme in Teaching for Critical Thinking

Intervention Approach

The teacher professional development programme was developed based on an integrated approach to professional development (Creemers et al., 2013). The major elements of the integrated approach concern providing teachers with the scientific knowledge base on the one hand, and encouraging their critical reflection upon that knowledge, which is mainly based on their teaching experiences, on the other hand (Creemers et al., 2013). In that sense, the programme combined aspects of at least two approaches that are usually employed to facilitate and support change in teacher knowledge and in teaching quality: direct instruction (or competency-based approach), and critical reflection (or a reflective/holistic approach) along with peer coaching, a combination that several other professional development programmes aimed at facilitating effective teaching and learning have used (e.g. Antoniou et al., 2011; Creemers et al., 2013; Demetriou & Kyriakides, 2011; Munro; 1999). Peer coaching as a key-element of the integrated approach was employed so that teachers could receive feedback about their teaching practices after being observed by the facilitator of the programme and/or a peer (in some schools where there was a group of teacher participants). Observation and reflective discussion encouraged teachers to reflect upon their everyday teaching practice so as to learn more, improve it and orient it towards the critical-thinking objective. Besides, learning is more likely when teachers have the opportunity to learn through active construction processes, see that their relevant existing empirical knowledge is valued, frame up authentic goals or challenges for learning, and have the opportunity for individual and collaborative learning activities in order to engage in self-direction and systematic reflection (Koutselini, 2008b, 2015; Munro, 1999). And further, promoting a culture of reflective practice and research among teachers has been one of the priorities that the European Commission has decided upon in order to increase the quality of teacher training programmes in the EU.

Under this framework and based upon the integrated approach to professional development employed for the development of the programme, what actually mattered was developing effective teaching behaviour oriented towards promoting critical thinking. In that sense, it was important that teachers were not only cognitively aware of the theoretical and scientific knowledge related to teaching for critical thinking, but also that they made conscious and reflective decisions to make good use of this knowledge in class.

Intervention Design

For designing the teacher professional development programme, two important elements that determine its effectiveness were taken into account: a) Firstly, an effective teacher professional development is defined as structured professional learning that results in changes to teacher practices and improvements in student learning outcomes (Creemers et al., 2013; Desimone, 2009; Munro, 1999), b) Secondly, effective teacher professional development is defined as a dynamic decision-making process, through which teachers become ongoing empowered learners and reflective thinkers (Creemers et al., 2013; Koutselini, 2008b, 2015).

Under this framework, the study considered the fundamental questions of curriculum that focus on elements of thought and action (Tyler, 1949; Dillon, 2009) so as to put the iterative phases of determining goals, defining content, and designing activities, as well as evaluation, in constant interaction (Gatawa, 1990; Hargreaves, 1991). In that sense, the goals and objectives of the programme were clearly determined, content related to critical thinking was carefully chosen and analyzed to reach the aims, and activities and learning experiences were accordingly designed (Gatawa, 1990). These elements were interrelated since each one of them informed the other, and thus their development was not linear. Besides, as Eisner (1967) asserts, educational objectives need not precede the selection and organization of content. In fact, the means through which imaginative curriculums can be built is as open-ended as the means through which scientific and artistic inventions occur (Eisner, 1967). Under this context, 24 80-minute training meetings – sessions, that were planned to be delivered on a school basis, were accordingly organized. The training sessions were aligned both horizontally in terms of aims, content and activities for each training session, and vertically, since they outlined a sequence for delivering content and provided a clear scope of what teacher participants needed in order to be empowered. With regard to the type of activities in which teachers were engaged in each training session, there were theoretical and practical activities, as well as reflective ones for use at the beginning and the end of each session, although reflection was encouraged throughout the training session. In addition, the manageability, that is, the amount of knowledge and skills that were put into the programme in relation to the allocated time (24 training sessions of 80 minutes each) was taken into account. And further, the coherence of the programme, that is, the relationships between the knowledge and skills included in the programme (Hargreaves, 1991) was considered. Table 3.3 presents an example of the horizontal alignment of the programme (three training sessions), indicating the way that certain goals, a given content as well as some concerted activities, as elements of thought and action, interact and correspond to one another, are shown. Table 3.4 presents the vertical alignment of the programme, that is, an overview of the programme's training sessions.

In order to evaluate the impact of the project, a summative evaluation was assumed. For the purposes of the summative evaluation, the Student Critical-Thinking Instrument was administered to both the experimental and the control group not only at the beginning, but also at the end of the programme intervention. Moreover, in order to measure the impact of the intervention on the quality of teaching, a Critical-Thinking Observation Tool was used three times for each teacher participant (23 teachers x 3 times = 69 observations throughout the programme). Teachers were told the importance of evaluating the impact of the professional development programme and they were ensured that the evaluation results would remain both anonymous and confidential. Furthermore, the principal researcher made sure that each teacher participant in the experimental group received the same amount of support. The only difference between them was related to the kind of interaction since in three schools there was a group of teacher participants while in four schools there was only one teacher participant interacting and collaborating with the principal researcher - facilitator. However, the facilitator of the programme was available to all teachers to support them in teaching for critical thinking. Moreover, in terms of evaluation, teachers in the experimental group were asked to fill in a reflections' questionnaire so as to investigate whether the professional development programme actually strengthened their knowledge of, commitment to and improvement of, teaching for critical thinking.

In another sense, the design of the programme took into account that teacher participants, as well as the principal researcher bring a set of beliefs, conceptions and knowledge to the programme, which is considered a critical input in the whole process. Considering that inputs do not remain static over time, the programme was monitored and revised while implemented based on what was working, and what was not working, and most importantly on the participants' needs (Creemers et al., 2013; Linder, 2011). In that vein, flexibility amendments to the design of the programme by tailoring the training sessions to the needs of the teachers, so as to facilitate them to become empowered learners, were allowed. Thus, teachers were encouraged to continually reflect upon their self and their actions, that is, their teaching practices with regard to the critical-thinking objective. In addition, they were encouraged to purposefully reflect upon the source materials used, such as the Critical-Thinking Curriculum developed within the programme, since such kind of materials form a potential source of professional development when designed to be "educative" (Desimone, 2009). Besides, conceptualizing teachers as active decision makers, who can, and should, exercise choice for becoming masterful and efficacious, is considered an important element of positive psychology (Seligman, 2002). Along this line of reasoning, the programme was designed so as to assure the experiential coherence of the teacher participants, upon which their motivation, commitment and progress depended, if change in their teaching practices is to be aimed and observed (Hargreaves, 1991). In this respect, the programme was focused on progressive improvement of instruction through developing teachers' critical thought (Paul, 2005). Figure 3.2 presents the design of the professional development programme in teaching for critical thinking in a diagrammatical way.

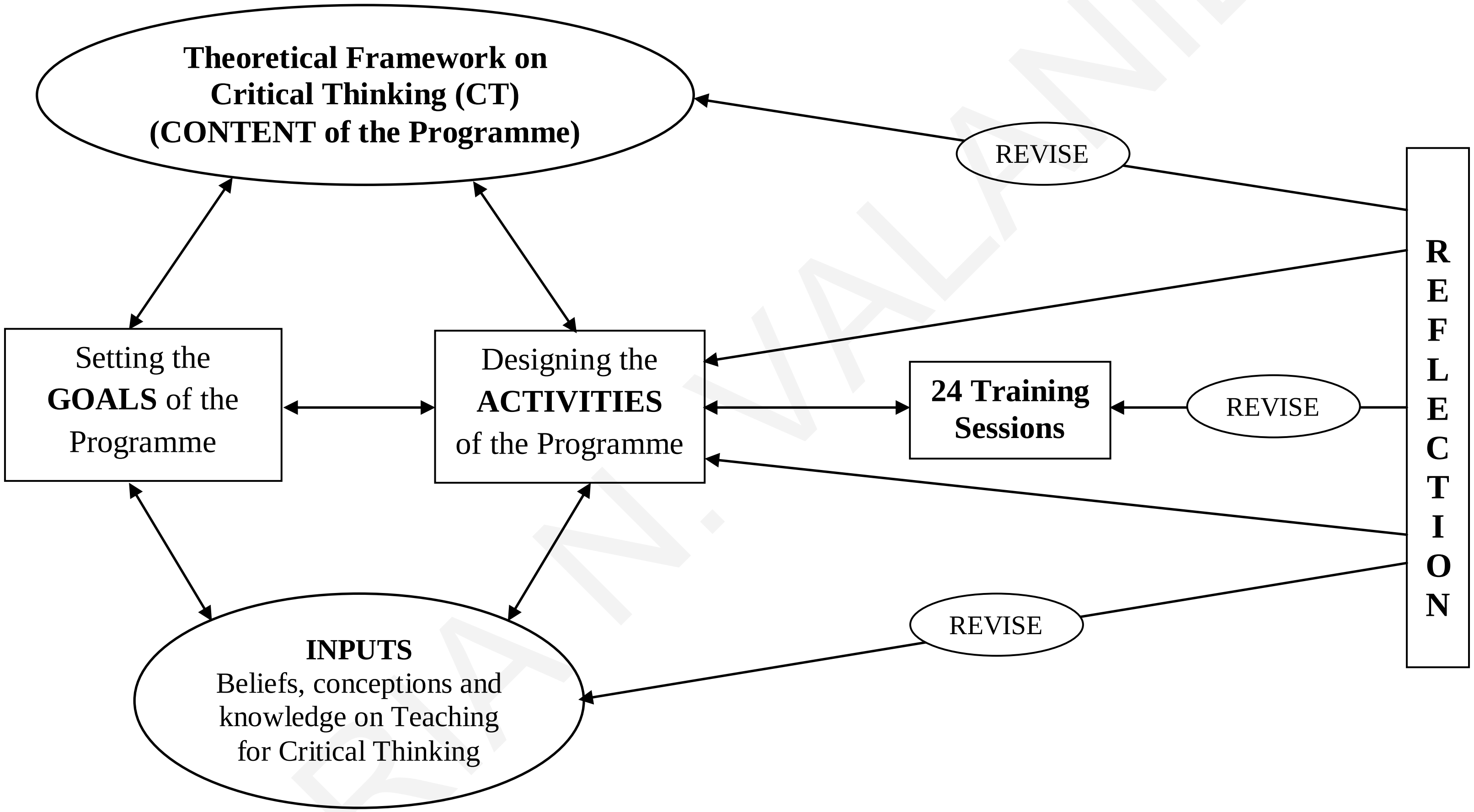

Figure 3.2. The design of the Professional Development Programme in Teaching for Critical Thinking (Developed within the Study)

Table 3.3

A Part of the Design of the Teacher Professional Development Programme in Teaching for Critical Thinking (Horizontal Alignment)

	TRAINING SESSION 1 **Introductory Meeting (Expectations, Aims and Procedures)**	
Goal	**Content**	**Type of activities**
1. Reflect upon and orient their expectations from the teacher professional development programme in teaching for critical thinking.	Main Assumptions of the programme and Administrative Issues	**(Reflective Part):** Discussing the participants' expectations from the teacher professional programme **(Theoretical Part):** a) Explaining the rationale of the professional development programme and its aims; b) Discussing the main characteristics and value assumptions of the integrated approach (Creemers et al., 2013) upon which the development of the programme was based; Focusing on presuppositions for the succession of the professional development programme: *i) Teachers need to be available (given the political, economical, educational conditions), sympathetic to teaching for critical thinking and willing to (learn how to) do so (Barnes, 2005; Ennis, 1997);* *ii) Teachers need to have a positive disposition towards self-direction of change in practice (Barnes, 2005; Karagiorgi & Symeou, 2007; Koutselini, 2008b; Munro, 1999) so as to be involved in the programme;* *iii) Students need to also be positively disposed to be taught in a different way, such that will enhance a purposeful way of thinking.* **(Practical Part):** a) Discussing procedures and administrative issues. Placing emphasis on the importance of evaluating the impact of the programme on teaching quality and student critical-thinking outcomes. Briefly describing the relevant tools to be used: *i) Student Critical-Thinking Instrument – Administered at two time points (pre- and post); ii) Student Reasoning Essay – Administered as a midway point between pre- & post-test (interim testing); iii) Critical-Thinking Observation Tool – Used three times over the period of the programme (November/December 2016, February 2017, April/May 2017);* b) Inviting teachers to participate in semi-structured interviews taking place on a convenient day, time and place preferably before the 2nd meeting (Optional) **(Reflective Part):** Discussing teachers' reflections upon what they have heard in the first meeting; Re-orienting their expectations from the professional development programme – for needs' assessment purposes.

Table 3.3 *(continued)*

TRAINING SESSION 2 The Concept of Critical Thinking – Critical-Thinking Skills and Dispositions		
Goal	**Content**	**Type of activities**
1. Define and explain what critical thinking is; 2. Identify and distinguish CT skills and dispositions	The substantive concept of critical thinking as described in the Delphi report *(Facione, 1990).*	**(Reflective part):** a) How would you define CT. Identify situations (i.e. in everyday life) where you use critical thinking as a grown up person. Make a CT diagram with keywords and decide whether you are a 'good' critical thinker. Explain why referring to specific characteristics. Plenary session so as to inductively reach the conceptualization of critical thinking as a two-factor model (skills & dispositions). **(Theoretical Part):** a) Definitions of critical thinking. What critical thinking is about and what it is not. The substantive concept of critical thinking adopted in the study; b) Core critical-thinking skills (interpretation, analysis, inference, evaluation, explanation and self-evaluation processes) and sub-skills (categorizing, decoding significance, clarifying meaning / examining ideas, identifying arguments, analyzing arguments / assessing claims and assessing arguments / querying evidence, conjecturing alternatives, drawing conclusions / stating results, justifying procedures, presenting arguments, self-examination) according to the theoretical framework adopted within the study; c) The non-linear character of critical thinking: There is no order in which one can use the critical-thinking skills so as to form the judgment about what to believe or do; d) The main CT dispositions (truth-seeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness, and maturity of judgment) according to the study's theoretical framework; e) The relationship between dispositions & skills: Are they dependent or independent learning tracks? **(Practical part):** Teaching scenarios/vignettes and/or learning material/tasks from Language Arts school textbooks are used as prompts for identifying critical-thinking skills and/or dispositions that might be promoted. Relevant prompt questions for discussion: *a) What critical-thinking skills are taught? b) What kind of activities and/or tasks/assignments are used so as to promote them? What exactly do teachers teach? Explain.* **(Reflective part):** Reflect upon your own CT diagram. Add accordingly to your CT profile as a grown up adult. Make your own CT profile as teacher (what CT skills you usually teach). Final Remarks and Conclusions.

Table 3.3 *(continued)*

TRAINING SESSION 3 The Programme's Operational Definition of the Concept of Critical Thinking Applied in a Critical-Thinking Curriculum		
Goal	**Content**	**Type of activities**
1. Interpret and analyze the CT skills as attainment targets and the CT subskills as teaching targets	The new philosophy of the New Curricula in Cyprus (Educational Reform, 2016); b) The substantive concept of critical thinking as described in the Delphi report (skills and subskills) *(Facione, 1990).*	**(Reflective part):** *Main question of inquiry: How would you use or include the critical-thinking skills and subskills mentioned in the previous training session in a Critical-Thinking Curriculum so that it would be a helpful tool for teachers' planning and designing?* You may use the philosophy of the Recent Reform of Curricula in Cyprus, namely success indicators or attainment targets, and competence indicators or teaching targets. Working in pairs or groups (whenever possible) and plenary session – discussion. **(Theoretical Part):** a) The substantive concept of critical thinking adopted in the study interpreted as, and analyzed in, attainment targets (for students, the expected critical-thinking outcomes) and teaching targets (for teachers, the minimum knowledge and skills that teachers need to teach for the attainment of attainment targets) (New Curricula of Cyprus, Ministry of Education and Culture, 2016); b) Core critical-thinking skills (interpretation, analysis, inference, evaluation, explanation and self-evaluation processes) and sub-skills for each skill (Interpretation: categorizing, decoding significance, clarifying meaning / Analysis: examining ideas, identifying arguments, analyzing arguments / Evaluation: Assessing claims and assessing arguments / Inference: querying evidence, conjecturing alternatives, drawing conclusions / Explanation: stating results, justifying procedures, presenting arguments / Self-regulation: self-examination, self-correction) according to the theoretical framework adopted within the study; c) The non-linear character of critical thinking: There is no order in which the CT skills may be included in the Curriculum or in which the teacher may teach and/or promote those critical-thinking skills and subskills; **(Practical part):** a) Studying and working on the new Language Arts Curriculum (2016, elementary education, 5th and 6th grades) as stimulus for identifying any of the critical-thinking skills and/or subskills discussed that might be included; b) Working on our own CT curriculum by analyzing each core CT skill and sub-skills. **(Reflective part):** *Main reflective question: What's possibly missing from the initial draft of our Critical-Thinking Curriculum?* Final Remarks and Conclusions.

Table 3.4

An Overview of the Teacher Professional Development Programme in Teaching for Critical Thinking (Vertical Alignment)

Month	Session	Content/Title of the Session
November 2016	1	Introductory Meeting (Expectations, Aims and Procedures)
	2	The Concept of Critical Thinking – CT Skills and Dispositions
	3	The Programme's Operational Definition of the Concept of Critical Thinking Applied in a Critical-Thinking Curriculum
First Set of Teacher Observations (23 observations)		
	4	A Critical-Thinking Curriculum: An Overview of Attainment Targets and Teaching Targets (1)
December 2016	5	A Critical-Thinking Curriculum: An Overview of Attainment Targets and Teaching Targets (2)
	6	Critical Thinking and Teaching Approaches
January 2017	7	Teaching for Critical Thinking: Orientation & Teaching Methodology (1)
	8	Teaching for Critical Thinking: Orientation & Teaching Methodology (2)
	9	Teaching for Critical Thinking: Teaching Strategies (1)
February 2017	10	Teaching for Critical Thinking: Teaching Strategies (2)
	11	Building a Learning Environment of Thoughtfulness – Class Material (e.g. Posters summarizing key critical-thinking concepts)
	12	Teaching for Critical Thinking: Designing Critical-Thinking Activities in the Subject Area of Language Arts
	13	(Re)designing Lesson-plans from the School Textbooks used in the Elementary Language Arts Course (1)
Second Set of Teacher Observations (23 observations)		
March 2017	14	Principles for a Critical-thinking Based Instruction
	15	(Re)designing Lesson-plans from the School Textbooks used in the Elementary Language Arts Course (2)
	16	Reflecting upon the Critical-Thinking Curriculum – Adding Critical-Thinking Rich and Challenging Tasks or Activities (1)
	17	(Re)designing Lesson-plans from the School Textbooks used in the Elementary Language Arts Course (3)
	18	(Re)designing Lesson-plans from the School Textbooks used in the Elementary Language Arts Course (4)
April 2017	19	Reflecting upon the Critical-Thinking Curriculum – Adding Critical-Thinking Rich and Challenging Tasks or Activities (2)
	20	Constructing a Teacher Reflection Tool on Critical Thinking (1)
Third Set of Teacher Observations (23 observations)		
May 2017	21	Constructing a Teacher Reflection Tool on Critical Thinking (2)
	22	Assessment of Critical Thinking (1)
	23	Assessment of Critical Thinking (2)
	24	Closing Session – Final Remarks, Reflections and Conclusions

Intervention Length

The sufficient duration of a teacher professional programme combined with sustained follow-up support is considered as one of the characteristics that make the programme effective (Creemers et al., 2013; Desimone, 2009; Kyriakides et al., 2017a). Under this framework, for making a decision for the intervention length, certain methodological implications were taken into account: (a) The longer the treatment, the greater the likelihood of statistically significant changes in students' critical thinking (Behar-Horenstein & Niu, 2011) and in teachers' quality of teaching (Kyriakides, et al., 2017a); (b) Instructional interventions longer than 12 weeks tend to be more effective in fostering students' critical thinking abilities than shorter interventions (Niu et al., 2013); (c) In longer treatments researchers need to be cautious about controlling threats such as students' maturation or significant life transitions, which can influence the effects (Behar-Horenstein & Niu, 2011). In addition, if your aim is to measure the results on student learning outcomes at the beginning and the end of the teacher professional development, you need to restrict the treatment into a school year since most teachers, especially in Cyprus, have a new set of students each year (Kyriakides et al., 2017a). In this context, the study took place for a school year while the actual intervention took place for 6 months (24 weeks), since the teacher professional development programme in teaching for critical thinking started on November 2016 and was completed in May 2017. During this period, the Christmas and Easter holidays, that is, a total of four weeks were excluded.

In addition, what was taken into account was that an educational intervention should be deemed sufficiently powerful to expect improvements in student performance over the timeframe of the study, while the timeframe should be short enough to exclude any uncontrollable changes such as those caused by student maturity (Wolcott et al, 2002). In the same vein, even if the ultimate goal of the professional development programme concerns improvements in student learning outcomes through improving teaching quality (Creemers et al., 2013; Guskey, 2003), it is more realistic within an intervention to expect modest rather than drastic improvements in student thinking abilities due to the fact that cognitive growth is a gradual and cumulative process (Halpern, 2001).

Under this framework, the principal concern of the study was not time alone, since effective professional development surely requires time, but how the time could be well organized, carefully structured, and purposefully directed (Guskey, 2003) to improve teaching quality. To this end, teachers in the experimental group participated in training meetings - sessions of initial, interim and ongoing training during which they were given continuous support on how to promote critical thinking in the subject area of elementary Language Arts. The training sessions took place from November 2016 to May 2017 on a school basis and were aligned both horizontally and vertically, outlining a sequence for delivering content and providing a clear scope upon how teacher participants could be empowered. More specifically, teacher participants, either individually or as a group (in case there was more than one teacher participant at a school), participated in a training session once a week, for 80 minutes per time. Every training session was carried out in an interactive way, and there was both a theoretical and a practical part where instructional implications of critical thinking were discussed. And further, there was a reflective part at the beginning and at the end of each training session. Table 3.4 presents an overview of the teacher professional development programme in teaching for critical thinking.

Employing a School-Based Professional Development

The training meetings – sessions of initial, interim and ongoing training during which teachers received continuous support on how to promote critical thinking in the subject area of elementary Language Arts were delivered on a school basis. The school-based professional development was chosen mainly for three reasons: (a) School-based in-service training makes it easier for teachers to stay committed to the programme throughout its duration (Kyriakides et al., 2017a) and it is usually preferred by teachers, especially in the context of Cyprus, who find it hard to participate in any kind of after-school training or professional development, especially on a regular basis, due to lack of time and/or other obligations (e.g. family, children, studies etc.), (b) School-based professional development makes the process of needs' analysis easier while training is closely linked to those individual needs, something that contributes to teachers' knowledge base, professionalism, and ability to (re)act on what they learn (Linder, 2001; McLaughlin & Talbert, 2006); and (c) School-based professional development encourages creating new knowledge and improving teachers' practice in context, that is, in their actual classrooms, since teachers are encouraged to reflect and act during teaching-and-learning in meaningful environments that contextualize learning (e.g. Koutselini, 2008b). And further, the present study draws upon policy implications and conclusions of a study aimed at diagnosing teachers' in-service training needs in Cyprus, among which one is that training schemes, which provide training opportunities during working time, should be promoted (Karagiorgi & Symeou, 2007). In another respect, the study aimed at employing the school-based empowerment scheme so as to deal with the wrong preconceptions and/or prejudices that teachers in

Cyprus hold on professional development, who usually translate it to afternoon workshop sessions during which teachers gather in a classroom to learn about the latest hot topic, determined by others, who are usually “the experts” (Karagiorgi & Symeou, 2007). And as Eisner (2000) asserts, most of the times those “experts” or those who speak from podia planted may know little about the concrete conditions within which the teacher works. In addition, that sense teachers hold that researchers, academicians and university staff ‘should know better’ is one of the main obstacles of any change (Koutselini, 2008b).

Choosing the Subject-Matter of Language Arts as the Context of the Programme

The subject-matter of Language Arts was purposefully chosen to become the context of the study for three reasons: a) Firstly, the cognitive skills incorporated in the operational definition of critical thinking adopted in the present study are frequently used in the subject area of Language Arts, especially in the learning situations of reading and writing (e.g. making inferences from reading passages). Besides, reading and writing are more or less defined as meaning constructed by a person, who is able to integrate the textual information and background knowledge by applying critical-thinking skills, and processes such as predicting, inferring, synthesizing, generalizing, and monitoring (e.g. Bean, 2011; Philips, 1988). This is in accordance with the conceptualization of the student critical-thinking performance the study adopted, which is determined by the quantity and quality of meaning that students derive from what they read and perceive (deep understanding) and that they express in what they write and say (substantive writing) (Bean, 2011; Lipman, 1988; Paul, 2005) by competently using a combination of critical-thinking skills; b) Research has shown that students find themselves memorizing, recalling, and mastering content (Fisher, 2001; Koutselini, 2008a; Lai, 2011; Paul, 1992, 2005; Tsui, 2002), performing poor reasoning skills (Nickerson, 1988; Philips, 1988) and being ‘surface readers’ focusing on facts and information. In that sense, there is a need to be encouraged for being ‘deep readers’ focusing on meaning (Bean, 2011), and effectively managing with reading and writing learning situations for which critical thinking skills are required (Bean, 2011; Paul, 2005); and c) The subject-matter of Language Arts is taught every day in an elementary school of Cyprus, for one or two teaching periods each day (40 minutes each). Therefore, there would be more teaching time (than any other subject matter) for teachers to explicitly apply critical-thinking principles into their teaching and consequently manage a positive effect on student critical-thinking outcomes.

Intervention Content

What is to be learned by way of critical thinking and teaching constituted the "content" core of the programme. To determine the content of the programme, the study drew on ideas from the disciplines of philosophy, psychology and education, thus ensuring a strong theoretical underpinning for the programme that would delineate its substance (Creemers et al., 2013; McGuinness, 1999). The content of the teacher professional development programme resulted after i) deciding on the study's operational definition of the concept of critical thinking, ii) investigating the teaching skills or qualities, derived by the study of teaching approaches, teaching strategies and/or tactics which could enhance students' critical thinking in class, and iii) clarifying the presuppositions and/or principles for a critical-thinking based instruction.

i) In that vein, the teacher professional development programme was explicitly based on a substantive concept of critical thinking as a two-factor model combining critical-thinking skills and dispositions (Facione, 1990). Based on this concept, critical thinking is a purposeful reflective process, during which a person forms a self-regulatory judgment so as to decide what to believe or do in a given context (Ennis, 1987, 1989, 1991; Facione, 1990a). In doing so, that person uses a set of cognitive skills, namely, analysis, interpretation, evaluation, inference, explanation, as well as self-regulation processes and their respective sub skills (Facione, 1990a; Facione & Facione, 1994).

ii) In addition, the teacher professional development programme was based on the best available research evidence, involving a range of effective teaching practices, methods, strategies and/or tactics that are consistent with a critical-thinking based instruction. And further, the programme emphasized the mixed teaching approach to critical thinking since findings of meta-analytic studies summarizing empirical evidence on the instructional efficacy of the four teaching approaches as taken from Ennis' typology (1989), have shown that the mixed teaching approach has the largest effect on the development of students' critical-thinking skills (e.g. Abrami et al., 2008; Bangert-Drowns & Bankert, 1990). The mixed teaching approach refers to teaching critical-thinking skills directly as a separate goal and/or explicitly in the context of their use or application to standard subject-matter course and/or other content (e.g. Ennis, 1989, 1997; Plath et al., 1999). Under it, students are involved in subject-matter critical thinking instruction, but there is also a separate thread (within the course), if needed, aimed at teaching general critical-thinking principles (Abrami et al., 2008; Ennis, 1989, 1997). In short, the mixed approach refers to a combination of the general approach with either the infusion or the immersion approach

(Ennis, 1989). Emphasis was given, though, to explicitly infusing critical thinking principles into teaching, since stronger effects were found for the infusion than for the immersion approach (e.g. Abrami et al., 2008). Besides, combinations and deviations between the four approaches in practice are not only possible but likely (Ennis, 1989). In particular, teacher participants were given opportunities to instructionally refine and design the mixed approach in terms of choosing tactics, strategies, behaviours, activities and tasks to enhance students' critical thinking, something that Ennis (1989, 1997) himself, who proposed the mixed approach, did not do (Valanides & Angeli, 2005).

iii) Lastly, certain principles of a critical-thinking based instruction were considered to reinforce the integrated solid theoretical framework of the programme. These principles concerned: (a) The teaching of thinking needs to be integrated into content instruction so that students are able to think about what they are learning (Plath et al., 1999; Swartz, 2003; Zohar et al., 1994); (b) The more explicit the teaching of critical thinking is, the greater the effects on students (Ennis, 1989; McGuinness, 1999; McTighe, 1985; Swartz, 2003; Zohar et al., 1994); (c) Teachers need to teach in ways that can help students internalize and follow strategies for skillful critical-thinking performances when it is appropriate to do so, meaning that they need to enable students to use the right type of thinking at the right time (Swartz, 2003; Willingham, 2007); (d) Critical-thinking skills are developed with practice since students are required to identify the critical-thinking skills they and other students are applying (Plath et al., 1999; Swartz, 2003; van Gelder, 2005); (e) The more the classroom incorporates an environment of thoughtfulness and self-reflection, the more open students will be to valuing good thinking (Newmann, 1991; Plath et al., 1999; Swartz, 2003).

The content material of the programme was purposefully filtered and used to develop an information/support pack for teachers with more in depth coverage of critical thinking and guidance about its integration in instruction. In that vein, teacher participants of the experimental group were progressively provided with parts of that information throughout the sessions of the programme. In particular, the information and support pack included:

(a) A Critical-Thinking Curriculum with a detailed description of the critical-thinking skills, as success indicators or attainment targets, and their respective critical-thinking subskills, as competence indicators or teaching targets. A copy of the Critical-Thinking Curriculum is included in Appendix G.

(b) A booklet entitled "Teaching for Critical Thinking", including critical-thinking prompts (brief theoretical background, guidance, questions for discussion, and suggestions for a critical-thinking based instruction), as well as a teacher reflection tool on critical thinking. A part of the booklet is included in Appendix H.

(c) Teaching and learning material on critical thinking for use in class (i.e. wall-charts and posters for class that summarize key critical-thinking concepts and skills);

(d) Audio-visual material on critical thinking and on-line links to critical-thinking content that could be downloaded without charge, including files that could be accessed for free;

(e) Redesigned – restructured lesson-plans and/or units of the school textbooks of the elementary Language Arts course with an explicit emphasis on critical thinking (as they resulted from the reflective discussions in which teachers and the principal researcher were engaged since ready-made knowledge or a prescribed set of lessons was not given).

After the completion of the intervention, teachers of the control group were also provided with the information and support pack that was developed within the teacher professional development programme.

Type of Professional Development Activities

With regard to the type of professional development activities, these were designed so as to be in line with the integrated approach employed for the development of the programme. In that sense, theoretical, practical and reflective activities were used in each training session. During the training sessions, on the one hand, teachers were provided with scientific knowledge as to what critical thinking is and how it is best taught by focusing on the mixed approach with an emphasis on the infusion teaching approach, as suggested by Ennis (1989, 1997), and praised by other theorists in the field (e.g. Abrami et al., 2008; Dewey & Bento, 2009; Marin & Halpern, 2011; Swartz, 2003). In addition, teachers were provided with scientific knowledge on the teaching strategies and practices that were found to be positively related to good student critical-thinking outcomes. On the other hand, teachers were engaged in systematic reflection and analysis of their existing knowledge of critical thinking and their knowledge and understanding about teaching for critical thinking. In that sense, training and support on how to teach for critical thinking was not externally imposed, nor were teachers given a prescribed set of lessons; they were, rather, left free to filter and reflect upon the scientific knowledge base on critical-thinking so as to instructionally refine certain key-concepts and design teaching for enhancing students' critical thinking by taking into account their needs accordingly. For example, in terms of reflection, teachers were asked to keep record of 'critical incidents' (e.g. a discussion in class, the use of a modelling strategy in class in relation to the reaction of students), as parts of their professional experience, so as to analyze and discuss them in the sessions.

Meanwhile, in order to facilitate theory analysis and reflection, teacher participants were engaged in "practical" activities or application activities through which they could apply the new knowledge and skills (Kyriakides et al., 2017a) and/or obtain practical examples of how this new knowledge related to the teaching for critical thinking could be applied in class. Some of these practical activities concerned a) focused conversations for being taken from the surface of a topic (i.e. definition of critical thinking) to its in-depth implications (i.e. how do we use critical thinking in every-day situations), b) studying teaching scenarios – vignettes for identifying teaching behaviours either consistent or not with a critical-thinking based instruction, c) viewing educational videos for identifying and reflecting upon teaching practices consistent with a critical-thinking based instruction, and d) examining student work for getting a critical source of information about how students are learning, developing and applying (new) critical-thinking skills. In addition, teachers were supported in planning, (re)designing and (re)structuring lessons and/or whole existing units of the elementary Language Arts course so as to purposefully integrate critical thinking. In that vein, the characteristics of the discipline chosen as a context, that is, the Language Arts subject area (known as "Greek" in the Cyprus elementary school) was taken into account, something that researchers in the field stress (e.g. Shim & Walczak, 2012). Therefore, the relevant material, that is, the school textbooks, the techniques and/or tactics used in the Language Arts lesson as described in the Cyprus Curriculum of 2016 as well as in the Course Guidelines (i.e. Manual on Instructional Tools used for Developing Oral and Written Language) were used as support tools in the training sessions.

Furthermore, in three cases, that is, in three out of the seven schools of the experimental group where there was a group of teachers, teachers were engaged in the process of lesson study, based on which they worked collaboratively to plan, teach, observe and evaluate a lesson with a focus and direction in promoting critical thinking. In particular, in each case, teachers collaboratively designed a detailed lesson plan that one of them delivered in her classroom while the other teachers with the facilitator could observe the lesson. At a second level the group met to discuss their observation notes and reflect upon the observed instruction while the principal researcher was facilitating the discussion. At the end, the lesson was revised so that another teacher could deliver it in her classroom. The same procedure was followed with observation and discussion on the observed instruction. In that sense, teachers were engaged in reflective discussions about the goals of a lesson, the tasks employed and the teaching strategies and tactics used to promote critical thinking. At the end, teachers were constructing knowledge themselves and they were progressively improving their instruction by developing their own critical thought (Paul, 2005). In the other cases, where there was only one teacher participant, co-teachings were planned instead, provided that there was a willingness to engage in such activity. Based on the methodology of co-teaching, the principal researcher and the teacher participant shared the planning, delivery, and assessment of instruction, as well as the physical space in class.

Under this framework, in-service teachers were treated as professionals whose practice should be informed by theory and critical reflection so as to map their theories into praxis and teaching design(s) and put these into trial in their classes (e.g. Creemers et al., 2013; Eisner, 2000; Koutselini, 2006; McNamara, 1990). Therefore, teachers were given opportunities to experiment with different teaching approaches, strategies and/or tactics to teach for critical thinking, something that was very important in shaping changes in their quality of teaching. In addition, teachers had the chance to analyze their findings collaboratively (either with the principal researcher and/or with teaching staff colleagues – participants in the programme), re-orient their practice and gradually explicate their own personal theory of teaching for critical thinking based on a refinement of the critical-thinking knowledge base provided throughout the programme. Along this line of reasoning, teachers were encouraged to share ideas, cooperatively analyze their students' needs in learning situations offered by the subject area of Language Arts (e.g. reading - writing learning situations) and map them with corresponding critical-thinking skills (e.g. making inferences from reading passages), decide teaching methods and objectives, design thinking activities and use key-objectives for a critical-thinking based instruction.

The Role of the Professional Development Facilitator

Helping teachers to understand (more) deeply the content they teach, that is, the concept of critical thinking and the ways students learn and use that content, that is the critical-thinking skills and/or dispositions, appears to be a vital dimension of effective professional development (Guskey, 2003). For that, an effective professional development facilitator is required, who needs to be influential enough so as to motivate teachers to change or improve their teaching practices (Barnes, 2005; Creemers et al., 2013; Linder, 2011). In that vein, the study adopted the role of a constructivist leader or a facilitator as proposed by Lambert (2003). According to Lambert (2003), a constructivist facilitator looks for and values teachers' points of view, challenges teachers' conceptions and beliefs, constructs meaning through reflection and dialogue, and assesses teacher learning in context. In order to make the constructivist facilitator profile with regard to the goal of motivation more specific, certain factors or qualities of an influential facilitator were considered. These qualities concern: a) credibility, which is related to the facilitator's content and pedagogical knowledge, his/her teaching experience, whether he/she provides proof or evidence with regard to the effectiveness of certain teaching approaches he/she proposes and his/her professionalism; b) support, which is related to whether he/she provides assistance and reacts appropriately to participants; c) motivation, which is related to the facilitator's pure motives for taking the role, that is, for example, his/her love for teaching and his/her excitement about the topic under focus; d) management, which is related to how he/she manages the sessions, makes the material meaningful, and organizes the material to present it; and e) personality, which is related to the facilitator's demeanor or the way he/she acts (Linder, 2011). These qualities are much alike with the ones of a champion, as Barnes (2005) characteristically claims, since the facilitator's job *"is not to mandate, but to motivate; not to control, but to clarify; not to find fault, but to facilitate; not to talk too much, but to listen actively"* (p. 10).

Under this framework, the professional developer facilitator provided assistance during the training sessions by leaving enough time for participants to complete and discuss activities, by offering a variety of resources for teachers to use during or following training sessions. Apart from the training sessions delivered on a school basis, the professional developer facilitator had ongoing communication with teachers via telephone, emailing, Skype meetings and/or meetings during afternoon hours, if requested, to offer further assistance, resource material and support. In that sense, the facilitator tried to minimize, at the very least, the difficulties or constraints of a regular-school basis professional development that were sometimes inevitable (e.g. unexpected school events). And further, apart from the training sessions, the facilitator regularly visited teacher participants at schools to discuss emergent issues related to the employment of new critical-thinking knowledge and skills in their everyday teaching and to provide them with support and constructive feedback, something that other professional development programmes have employed, as well (Kyriakides et al., 2017a). Moreover, the professional developer facilitator tried to meet teacher participants' needs during the training sessions by connecting critical-thinking information to practices they were using in class and making that knowledge applicable to the context of the Language Arts course. In that sense, she was using challenging learning experiences and activities that were explicitly related to classroom practice. And further, in each training session she ensured that all the materials prepared prior to the session were easily accessible for the participants during the session and that time was not wasted. And further, the facilitator was friendly and outgoing with a sense of confidence and calm, able to use humor or tell stories when presenting new knowledge so as to keep the teacher participants motivated.

During the classroom observations, the facilitator provided teachers with constructive feedback and concrete, practical suggestions and discussed with them any difficulties faced during their teaching; thus, a kind of trust and rapport was built among teacher participants and the facilitator. Teachers also realised that the professional developer facilitator was available to support them in teaching for critical thinking since she was completely devoted to the programme while her motives were related to her real interest in teaching for critical thinking and professional growth and development. In proof of that, the entire endeavour did not entail any "pay check"; on the contrary, the cost for offering school-based professional development was high enough but the cost-effectiveness of the programme was not, of course, under concern.

Data Collection Methods and Instruments

The research design and the research questions of the present study have determined the data collection methods and the research tools for use. The research tools that were developed and pilot-tested within the study were based on the kind of data that were to be collected, which is both quantitative and qualitative. In particular, two different sets of research tools were developed, one set for the student and one set for the teacher.

For the student, three instruments were developed and used:

a) The Student Critical-Thinking Instrument (pre- and post-testing) (SCTI)

b) The Student Reasoning Essay (interim-testing) (SRE)

c) The Student Demographics' Questionnaire (student background characteristics)

For the teacher, three instruments were developed and used:

a) A Critical-thinking Observation Tool for assessing a critical-thinking based instruction

b) The Teacher Demographics' Questionnaire (teacher background characteristics)

c) The Teacher Reflections' Questionnaire administered to the teachers of the experimental group after the completion of the teacher professional development programme.

In addition, during the study the principal researcher kept a reflective journal, data of which were used for exploring and understanding teacher deficiencies, misconceptions, difficulties in teaching for critical thinking, as well as the conditions and presuppositions under which teaching for critical thinking could be facilitated in elementary classes.

What is worth mentioning is that the present study developed the SCTI along with the SRE and did not use any one of the standardized widely known critical-thinking instruments for three reasons: (a) most of these widely known tests have been developed for secondary and post-secondary students and adults; there are very few intended for elementary-school students (e.g. CCTST-MIB, CCTT-Level X) whose age range, though, is high (e.g. the Cornell Critical Thinking Test-Level X is for grades 4-14), something that makes the psychometric properties of the tests questionable; (b) results obtained by several validation studies of those tests intended for elementary-school students are inconsistent (e.g. Bernard, Zhang, Abrami, Sicoly, Borokhovski and Surkes, 2008; Ennis, Millman, & Tomko, 1985, 2004, 2005; Jacobs, 1995, 1999), something that shows that the construct validity of those tests cannot be declared with justified confidence; and (c) the interdependency of critical-thinking skills (Bailin et al., 1999a; Ennis, 1991; Ennis et al., 1985, 2004, 2005; Facione, 2000; Facione & Facione, 1996; Swartz, 2003) usually externalized by being written or demonstrated for others to observe and evaluate (Facione & Facione, 1996) makes the locally developed or "naturalistic" measures holistically assessing critical thinking more valid (Wolcott et al, 2002). And further, using (multiple) instrument(s) purposefully developed by the instructor or researcher can better contribute to describing the practical significance of the treatment (Behar-Horenstein & Niu, 2011).

The Student Critical-Thinking Instrument (pre- and post-testing) (SCTI)

One engages in critical thinking when he/she is asked to perform certain tasks, such as understanding some material, making an evaluative judgment, solving a problem or making a decision (e.g. Ennis, 1989, 1991; Fischer et al., 2009; Shim & Walczak, 2012). The Student Critical-Thinking Instrument developed within the study mainly employs the first task taking into account that students often demonstrate critical-thinking skills through the written products they produce (Bean, 2011; Ennis, 1991; Lipman, 1988; Nickerson, 1984; Paul, 1992, 2005).The Instrument that was used for pre- and post-testing purposes (without any changes from pre- to post-testing) was accordingly developed to be sensitive enough to stimulate students to exhibit certain critical-thinking skills, as well as to pick up subtle changes in students' thinking abilities (Halpern, 2001, p. 273) in order to assess the instructional effects of the intervention. This is in accordance with the way the study conceptualizes teaching for critical thinking that concerns improving the quantity and quality of meaning that students derive from what they read and perceive and that they express in what they write and say (Lipman, 1988; Paul, 2005). Moreover, the Instrument considers that critical thinking encompasses a creative process in which students should consider all the gathered data so as to formulate a response, draw a conclusion or make a decision (e.g. Ennis, 1991; Hudgins et al., 1989).

Experts on educational outcomes assessment argue that to measure student performance it is necessary to clarify educational objectives, referred to as intended student outcomes or as desired student competencies, skills, or behaviors (e.g. Wolcott et al, 2002). Therefore, for the development of the Student Critical-Thinking Instrument, the six basic critical-thinking skills, namely, interpretation, analysis, evaluation, inference, explanation and self-regulation processes, as described in the study's operational definition for critical thinking, were selected as goals to be addressed. To this end, the Instrument's content validity was safeguarded since it was developed to assess these basic critical-thinking skills, which reflect the conceptualization of critical thinking, as described in the Delphi definition (Facione, 1990a). Moreover, these cognitive skills are frequently used both in everyday life as well as in the subject area of Language Arts that is chosen as the context of the study, especially in the learning situations of reading and writing. Besides, as McMillan (1987) asserts, it is better to teach and measure critical-thinking skills that are in some way specific to the content area addressed. Even more, these skills – as well as their associate sub skills – are cited by many theorists in the field of critical thinking (e.g. Ennis, 1989, 1991; Facione, 1990a; Halpern, 1998; Kennedy et al., 1991; Lipman, 1988; Paul, 1992; Swartz, 2003), while they have been the focus point, even if differently weighted and interpreted, of many widely known standardized critical-thinking instruments (e.g. California Critical Thinking Skills Test, Cornell Critical Thinking Test) and interventional studies (e.g. Angeli & Valanides, 2009; Blattner & Frazier, 2002).

Furthermore, no discipline-specific primary level content knowledge was presumed for the development of the Student Critical-Thinking instrument. However, the Critical-Thinking Instrument does involve content, upon which the critical thinking is done, content that is familiar and interesting to elementary students (Ennis, 1989). Besides, thinking always occurs within a domain of knowledge, a domain-specific content (Brown, 1997; Halpern, 1998), which is not however, necessarily included in the school-curriculum subjects (Ennis, 1989). Under this framework, the six critical-thinking skills addressed in the study were measured in the context of an everyday decision-making situation, meaning that the instrument incorporated real-life source material, both in terms of kind (i.e. short article titled "Dog: A man's best friend") and content (i.e. interesting and challenging).

With regard to the construction of the items included in the Instrument, emphasis was placed on the context of the items in terms of critical-thinking prompting, and thus many widely known instruments were taken into account. For example, the Test of Inference Ability in Reading Comprehension (1987*)* by L. M Phillips and C. Patterson (Institute for Educational Research and Development, Memorial University of Newfoundland, St. John's, Newfoundland, Canada A1B 3X8) aimed at grades 6-8, was taken into consideration. According to Ennis (1993), the test examines the ability to infer information and interpretations from short passages, and there is a multiple choice version (by both authors) as well as a constructed response version (by Phillips only). In addition, the Halpern Critical Thinking Assessment using everyday situations (HCTA with two forms), which is a multi-response format assessment used by several studies (e.g. Ku & Ho, 2010; Marin & Halpern, 2011), was also taken into account. The Halpern Critical Thinking Assessment is appropriate for high-school students and consists of 25 everyday scenarios (believable examples) on a variety of topics, each followed by questions that first require a constructed (open-ended) response and then forced-choice items (i.e. multiple choice or multiple rating) that probe for the reasoning behind an answer (Marin & Halpern, 2011). Moreover, the California Critical Thinking Skills Test (CCTST), the conceptual basis of which is formed by the conceptualization of critical thinking as given in the Delphi definition (Facione, 1990a; Facione & Facione, 1994), was taken into account. The CCTST is a standardized, 34-item multiple choice test (19 four-option and 15 five-option multiple-choice items), which is non discipline-specific and targets core critical-thinking skills.

The Student Critical-Thinking Instrument was developed by initially including 24 items targeting certain critical –thinking skills. Before the Instrument's pilot-testing, the principal researcher along with her supervisor, on the basis of their pedagogical knowledge and study on critical thinking, evaluated the face validity of the instrument. In light of their fruitful discussions, minor amendments were made, particularly where the guidelines or structure used were not easily comprehensible or terms that had been used were seen as difficult or unfamiliar to elementary students. After that, the Instrument was pilot-tested in a sample of 120 10-11 year-old students. Based on descriptive statistical analysis and preliminary qualitative analysis of students' answers in the open-ended items, the meaning of certain expressions in some items was clarified. In addition, three items (i.e. 1 open-ended item assessing interpretation, 1 open-ended item assessing inference, and 1 open-ended item assessing explanation) were totally removed from the Instrument, since they were considered to be either too difficult or too easy for students to understand. Once the pilot-testing was completed, the previous procedure was repeated with a third judge, an elementary teacher, who had not seen the questionnaire before. In that sense, the comments of the third judge served to validate the final version of the Instrument.

Under this framework, the final version of the Student Critical-Thinking Instrument includes 21 items in total. Some items centre on the text (short article) while others are not directly text-based (although they are related to the text content) since textual information alone is not sufficient to apply critical thinking skills, that is, for example, to make good inferences (Philips, 1988). Besides, reading is more or less defined as meaning constructed by a reader, who is able to integrate the textual information and background knowledge by applying critical-thinking skills, and processes such as predicting, inferring, synthesizing, generalizing, and monitoring (Bean, 2011; Philips, 1988). In the Instrument there are both close-ended and open-ended items, since it is important to depict not only what students think but also how they think (Brunt, 2005; Facione, 1990), that is, how they reach a decision, how they pick up an argument, or how they draw a reasonable conclusion. In particular, there are 9 multiple-choice (four-option multiple-choice items) and 12 open-ended items. Table 3.5 presents the distribution of the items. The blue colour represents the open-ended items. A copy of the CTI is included in Appendix A.

Table 3.5

Distribution of the Items in the Student Critical-Thinking Instrument (SCTI)

Student Critical Thinking Instrument (SCTI)				
Critical-Thinking skills	**Multiple-choice Items**	**Open-Ended Items**	**Total**	**Items in the SCTI**
Analysis	--	4	4	1, 2, 4, 6
Interpretation	2	1	3	5, 7, 8
Inference	1	3	4	9, 14, 15, 17
Evaluation	4	--	4	10, 11, 16, 18
Explanation	--	3	3	3, 12, 19
Self-regulation	2	1	3	13, 20, 21
TOTAL	9	12	**21**	**21 items**

For the scoring of the 21 items included in the Student Critical-Thinking Instrument, what was taken into account is that critical thinking aims at making not just a choice or just finding an answer, but the best possible choice or answer (Insight Assessment, 2015; Philips, 1988; Ruggiero, 2003). And further, *"critical thinking assessment strategies whether for use in the individual class or for broader purposes must not simply reward arriving at correct answers. They must, however, recognize achieving correct answers by* *way of good critical thinking"* (Facione, 1990, p. 33). In accordance to that, options in the multiple-choice items of the Instrument were purposefully constructed and pre-coded (e.g. 0=wrong, 1=partly wrong, 2=partly correct and 3=correct). Table 3.6 presents a coding example of a multiple-choice item included in the student critical-thinking instrument.

Table 3.6

A coding example of a multiple-choice item included in the SCTI

Item 9 (Multiple-choice item)		
Inference skill – Drawing conclusions from data provided by determining which of several possible conclusions is most strongly warranted		
Type of answer	**Criteria**	**Scoring**
Wrong answer	No conclusion / Irrelevant answer	0
Partly wrong	Probably true conclusion, less plausible based on textual information	1
Partly correct	Plausible conclusion but not the most strongly warranted	2
Correct answer	Plausible conclusion, strongly warranted by the textual information	3

Table 3.7

A Coding Example of an Open-Ended Item Included in the SCTI

Item 12 (Open-ended item)		
Explanation skill – Present arguments = Give reasons for accepting some claim		
Type of answer	**Criteria**	**Scoring**
Wrong answer	Irrelevant answer	0
Partly wrong	Vague justification – Conclusion (Agree or Disagree) & 1 or 2 reasons not both completed in meaning to make sense	1
Partly correct	Conclusion + 2 sound completed in meaning reasons OR 1 sound completed in meaning reason with 1 example	2
Correct answer	Conclusion + 2 sound completed in meaning reasons + at least 1 example OR another completed in meaning reason	3

For the open-ended items, a rubric was inductively constructed using the constant comparative analysis method, which constitutes the core of qualitative analysis in the grounded-theory approach developed by Glaser and Strauss (1967) (Strauss & Corbin, 1990). The aim of the method was to classify each individual answer/incident into an appropriate level of the rubric. The rubric resulted from the constant comparison of the incidents (students' responses), which very soon started to generate theoretical properties of each category (Glaser, 1965). Again, the scoring for most of the open-ended items resulted in the coding 0-3 (e.g. 0=wrong, 1=partly wrong, 2=partly correct and 3=correct), and for one open-ended item (item 19) the coding range was 0-6. Table 3.7 presents a coding example of an open-ended item.

Although the 21 items in the Student Critical-Thinking Instrument were identified as targeting particular skills, scores for these sub-scales were not considered independent of one another, and they could be used only as gross indicators of possible critical thinking strengths and weaknesses. Therefore, the Student Critical-Thinking Instrument reports an overall score on student critical-thinking performance, something that various research studies using similar instruments have employed (Ennis et al., 2005; Zohar et al, 1994).

The Student Reasoning Essay (interim testing) (SRE)

Aiming to examine whether students of the experimental group could show greater gains in answering open-ended essay questions by using a combination of critical thinking skills (Halpern, 2001), a Reasoning Essay was developed within the study to be used as an interim testing. In addition, data obtained by the Reasoning Essay were used as a source of feedback for the principal researcher – professional developer facilitator since she could reflectively understand whether students had actually improved their critical-thinking performance while the programme was still in progress. In this respect, the principal researcher used data obtained from the interim testing so as to make decisions about how the training activities and/or material of the programme could be revised and/or enhanced, a procedure that enhances the critical-thinking effort in general (Barnes, 2005) and serves the programme's constant evaluation (Gatawa, 1990).

The Reasoning Essay was argumentative in nature, requesting students to incorporate source material (e.g. real-life school-based problem/scenario) into their writing to support their point of view on a controversial issue. Students were asked to read a school-based scenario (regarding different proposals for punishment for the termination of a basketball game due to disorders), and reach an informed decision by reasoning within a point of view. A copy of the Student Reasoning Essay is included in Appendix B.

The Reasoning Essay was based on the study's defensible conception of critical thinking. The main question consisting three open-ended item(s) in the Reasoning Essay asked students to exhibit critical-thinking skills that reflect the conceptualization of critical thinking, as described in the Delphi definition (Facione, 1990), namely to (a) analyze the problem by identifying the main idea and its arguments, (b) generate options/solutions, (c) develop the reasoning for each solution/option, (d) decide which is the best solution and draw conclusions. Therefore, the Delphi conceptual definition of critical thinking was translated into an authentic measure of critical thinking, something that other researchers exemplary did in the context of higher education, such as Facione and Facione (1996) within the framework of nursing education and Angeli and Valanides (2009) within the framework of teacher education (for the most part).

For the development of the Student Reasoning Essay, similar reasoning essays used in research studies were taken into account. An essay considered was the *Ennis-Weir Critical Thinking Essay Test (1985)* by R. H. Ennis and E. Weir (Midwest Publications, P.O. Box 448, Pacific Grove CA 93950), which is aimed at grades 7 through college. According to Ennis (1993), this open-ended test incorporates getting the point, seeing the reasons and assumptions, stating one's point, offering good reasons, seeing other possibilities (including other possible explanations), and responding to and avoiding equivocation, irrelevance, circularity, reversal of an if-then (or other conditional) relationship, overgeneralization, credibility problems, and the use of emotive language to persuade, and it is also intended to be used as a teaching material. Another Critical Thinking Essay Test taken into account, developed by Robert Ennis in cooperation with Marguerite Finken, was the Illinois Critical Thinking Essay Test (Finken & Ennis, 1993). This test uses a scenario along with a question and asks students to write an essay, clarifying to them what they are expected to do, namely, to state and clarify their position, give reasons for taking this position, make a conclusion and give a title. And further, similar written essays used in other (interventional) research studies in the field of critical thinking (e.g. Angeli & Valanides, 2009; Frijters et al., 2008) were considered. For example, Frijters et al. (2008) constructed a curriculum-independent measure, that is, a written essay test involving two shorter essay tests, a protagonist test and an antagonist test. In the antagonist test high-school student participants were asked to determine their own position and give reasons for their choice on an environmental issue (e.g. ‘‘preventing pollution by recycling’’) (Frijters et al., 2008). In the protagonist test students were asked to elaborate on their opinions regarding each of two environmental issues presented (e.g. ‘‘small domestic appliances: throw away or recycle?’’) to generate a ‘solution’ and to support this solution with reasons and arguments. In a similar way, Angeli and Valanides (2009) asked student participants working in dyads to prepare a joint outline for a paper on the issue “Should drugs be legalized?” after their participation in three teaching sessions.

Along with the main Student Critical-Thinking Instrument, the Reasoning Essay was also pilot-tested. Of the 120 students who participated in the pilot-testing of the main Critical-Thinking Instrument, data from 20 of them who were administered the Essay, were used for field-testing purposes. After that, the meaning of some expressions used was clarified and the duration of the essay's administration was determined.

Considering what it is increasingly recognized, that a) locally developed or ''naturalistic'' measures might be more valid for addressing certain types of educational outcomes (e.g. a holistic set of critical-thinking skills), and that b) such measures typically involve the use of rubrics (descriptive scoring schemes) to evaluate student responses, essays and so on (Wolcott et al, 2002), the students' quality of thinking in the Reasoning Essay was assessed by using a Rubric. For the construction of the rubric, rubrics constructed in several studies in the field of critical thinking were taken into account. For example, Angeli and Valanides (2009) constructed a rubric by using the constant comparative analysis method for the assessment of undergraduate students' outlines – responses on a question requiring a constructed (open-ended) response.The critical-thinking scoring rubric had five mutually exclusive levels, and participants' scores ranged from 1 (low performance) to 5 (high performance) (Angeli & Valanides, 2009). And further, the Holistic Critical Thinking Scoring Rubric developed by Facione and Facione (1994, 1996) that has been designed for the global assessment of critical thinking and might be used for the holistic measure of critical thinking in a variety of forms, has also been considered in the present study. Based on that four-point holistic critical-thinking scoring rubric developed by Facione and Facione (1994), Blattner and Frazier (2002) developed a similar rubric to assess college students' writing so as to particularly assess their abilities to accurately interpret evidence, identify salient arguments, analyze and evaluate alternative points of view, draw warranted conclusions, justify and explain results, and regard evidence with an open mind. Finker and Ennis (1993) have also developed a rubric for scoring the Illinois Critical Thinking Essay Test, the features of which concerned, in particular, focus (clear main idea), supporting reasons, reasoning, organization, conventions and integration. Keeley et al. (1982) had similarly developed criteria for scoring college students' responses to the essay articles. In their rubric, each criterion included a scoring rule statement defining a correct response, as well as a set of examples of possible appropriate responses for each of the questions.

In that sense, the Rubric used for the assessment of students' responses in the Reasoning Essay was inductively constructed using the constant comparative analysis method, according to which an incident is coded for a category and at the same time compared with the previous incidents coded in the same category (Glaser, 1965; Strauss & Corbin, 1990). The aim of this method was to classify an individual essay into an appropriate level of the rubric. In that way, a baseline score of students' critical thinking ability could be obtained. The critical-thinking scoring rubric had five mutually exclusive levels, and participants' scores ranged from 0 (zero to low performance) to 4 (high performance). An independent rater, namely an elementary school teacher, was trained on the critical-thinking scoring rubric and assessed 80 (approximately 20%) students' outlines, which were randomly selected in order to determine the inter-rater reliability. The inter-rater agreement for the student critical-thinking performance in the Reasoning Essay was calculated and was found satisfactory, *r*=0.87. The independent rater and the principal researcher discussed their assessments and easily resolved the existing differences. The Individual Critical Thinking Holistic Scoring Rubric is presented in Table 3.8.

Table 3.8

Individual Critical Thinking Holistic Scoring Rubric (Student Reasoning Essay)

Individual Critical-Thinking Holistic Scoring Rubric	
Criteria	**Scoring**
▪ Reach an informed decision by reasoning within a point of view. ▪ Explain with convincing reasons and evidence which perspective they think is best. ▪ Discuss the different perspectives identifying pros and cons for each perspective. ▪ Formulate an alternative for resolving the problem, explaining why they think it is best.	4
▪ Reach an informed decision by reasoning within a point of view. ▪ Explain with convincing reason(s) which perspective they think is best. ▪ Briefly discuss the different perspectives identifying pros and cons for each perspective. ▪ Formulate an alternative for resolving the problem without, or briefly, explaining why they think it is best OR Explain why they can not think of an alternative.	3
▪ Briefly express, with uncertainty, a point of view. ▪ Briefly explain with reasons which perspective they think is best. The reason(s) provided are not convincing enough. There is re-voicing. ▪ Briefly discuss the different perspectives without clearly identifying pros and cons for each perspective. ▪ May formulate alternative(s) for resolving the problem without, or briefly, explaining why they think it is best.	2
▪ Briefly express, with uncertainty, a point of view. ▪ Do not explain with good and convincing reasons which perspective they think is the best.	1

▪ Do not discuss the different perspectives by identifying pros and cons for each perspective. Any minor discussion provided is superficial. ▪ May formulate an alternative for resolving the problem without or briefly explaining why they think is the best.	
▪ Irrelevant or Complicated answer	0

The Student Demographics' Questionnaire

The student demographics' questionnaire was developed so as to collect student background characteristics. The questionnaire asked students to give information about themselves and their parents. In that vein, the student background characteristics concerned student sex, age (or years of staying in Cyprus), opportunities to learn (reading newspapers and/or books), as well as free-time activities (e.g. electronic games, watching TV or computer movies, web browsing and web surfing, studying school homework with parents, studying school homework with a teacher at home or a private institute, spending some quality time with parents, playing with friends, and outdoor activities such as dancing, sports, music or painting). The variables related to the students' parents concerned mother's and father's mother tongue, mother and father's education level, mother and father's job, and the frequency parents read books and newspapers. A copy of the Student Demographics' Questionnaire is included in Appendix C.

The Critical-Thinking Observation Tool (CTOT)

Taking into account that it is rather difficult to know whether the critical features and principles of teaching for critical thinking, upon which teachers were empowered, were refined and implemented in the same way by all teacher participants across all classrooms (Hiebert & Grouws, 2007), a Critical-Thinking Observation Tool was developed and pilot-tested within the study.

The goal of the Observation Tool was threefold: a) Firstly, to monitor changes and/or improvement in teacher effectiveness in, and quality of, teaching for critical thinking as a result of teachers' engagement in professional development, in comparison with the teaching quality and performance of teachers of the control group; b) Secondly, to address the needs of teachers in the experimental group with regard to their teaching performance and effectiveness in teaching for critical thinking so as to accordingly revise, if needed, the activities and/or emphases of the professional development programme (Creemers et al., 2013; Linder, 2011); c) Thirdly, to examine whether the teaching quality, as recorded by classroom observations, is positively related to student critical-thinking outcomes. Besides, the ultimate goal of teacher professional development concerns improving student learning outcomes through improving teaching quality (Creemers et al., 2013; Desimone, 2009; Guskey, 2003). So, the Critical-Thinking Observation Tool was designed to be used as a measure of teacher practice on the one hand, and as a measure of the impact of the teaching practice on students, on the other.

For the construction of the Critical-Thinking Observation Tool, observation schemes and key-lists developed by several studies in the field of critical thinking were taken into account (e.g. Newmann, 1991; Torff & Warburton, 2005; Tsui, 2002). For example, Newmann (1991) had developed a classroom observation scheme so as to examine the extent to which higher-order thinking was promoted in 16 high-school departments of Social Studies. Lessons were initially rated on 15 possible dimensions of classroom thoughtfulness. Each was used to make an overall rating of an observed lesson on a 5-point scale from 1="a very inaccurate" to 5="a very accurate" description of this lesson. After these qualities were observed in 160 lessons in five selected social studies departments and were further examined from a theoretical point of view, six main dimensions were chosen as the most fundamental ones. Nevertheless, these dimensions were too general (e.g. ‘the lesson displayed substantive coherence and continuity’), and they referred to higher-order thinking in general and not into critical thinking, in particular. In the study of Newman (1991), for the estimation of inter-rater reliability, 87 lessons in 16 high schools were observed independently by different pairs of raters drawn from a team of six researchers. The overall correlation between two observers was 0.76. The raters agreed on 64% of the ratings, and they differed by one point or less on 96% of the ratings. Similarly, in the study of Torff and Warburton (2005), two raters made assessments of critical thinking use once per minute using a 5-point Likert-type scale (5=a great deal, 4= a lot, 3=some, 2=a little, 1=not much or a rating of ‘no teaching’), and ratings were then entered on specially prepared score sheets as summaries of the previous minute of classroom activity. However, measurement of teachers’ use of critical thinking in a minute-by-minute basis is rather difficult, as well as sensitive to changes in classroom activities even if ongoing assessment is provided.

The main question brought up so as to develop the Critical-thinking Observation Tool of the study was the one that Newmann (1991) also used in his study: What kinds of indicators or teaching criteria would provide information on the extent to which critical thinking is promoted in class? In that vein, the study aimed at arriving at a general framework through which teacher behaviors and/or actions could be interpreted as promoting or undermining critical thinking. At first, certain principles of a critical-thinking based instruction were considered to constitute the theoretical framework of the tool. Secondly, these principles were accordingly filtered and coded as teaching criteria or instructional qualities of teaching for critical thinking. Thirdly, effectiveness factors or teaching quality dimensions with an impact on student learning outcomes, under which the teaching criteria could fall, were drawn mainly from the dynamic model of educational effectiveness that mainly refers to the actions taken to improve teaching and the school learning environment (Creemers & Kyriakides, 2008). In particular, according to Creemers and Kyriakides (2008), quality of teaching concerns student assessment and evaluation, lesson structuring, orienting students to achieve specific goals, application exercises, using questions as an teaching technique, use of learning strategies, time management, and the classroom as a learning environment. Under this framework, the teaching criteria developed for the Critical-Thinking Observation tool fell under four main effectiveness factors, namely a) orientation, b) general teaching methodology, c) teaching and learning strategies, and d) learning environment.

In particular, principles concerning the explicit teaching of critical thinking (Bensely et al., 2010; Ennis, 1989; McGuinness, 1999; McTighe, 1985; Swartz, 2003; Zohar et al., 1994), the integration of critical thinking into content instruction (Plath et al., 1999; Swartz, 2003; Zohar et al., 1994) and the setting of a certain context (i.e. material understanding, making an evaluative judgment, solving a problem or making a decision) under which one would engage in critical thinking (e.g. Ennis, 1989, 1991; Facione, 2011; Fischer et al., 2009; Shim & Walczak, 2012) were coded as teaching criteria – qualities of orientation. For, orientation is briefly related to providing the objective(s) for which a specific task or lesson takes place and challenging students to identify the reason for which they are engaged in certain activities (Creemers & Kyriakides, 2006; Creemers & Kyriakides, 2008). The principles concerning the opportunities to practice critical thinking in structured challenging tasks and critical-thinking rich activities (Plath et al., 1999; Swartz, 2003; van Gelder, 2005), along with purposeful questioning, short discussions, formative assessment and feedback, were coded as teaching criteria – qualities of general teaching methodology. For, general teaching methodology comprises, in general, the methods and practices used by teachers to enable student learning and active participation. Along the same line of reasoning, the ways teachers enable students to use the right type of thinking at the right time for skillful critical-thinking performances (Swartz, 2003; Willingham, 2007) by stressing the language of the thinking process and using explicit prompts and critical-thinking concepts (Bailin et al., 1999a; Swartz, 2003), were coded as teaching criteria –

qualities of teaching and learning strategies that are mostly guided by how students learn and understand (Creemers & Kyriakides, 2008; Donovan et al., 1999). And lastly, the classroom as a learning environment that comprises teacher-student interactions as well as the teacher behaviors that encourage and motivate students participate in class (Creemers & Kyriakides, 2008), incorporated the principle of building a learning environment of thoughtfulness and self-reflection (Newmann, 1991; Plath et al., 1999; Swartz, 2003), that is also related to the enhancement of an aporetic side of thought (Papastephanou & Angeli, 2007). In this repsect, the Critical-Thinking Observation Tool was cautiously, critically and reflectively developed, establishing in this way the content validity of the tool.

Before the pilot-testing of the Critical-thinking Observation Tool the principal researcher along with her supervisor, on the basis of their pedagogical knowledge and study on critical thinking, evaluated the face validity of the tool. In the light of their fruitful discussions, minor amendments were made, particularly where the teaching criteria - qualities used were not easily observable and measurable or terms and prompting used were seen as not needed for facilitating the observation. Before its actual use for the purposes of the study, the observation tool was pilot-tested twice in two different classes. In particular, the principal researcher along with another observer, who was accordingly trained (before the programme), visited two classes over a period of two weeks and used the tool. During the visits, although the two observers were together, they made separate assessments without access to each other's ratings so as to later on test the level of their agreement. After the observations, the two observers exchanged their observational records, compared their assessments based on which they discussed how easy or difficult the use of the observation tool was, whether some teaching criteria-qualities were directly observable or not, and whether the dichotomous scale (0 = in case the teaching criterion is not observed, 1 = in case the teaching criterion is observed) was working. In that sense, some expressions or prompting used in some teaching criteria - qualities, which were written as statements, were edited so as to become more specific and consistent with a critical-thinking based instruction. And further, the pilot-testing of the tool revealed that there was a need to record a frequency scale for the teaching criteria observed (e.g. how many times or for how long observed), and thus a relevant scale was added for each statement. In that sense, the pilot-testing served to validate the final version of the Critical-thinking Observation Tool.

The final version of the Observation Tool includes 10 teaching criteria - qualities targeting particular teaching skills oriented towards teaching for critical thinking. The criteria are written in statement format and measured using an ordinal dichotomous scale (i.e. 0 = in case the teaching criterion - quality is not observed, 1 = in case the teaching criterion - quality is observed). In addition, the extent to, and/or frequency under which each criterion was observed, is recorded. Some teaching criteria, if performed by the teacher and thus observed, were measured in terms of how many times they were observed (e.g. 0 times, 1 time, 2 times, 3 times, 4 times etc.), while others were measured in terms of duration, that is for how long they were observed. In particular, three teaching criteria out of ten were measured in terms of duration. Those concerned: a) Providing students with opportunities to practice critical thinking in structured challenging tasks and critical-thinking rich activities (teaching criterion 5; item 10); b) Modeling discrete thinking-skills processes through thinking diagrams by using and stressing the language of the thinking processes and using explicit critical-thinking verbal prompts (teaching criterion 7; item 14); c) Modeling discrete thinking-skills processes through the thinking aloud technique by stressing the language of the thinking process (teaching criterion 8; item 16). For these three teaching criteria, the coding of their frequency was from 0 to 4, that is, 0 in case there was no duration; 1 in case the teaching criterion lasts for up to 5 minutes; 2 in case the teaching criterion lasts for up to 10 minutes; 3 in case the teaching criterion lasts for up to 15 minutes; 4 in case the teaching criterion lasts for more than 16 minutes. In that vein, data obtained by the observational records concerned 20 different measures – items (i.e. 10 teaching criteria & 10 frequencies for those teaching criteria).

What's worth noting is that the initial version of the Observation Tool included 15 teaching criteria - qualities along with 15 frequencies for those criteria (a total of 30 measures – items). However, five of them were excluded from the observation tool since they were (re)considered to be too generic and not critical-thinking specific teaching skills; thus their contribution to the promotion of critical thinking was rather ambivalent. These five statements, that were excluded from further analysis concerned i) the purposeful use of the lesson content so as to encourage thinking, ii) the enrichment of the lesson content with relevant and authentic material, iii) the use of cooperative learning, iv) the encouragement of interaction between students during group work, and v) the encouragement of students to think aloud.

Along this line of reasoning, only 10 teaching criteria – qualities targeting particular teaching skills oriented towards teaching for critical thinking, along with the 10 measures of their frequency were considered for analysis. Although these teaching criteria theoretically fell under the four main dimensions of teaching quality that were purposefully chosen as instructional factors for the construction of the tool (i.e. 2 criteria for Orientation, 4 criteria for General Teaching Methodology, 2 criteria for Teaching and

Learning Strategies, and 2 criteria for Learning Environment), they were all taken together to report an overall score on teaching quality related to the promotion of critical thinking. Besides, the literature based on which the observation tool was developed has indicated that the criteria listed in the tool, taken together, have a significant effect on student critical-thinking outcomes. A copy of the observation tool is included in Appendix D.

As from mid November 2016, three observations of Language Arts lessons were carried out for each teacher participant, that is, a total of 69 observations (23 teachers x 3 times each). Each observation lasted for 80 minutes, and all the observations were carried out by the principal researcher, who used the Critical-Thinking Observation Tool. In that sense, the observations were spread out over the period that the teacher professional development programme in teaching for critical thinking took place (November 2016, February 2016 and April/May 2016). When scheduling observations, teacher participants of both the experimental and control groups, were asked to host the principal researcher in periods featuring teacher-led activities and not a special event (e.g. a guest presentation), or a lesson in which the teacher's role was minimized (e.g. an examination).

The Teacher Demographics' Questionnaire

The teacher demographics' questionnaire was developed so as to collect teacher background characteristics. The questionnaire asked teachers to give information about themselves as professional biographies. In that vein, the teacher-related variables concerned teacher sex, school, school position (i.e. teacher, deputy head teacher), total years of teaching experience, years of teaching experience in the elementary 5th or 6th grade, educational level (i.e. Master, PhD), previous training and professional development opportunities in teaching for critical thinking (i.e. seminars, conferences, research, postgraduate studies, personal study), as well as whether they were involved in the recent reform of the national curricula of Cyprus. All 23 teacher participants of the study were asked to complete the Teacher Demographics' Questionnaire, a copy of which is included in Appendix E.

The Teacher Reflections' Questionnaire

The goal of the Teacher Reflections' Questionnaire was twofold: a) Firstly, to investigate the contribution of the ongoing teacher professional development in teaching for critical thinking on teachers' perceived ability to enhance their students' critical thinking, and b) secondly, to (re)examine whether the professional development programme could actually strengthen teachers' meaning making, knowledge of, and commitment to teaching for critical thinking. The self-reporting format of the questionnaire becomes valid through the fact that observations, by which changes and/or improvements in teacher effectiveness in teaching for critical thinking were recorded, preceded. In that vein, after the completion of the programme, the 12 teachers of the experimental group were asked to reflect upon their professional development experience by completing the short questionnaire and sending it via email to the principal researcher within a two-week period.

For the development of the reflections' questionnaire, self-reported and reflective questionnaires developed by similar studies in the field of critical thinking were taken into account. For example, in the study of Dewey and Bento (2009), teacher participants in the ACTS (Activating Children's Thinking Skills Intervention) programme intervention, who were engaged in training for delivering the ACTS intervention, completed questionnaires following the first and second year of the intervention so that the impact on children's learning and on their own professional development could be examined. The questionnaire used four self-referring statements on a five-point scale and a fifth open-ended item, asking teachers to indicate how the ACTS contributed to their professional development as teachers (Dewey & Bento, 2009).

In a similar way, the teacher reflections' questionnaire was developed within the study and consisted of three parts. In Part A six self-referring statements on a four-point scale (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree) were used. Those were: *a) The programme met my expectations; b) The training sessions helped me clarify the concept of critical thinking and understand how it is taught; c) The programme enriched my teaching skills in teaching for critical thinking; d) The training and teaching material of the programme was helpful; e) I made good use of the programme's teaching material in my teaching; f) The programme helped me to become more self-reflective of my own teaching practice*. In Part B, three open-ended items asked teachers to i) explain how the programme has contributed to their professional development as teachers, ii) refer to at least two important key-ideas that helped them broaden their knowledge base and understanding of teaching for critical thinking and iii) suggest something that would have improved the enactment of the teacher professional development programme. These open-ended items allowed for an analysis of alterations of teachers' perceived ability to teach for critical thinking. In Part C, teachers were asked to feel free and share any true feelings, comments and opinions with regard to their professional development experience. A copy of the Teacher Reflections' Questionnaire is included in Appendix F.

Qualitative data obtained by the Teacher Reflections' Questionnaire were processed and analyzed according to key themes (or "patterns") as identified by the thematic analysis procedure (Braun & Clarke, 2006), a similar procedure that Dewey and Bento (2009) also employed for the qualitative data of their study.

The Reflective Journal of the Principal Researcher – Facilitator of the Programme

Throughout the year of the study during which the principal researcher collaborated with the teacher participants in the professional development programme, the researcher took notes in her reflective journal so that she could address teachers' needs. In that sense, she was reflectively writing down anything that concerned the teachers and their engagement in the programme and/or her own role in the programme. In particular, she kept notes with regard to teachers' misconceptions of critical thinking, and deficiencies or difficulties in teaching for critical thinking. And further, she recorded teachers' concerns with regard to the use of the Language Arts Curriculum, which was under public concern and discussion due to the recent reform of National Curricula in Cyprus, during the lifespan of the programme. In addition, the principal researcher kept a record of 'critical incidents' (e.g. a discussion in class, the use of a modelling strategy in class in relation to the reaction of students), either observed in class (through classroom observations) or raised in discussions with the teacher participants during the training sessions.

To get the most benefit from reflection and revise accordingly, if needed, the programme and its activities, the principal researcher tried to distance herself from her immediate impressions and be objective. To do that, she kept a 'split' journal where she could record what was going on and then return to reflect upon, and comment on, that a little while later (in a day, a week or even a month). In that sense, the reflective journal served as an effective means of professional development for the principal researcher herself since constant and critical self-reflection empowered her knowledge and skills both as a teacher and as researcher in the field of critical thinking.

Data Analysis Techniques

In the present study there was a deliberate data collection from two levels, namely, from the teacher and the student. Therefore, both quantitative and qualitative methods were employed to tap multiple sources of data while multilevel modeling techniques were used.

Besides, contemporary research in the field of teacher effectiveness encourages multilevel multidimensional statistical analyses (e.g. Creemers & Kyriakides, 2006; Kyriakides et al., 2017a; Kyriakides et al., 2017b), something that could lead to rich contextual evidence of the types of instructional factors that are associated with the reported gains in student critical-thinking outcomes. Before applying Rasch psychometric techniques analyses, descriptive and inferential statistics as well as multilevel analyses to organize and interpret the information collected within the study, variables needed to be clarified and related to the research questions. In this respect, the present study incorporated the following dependent and independent variables:

Dependent Variables (DV) of the Study

- Student Critical-Thinking Performance in post-testing [Measured by the SCTI]
- Teaching Quality consistent with a critical-thinking based instruction [Measured three times by the CTOT]

Independent (Explanatory) Variables (IV) of the Study

- Treatment Group [Teacher participation either in the experimental or the control group]
- Student Critical-Thinking Performance in pre-testing [Measured by the SCTI]
- Student Critical-Thinking Performance in interim-testing [Measured by the SRE]
- Student Background Characteristics [by the Student Demographics' Questionnaire]
- Teacher Background Characteristics [by Teacher Demographics' Questionnaire]

The independent variables of the study are referred to as inputs, predictors or explanatory variables, since information from these variables are used to predict the value of the dependent variables. Dependent variables are used to investigate whether they are predicted or explained by the independent (explanatory) variables, that is, the teacher engagement in the professional development programme, the student critical-thinking performance in the pre-test, the student critical-thinking performance in the interim-test, as well as the student and teacher background characteristics. Figure 3.3 presents the relations between the variables of the study.

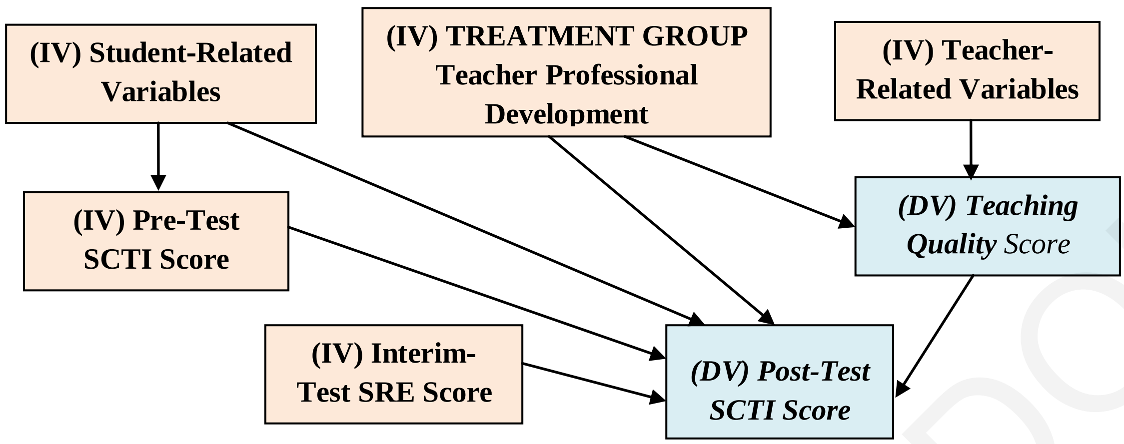

Figure 3.3: Relations between the Independent and Dependent Variables of the Study

With regard to the data analysis techniques that were chosen to answer the research questions of the study, Table 3.9 briefly presents which were employed for each research question, as well as the tools that were used for obtaining the data.

Table 3.9

Data Analysis Techniques Used for Each Research Question of the Study

Research Question	Research Tool	Data Analysis Techniques
1. Whether, and to what extent, did the teacher professional development programme in teaching for critical thinking contribute to student critical-thinking outcomes?	- The Student Critical-Thinking Instrument *(Comparison between groups)*	-Rasch Analysis Psychometric Techniques: i) to evaluate the measurement functioning of the instrument; ii) to compute each student's critical-thinking performance into a score -T-test Independent Samples - Multilevel Modelling Techniques
2. What was the contribution of the teacher professional development programme in teaching for critical thinking to student critical-thinking outcomes?	- The Student Critical-Thinking Instrument *(Comparison within each group)*	-Rasch Analysis Psychometric Techniques i) to evaluate the measurement functioning of the instrument; ii) to compute each student's critical-thinking performance into a score -T-test Paired Samples -Multilevel Modelling Techniques
3. Whether, and to what extent, did the teacher	- The Critical-Thinking	-Rasch Analysis Psychometric Techniques: i) to evaluate the

professional development programme in teaching for critical thinking improve teachers' quality of teaching with regard to the promotion of critical thinking?	Observation Tool (CTOT) *(23 teachers x 3 observations each)*	measurement functioning of the observation tool; ii) to compute data obtained by the observation of each teacher into a score. -T-test Independent Samples & T-test Paired Samples -Linear Regression Analysis
4. What proportion of variance in student critical-thinking outcomes was attributable to the student's background characteristics, the teacher's characteristics, and the professional development programme effects?	- The Student Critical-Thinking Instrument - The Student Demographics' Questionnaire - The Teacher Demographics' Questionnaire	-Rasch Analysis Psychometric Techniques: i) to evaluate the measurement functioning of the instrument; ii) to compute each student's critical-thinking performance into a score -Correlation Analyses -Multilevel Modelling Techniques
5. Did the teacher professional development programme in teaching for critical thinking empower teachers and enhance their perceived ability to promote critical thinking, as well as their meaning-making towards teaching for critical thinking?	Teacher Reflections' Questionnaire *(Data obtained by the teachers of the experimental group)* The Principal Researcher's Reflective Journal	-Thematic Analysis: For identifying, analyzing, and reporting patterns - themes within data

Quantitative Data

- ***Rasch Analysis Psychometric Techniques (QUEST software package)***

In order to answer the first four research questions, there were two needs: a) to construct interval-level measures, meaning that each student's critical thinking performance as measured by the SCTI was computed into a score, and b) to compute data obtained by the three observations of each teacher into three scores of teaching quality (teacher effectiveness scores). To this end, the Rasch model, a powerful measurement model, was used so as to examine whether performance on each item could be reducible to a common unidimensional scale that enables the specification of a hierarchy of item difficulty, since items can be ordered according to the degree of their difficulty (Kyriakides, Kaloyirou, & Lindsay, 2006; Kyriakides et al., 2017a). The Rasch model was considered appropriate for determining this scale since it enables researchers to test the extent to which the data meet the requirement that both the performances on each item of an instrument and the difficulties of the relevant items, form a stable sequence (within probabilistic constraints) along a single continuum (that is, if the students' measures and the item difficulties could be represented on the same scale) (Kyriakides, Crreemers, Papastylianou & Pastou, 2014). In that sense, people performing the tasks - items can be ordered according to their performance in the construct under investigation (Kyriakides, Creemers, & Antonioy, 2009; Kyriakides et al., 2017a). Considering that the Rasch model converts ordinal data into interval data, it also made it possible to make statements about the relative difficulty of the items included in SCTI and CTOT and investigate the conceptual structure of the measures (Kyriakides et al., 2014), that is, the construct validity of the SCTI and CTOT respectively.

Rasch Analysis for Student Data obtained by the SCTI

For each measurement occasion (i.e. before and after the intervention), data that emerged from SCTI were analyzed using the computer program Quest (Adams & Khoo, 1996). Two scales were created based on the log odds of students' responses in the pre- and post-test (Kyriakides et al., 2014). The study used the simplest version of the Rasch models, the dichotomous model that predicts the conditional probability of a binary outcome (correct/ incorrect), given the person's ability and the item's difficulty (Kyriakides et al., 2006). In particular, the probability of a correct response is a logistic function of the difference between the ability of the person and the difficulty of the item. This S-shaped function transforms any value of the real line into a value between 0 and 1 (Kyriakides et al., 2006). The rating scale model as developed by Rasch back in 80s is an extension of the dichotomous model to the case in which items have more than two response categories (Kyriakides et al., 2006) and for that reason it was used to analyze the data obtained by the students' responses to the 21 items of the SCTI. In particular, twenty of the SCTI items had a four response coding, and only one open-ended item (item 19) had a six response coding. After performing descriptive statistics to monitor the frequency of each response, it resulted that there was a need to recode eight items, since some of their responses had less than 8% frequency. After the recoding, thirteen items were modeled as having three thresholds, while eight were modeled as having two thresholds. Each threshold has its own difficulty estimate, and thresholds are calculated in log odds (otherwise called logits) and should be ordered to represent decreasing probability of each event occurring (Kyriakides et al., 2006). During the analysis emphasis was placed on the distances between the threshold estimates; that they should be neither too close together nor too far apart on the logit scale (Bond & Fox, 2001). In addition, what was taken into account was the model's fit statistics: (a) infit (weighted) and (b) outfit (unweighted) mean square statistic. Fit statistics were used to assess whether a given student's performance (or a given item) is consistent with other students' performances (or items) and are based on the differences between the expected and observed performances (Kyriakides et al., 2006). Outfit statistics are based solely on the difference between observed and expected scores, whereas in calculating infit statistics extreme persons or items are downweighted (Kyriakides et al., 2006). All weighted (i.e. infit) statistics in the Rasch model actually increase the weight of targeted responses. Items are considered to fit the Rasch model if they have item infit within the range of 0.77–1.30 while the normalized statistics, infit t and outfit t, have a mean near zero and a standard deviation near one when the data conform to the measurement model (Kyriakides et al., 2006).

Rasch Analysis for Teacher Data obtained by the CTOT

Along the same line of reasoning, the teacher data obtained by the classroom observations were analyzed by using the computer programme Quest to create three scales referring to teacher effectiveness scores in terms of teaching for critical thinking: a) the initial teaching quality (observed on November 2016), the second teaching quality (observed on February 2016), and the third teaching quality (observed on April/May 2016). The study again used the simplest version of the Rasch models, the dichotomous model that predicts the conditional probability of a binary outcome (correct/incorrect), given the person's ability and the item's difficulty (Kyriakides et al., 2006). This S-shaped function transforms any value of the real line into a value between 0 and 1 (Kyriakides et al., 2006). The rating scale model as an extension of the dichotomous model is used in the case in which items have more than two response categories (Kyriakides et al., 2006) and for that reason it was used to analyze the data obtained by the CTOT. In particular, the ten main items were measured using a dichotomous scale (i.e. 0=no, if not observed, 1=yes, if observed), while the other ten items concerned the extent to, and/or frequency under which the ten main items – teaching criteria were measured either in terms of how many times they were observed (e.g. 0-4, where 0 equals to 0 times, 1 equals to 1 time, 2 equals to 2 times, 3 equals to 3 times and 4 equals to four times) or in terms of duration, that is for how long they were observed (e.g. 0-4, where 0 equals to 0, 1 equals up to 5 minutes, 2 equals up to 10 minutes, 3 equals up 15 minutes, and 4 equals 16 minutes and above). Out of these ten items measuring frequency or duration, only 1 item (item 6) had an 8 response coding. After performing descriptive statistics to monitor the frequency of each response, it turned out that there was a need to recode this particular item only, since some of its responses had less than 8% frequency. After the recoding, that item (item 6) was modeled as having 4 thresholds. In that sense, ten items (ten main teaching criteria) were modeled as having one threshold, four items (item 2, 6, 12 measuring frequency and item 10 measuring duration) were modeled as having four thresholds, one item (item 14 measuring duration) was modeled as having three thresholds, and five items (items 4, 8, 18, 20 measuring frequency and item 16 measuring duration) were modeled as having two thresholds. Based on the Rasch methodology, each threshold has its own difficulty estimate, while thresholds are calculated in log odds (otherwise called logits) and should be ordered to represent decreasing probability of each event occurring (Kyriakides et al., 2006).

- ***Multilevel Modelling Regression Techniques (MLwiN software package)***

Multilevel models provide an answer to the unit of analysis problem because these models allow researchers to simultaneously consider multiple levels of effects (Huang & Moon, 2009; Kyriakides & Charalambous, 2004; Pike & Roconni, 2012). Multi-level modelling techniques, a methodology for the analysis of data with complex patterns of variability, can meet the drawbacks of single-level analysis, such as the neglect of the original data structure assuming that individuals within similar subunits (i.e. classes) do not share common characteristics (Kyriakides & Charalambous, 2004). In particular, multilevel analysis explicitly models the way students are grouped within classes or schools and, therefore, has several advantages: (a) Firstly, multi-level analysis takes into account the hierarchically structured data and the variability associated with each level, since there is variability between students as well as between classes; (b) Secondly, it provides a means of partitioning the outcome variance of the variable into different levels (within and between units), enabling researchers to compare the teacher and/or school effects; (c) Third, it yields better-calibrated estimates for the variance of standard errors; (d) Fourth, it offers a single framework that combines the information within and across units to produce more accurate explanations and outcomes; (e) Lastly, clustering information provides correct standard error confidence intervals and significance tests, which are more conservative than the traditional ones that result by ignoring the presence of clustering (Kyriakides & Charalambous, 2004).

Along this line of reasoning, the present study used multilevel modelling regression techniques to disentangle the student, class (teacher), and school variance components, since the data were nested; namely, students within classes/teachers and schools. The main aim was to explore the extent to which the differences in student critical-thinking performance between the experimental and control groups were accountable for by factors related either to the school, class/teacher or student characteristics, since multilevel analysis allows the use of covariates measured at any of the levels of a hierarchy (Huang & Moon, 2009; Kyriakides & Charalambous, 2004). Under this framework, the first step in the analysis was to determine the variance at individual, class, and school level without explanatory variables (empty model or model 0). Since the number of schools involved in the research study was relatively small (N=14), it was decided to distinguish two levels (i.e. classroom/teacher and student). The second step in the analysis was to add to the empty model student-related explanatory variables, namely the student critical-thinking performance as measured in the pre-test, the student critical-thinking performance as measured in the interim test, as well as other student-related variables (i.e. sex, free-time activities) and parent-home-related variables (i.e. profession, education) (model 1). On a third level, that is, in model 2a, the explanatory variable of teaching quality was added. The variable of teaching quality was aggregated from the teacher level data (three measurements for each teacher obtained by classroom observations). Subsequently, the explanatory variable of teaching quality was removed, while the explanatory variable of treatment group (experimental or control) was added to Model 2b. In model 2c, both explanatory variables, namely, teaching quality score (as emerged from the aggregation of the three measurements for each teacher obtained by classroom observations) and the treatment group, as independent variables, were added.

- ***Descriptive and Inferential Statistics (SPSS software package)***

Descriptive Statistics for Student Data

Descriptive Analyses. Descriptive statistics were employed in order to summarize information about student background characteristics in the study's dataset, such as the averages and the variances of those variables, as well as to investigate frequencies, that is, the numbers of cases that fall into various categories/values. In that sense, descriptive statistics helped the principal researcher to make several decisions, namely: a) to recode some of the 21 ordinal variables obtained by the students' responses in the SCTI in cases, where the frequency of particular values for a variable was below 8%, and b) to clear up the student background characteristics obtained by the demographics' questionnaire (i.e. sex, academic achievement, parents' mother tongue, parents' education, parents' profession, free-time activities).

Inferential Statistics for Student Data

Chi-Square Test of Independence. Chi-Square Test was employed so as to examine whether some observed differences within a variable (e.g. boys and girls) in terms of their distribution among categories was statistically different from the pattern expected due to chance. In that sense, the variables crosstabulated for calculating the Chi-Square were student sex and treatment group as well as student sex and academic achievement.

T-Test Independent Samples & T-test Paired Samples. The T-test technique was used for comparing mean values of student critical-thinking performance as measured in the pre- and post-test. The comparison provided a statistic for evaluating whether the difference between the two means was statistically significant. T tests were used to compare two independent groups (independent-samples t test) and to compare observations from two measurement occasions (pre- and post-test) for the same group (paired-samples t test). T tests were necessary in order to be sure whether any critical-thinking gains of the experimental group was more likely due to critical-thinking based instruction enacted by teachers who were empowered than to systematic differences of the two groups in the critical-thinking performance as measured in the pre-test.

- *The Independent-Sample t Test* was used to compare the scores on critical-thinking (pre-test and post-test) of students in the experimental and control group to evaluate whether there is a statistically significant difference in their scores.
- *The Paired-Sample t Test* was used to compare the means of pre- and post- scores on critical-thinking within each group, that is, the experimental and the control to evaluate whether there is a statistically significant difference between pre-test scores and post-test scores among the students in each group.

Correlation. In order to measure the linear relationship between variables, correlation analysis was also used, considering the values of the correlation coefficients (when closer to the absolute value of 1, there is a strong relationship between the variables being correlated, when closer to 0, there is little or no linear relationship) and their signs. The sign of a correlation coefficient describes the type of relationship between the variables being correlated. A positive correlation coefficient indicates that there is a positive linear relationship between the variables: as one variable increases in value, so does the other. The present study used the correlation – bivariate analysis so as obtain correlations between *Student Critical-Thinking Performance (post-test)* and *Student Reading Books*, and between *Student Critical-Thinking Performance (post-test)* and *Student Critical-Thinking Performance (interim-test).*

Descriptive Statistics for Teacher Data

Descriptive Analyses. Descriptive statistics were employed in order to summarize information about the teacher-related variables in the study's dataset, such as the averages and the variances of those variables, as well as to investigate frequencies, that is, the numbers of cases that fall into various categories/values. In that sense, descriptive statistics helped the principal researcher to make several decisions, namely: a) to recode some of the 10 ordinal variables obtained by classroom observation by using the CTOT in cases where the frequency of particular values for a variable was below 8%, and b) to clear up the teacher-related variables obtained by the demographics (i.e. teaching experience, teacher education level, opportunities for training in critical thinking). Considering that the post-test mean scores on the SCTI are partial indicators of teacher effectiveness in teaching for critical thinking, investigating the contribution of other teacher-related variables could suggest which of them are virtually irrelevant or not to teacher effectiveness in teaching for critical thinking.

Inferential Statistics for Teacher Data

T-Test Independent Samples & T-test Paired Samples. The T-test technique was used for comparing mean values of teaching quality, namely teacher effectiveness in teaching for critical thinking as measured during the three observations that took place for each teacher. The comparison provided a statistic for evaluating whether the difference between the two means was statistically significant. T tests were used to compare two independent groups (independent-samples t test) and to compare observations from two measurement occasions (i.e. teaching quality 1 and teaching quality 3) for the same group (paired-samples t test). T tests for teacher data were necessary in order to be sure that teachers in the experimental and control group had no statistically significant differences in teaching quality during the first observation. And further, T-Test were used so as to examine whether the teaching quality of teachers in the experimental group was gradually improving in terms of becoming more effective in teaching for critical thinking as a result of their engagement in the teacher professional development programme.

- *The Independent-Sample t Test* was used to compare the teaching quality scores (observation 1, observation 2 and observation 3 for each teacher) of teachers in the experimental and control group to evaluate whether there is a statistically significant difference in their scores.
- *The Paired-Sample t Test* was used to compare the means of the teaching quality scores within each group, that is, the experimental and the control to evaluate whether there is a statistically significant difference between teaching scores as measured in first and the third observation among the teachers in each group.

Linear Regression Analysis. Regression, as a technique through which the effects of one or more predictor variables on an outcome/dependent variable are investigated, was used to make statements about whether and how well the treatment group, that is, teachers' engagement in the professional development programme in teaching for critical thinking, was a good predictor of teaching quality in terms of teacher effectiveness in teaching for critical thinking.

Qualitative Data

Data Obtained by the Teacher Reflections' Questionnaire

Thematic analysis was used to analyze data obtained by the teacher reflections' questionnaire, which was completed by the 12 teachers of the experimental group. Thematic analysis offers an accessible and theoretically-flexible approach to analyzing qualitative data because it works both to reflect the reality of participants (essentialist or realist approach), and to unpick or unravel the surface of reality, that is, the ways individuals make meaning of their experience(s) (constructionist approach) (Braun & Clarke, 2006). In that sense, thematic analysis was used for identifying, reporting, analyzing and interpreting repeated patterns of meaning (themes) within the data (Braun & Clarke, 2006). What counted as a theme depended on whether it was capturing something important in relation to the fifth research question (which maps onto the more theoretical approach of thematic analysis) while all themes identified formed an accurate reflection of the content of the entire data set (Braun & Clarke, 2006). To apply the thematic analysis, the six phases of the analysis provided by Braun and Clarke (2006) were used, namely:

(a) Immersion in the data = Repeated active reading of the data; searching for repeated patterns of meaning, taking notes or marking ideas for coding

(b) Coding data extracts = Organizing data into meaningful groups and have them collated

(c) Forming main themes and sub-themes = Themes tend not to be quantified (as happens in content analysis) and should be internally coherent, consistent, and distinctive.

(d) Reviewing and refining themes = a) Reading all the collated extracts for each theme, and considering whether they appear to form a coherent pattern, b) Ascertaining whether the themes work in relation to the entire data set and recoding any additional data within themes, if needed.

(e) Defining and naming themes = Identifying the essence of what each theme is about (as well as the themes overall), and determining what aspect of the data each theme captures.

(f) Producing the final report = Providing a concise, coherent, logical, non repetitive, and interesting account of the story the data tell within and across themes and choosing vivid examples that demonstrate the prevalence of the theme.

Data Obtained by the Principal Researcher's Reflective Journal

The six phases of the thematic analysis, as described by Braun and Clarke (2006), were also used to analyze the rich data obtained by the reflective journal of the principal researcher. This method of analysis was chosen for identifying, reporting, analyzing and interpreting repeated patterns of meaning (themes) within the data (Braun & Clarke, 2006). Nevertheless, to analyze the data of the reflective journal, coding was not used for answering a specific research question (which maps onto the more theoretical approach) as in the case of teachers' reflections. Instead, the specific research question evolved as data obtained by the reflective journal were inductively analyzed and coded (which maps onto the inductive approach). In that sense, three main distinctive themes emerged, which were recorded throughout the year by the principal researcher while she was collaborating with the teacher participants in the professional development programme in teaching for critical thinking. Those themes mainly concerned teachers' needs since the main goal of the reflective journal was to address the teacher participants' needs and revise the activities and emphases of the professional development programme accordingly. In that sense, themes are strongly related to the main purpose of the study and further inform the inquiry with regard to the presuppositions, conditions, processes and difficulties in teaching for critical thinking in the subject area of Language Arts. Those themes concern:

a) Misconceptions of critical thinking;

b) Deficiencies related to the use of the Language Arts Curriculum, developed within the recent reform of National Curricula in Cyprus (November, 2016), for determining critical-thinking objectives;

c) Deficiencies related to the design of lessons that purposefully and explicitly aim at teaching for critical thinking;

d) Difficulties encountered in teaching for critical thinking;

e) Important elements and/or presuppositions of a critical-thinking based instruction that facilitate the teaching for critical thinking in the elementary Language Arts course.

CHAPTER IV
RESULTS

In Chapter IV the results of the study are presented, as they have resulted from the quantitative and qualitative analyses performed based on the purpose and the research questions. Both quantitative and qualitative methods were employed to tap the multiple sources of data, while multilevel modelling techniques were used at the end to explore the extent to which the differences in student critical-thinking outcomes between the experimental and control groups were accountable for by factors related either to the class/teacher or student characteristics.

In that sense, the chapter firstly presents results related to the student critical thinking performance as measured by the SCTI (pre-test and post-test) as computed into scales using Rasch Analysis Psychometric Techniques and continues with comparisons between groups (pre-test, post-test and interim-test scores) and within groups (pre-test and post-test scores). On a second level, the chapter presents results related to the quality of teaching in terms of effectiveness in teaching for critical thinking as measured by the CTOT and as computed into a scale using again Rasch Analysis Psychometric Techniques. The chapter then continues with comparisons between groups and within groups, with regard to the quality of teaching as measured during the third and the first classroom observation. On a third level, the chapter presents results investigating how well the treatment group (independent variable), as well as other teacher background characteristics, predict the value of the quality of teaching (dependent variable). Subsequently, results with regard to the proportion of variance in student critical-thinking performance explained by the treatment group, that is, the teacher professional development programme and other explanatory student-related variables (e.g. interim-test score), as resulted from multilevel analyses, are presented. At the end, results with regard to the teachers' perceived ability to teach for critical thinking and meaning-making towards teaching for critical thinking are given. The chapter concludes with presenting teachers' misconceptions of critical thinking, difficulties, and presuppositions for teaching for critical thinking, as resulted from the analysis of the rich data obtained by the reflective journal of the principal researcher.

In that vein, the results presented in chapter IV particularly concentrate on the impact of the intervention, that is, teachers' engagement in professional development in teaching for critical thinking, upon three dependent variables: (a) student critical-thinking performance,

(b) the quality of teaching consistent with a critical-thinking based instruction, as well as (c) teachers' reflections upon their perceived ability to teach for critical thinking.

The Student Critical Thinking Performance as Measured by the SCTI

To answer the first two and the fourth research questions of the study concerning comparisons of students' critical-thinking outcomes between and within groups, there was a need to determine each student's critical-thinking performance as measured by the SCTI.

To this end, Rasch Analysis Psychometric Techniques were used. The aim of using Rasch Analysis Psychometric Techniques was twofold: a) Firstly, to evaluate the measurement functioning of the Critical-Thinking Instrument (SCTI); b) Secondly, to construct interval-level measures, meaning that each student's critical-thinking performance as measured by the SCTI was computed into a score. In that sense, the data obtained in the pre-test were analyzed with the whole sample (N = 395) and all its 21 items together. There was no item that did not fit the model, and the analyses therefore enabled the testing of the meaning, targeting, validity, and reliability of the SCTI. Subsequently, the analyses were repeated with the data obtained in the post-test again with the whole sample (N = 395) and all its 21 items together.

Model fit

Student Critical-Thinking Performance: Pre-Test Scale

Figure 4.1 illustrates the scale for the 21 items of the SCTI concerning the student critical thinking performance as measured in the pre-test. Both item difficulties and students' measures are calibrated on the same scale. Figure 4.1 reveals that the items have a good fit to the measurement model, indicating a strong mutual consistency in the responses of the 395 students located at different positions on the scale, across all 21 items. Moreover, the items are well targeted against the students' measures, since the students' scores range from -1.97 to 1.67 logits, whereas the item difficulties range from -0.80 to 1.20 logits. Logits for items were calculated by aggregating their thresholds. As Figure 4.1 shows, a very small number of students have reached the upper positions of the scale, which is not a concern for the targeting of the SCTI's items.

```
--------------------------------------------------------------------------------
High Critical-Thinking Scores       Difficult Critical-Thinking Items
  4.0                            |
                                 |
                                 |
                                 |
                                 |
                                 |
                                 |
                                 |
                                 |
  3.0                            |
                                 |
                                 |
                                 |
                                 |
                                 |
                                 |
                                 |
                                 |
  2.0                            |
                                 |
                                 |
                             X   |
                                 |
                             X   |
                                 |
                             X   |      12
                             X   |
  1.0                            |
                            XX   |
                            XX   |      21
                           XXX   |
                       XXXXXXX   |      19   4
                         XXXXX   |
                       XXXXXXX   |       8   14
                   XXXXXXXXXXX   |
                       XXXXXXX   |      18
            XXXXXXXXXXXXXXXXXX   |       7   9    17
   .0          XXXXXXXXXXXXXXX   |      15   16
                       XXXXXXX   |       3   10
                XXXXXXXXXXXXXX   |
                     XXXXXXXXX   |
                          XXXX   |      11
                          XXXX   |       1   5
                            XX   |      20
                         XXXXX   |       2   13
                             X   |       6
 -1.0                       XX   |
                             X   |
                                 |
                                 |
                             X   |
                                 |
                                 |
                                 |
                                 |
 -2.0                            |
Low Critical-Thinking Scores       Easy Critical-Thinking Items
--------------------------------------------------------------------------------
Note. Each X represents 3 students
```

Figure 4.1. Pre-Test Scale for the Student Critical-Thinking Performance in the SCTI

```
--------------------------------------------------------------------------------
High Critical-Thinking Scores       Difficult Critical-Thinking Items
  3.0                            |
                                 |
                                 |
                             X   |
                                 |
                                 |
                            XX   |
                                 |
                            XX   |
  2.0                            |
                           XXX   |
                          XXXX   |
                                 |
                          XXXX   |
                          XXXX   |       12
                        XXXXXX   |
                         XXXXX   |
                      XXXXXXXX   |
  1.0                   XXXXXX   |       17
                     XXXXXXXXX   |
                        XXXXXX   |
                      XXXXXXXX   |        4
             XXXXXXXXXXXXXXXXX   |
                    XXXXXXXXXX   |        8
            XXXXXXXXXXXXXXXXXX   |       18   14   16
                    XXXXXXXXXX   |       15   19
                  XXXXXXXXXXXX   |       21
   .0                 XXXXXXXX   |        9   10
             XXXXXXXXXXXXXXXXX   |        6    7
                      XXXXXXXX   |
                      XXXXXXXX   |        3
                       XXXXXXX   |       11
                           XXX   |        5    1
                        XXXXXX   |
                           XXX   |       13   20
                            XX   |
                           XXX   |        2
 -1.0                       XX   |
                             X   |
                             X   |
                                 |
                                 |
                             X   |
                             X   |
                                 |
                                 |
 -2.0                            |
                                 |
                                 |
                             X   |
                                 |
                                 |
                                 |
                                 |
                                 |
 -3.0                            |

Low Critical-Thinking Scores       Easy Critical-Thinking Items
--------------------------------------------------------------------------------
```

Note. Each X represents 2 students

Figure 4.2. Post-Test Scale for the Student Critical-Thinking Performance in the SCTI

Student Critical-Thinking Performance: Post-Test Scale

Figure 4.2 illustrates the scale for the 21 items of the SCTI concerning the student critical thinking performance as measured in the post-test. Both item difficulties and students' measures are calibrated on the same scale. Figure 4.2 reveals that the items have a relatively good fit to the measurement model, indicating a strong mutual consistency in the responses of the 395 students located at different positions on the scale, across all 21 items. However, as Figure 4.2 shows, almost all of the items are well targeted against the students' measures, since the students' scores range from -2.34 to 2.64 logits, whereas the item difficulties range from -0.91 to 1.43 logits. Logits for items were calculated by aggregating their thresholds. Based on the targeting shown in Figure 4.2, probably more difficult items would be needed to target the students (probably from the experimental group), whose critical-thinking performance might have improved.

Psychometric Properties of the SCTI

The analysis of student responses to the 21 items of SCTI (pre-test & post test) revealed that the SCTI had relatively satisfactory psychometric properties. Table 4.1 provides a summary of the statistics of each scale for the whole sample.

Table 4.1

Statistics Related to Each of the Two Scales of the SCTI for the Whole Sample

		Pre-Test Scale (SCTI Pre-Testing)	Post-Test Scale (SCTI Post-Testing)
Mean	Items	0.0	0.0
	Persons	0.1	0.41
Standard Deviation	Items	0,55	0.57
	Persons	0.52	0.74
Separability	Items	0.86	0.85
	Persons	0.73	0.83
Mean Infit mean square	Items	1.00	1.00
	Persons	1.02	1.00
Mean Outfit mean square	Items	1.01	1.00
	Persons	1.01	1.00
Infit t	Items	0.04	0.10
	Persons	0.04	0.02
Outfit t	Items	0.08	0.00
	Persons	0.06	0.06

Reliability is calculated by the Item Separation Index and the Person Separation Index. Separation indices represent the proportion of the observed variance considered to be true. A value of 1 represents high separability in which errors are low and item difficulties and student measures are well separated along the scale (Wright & Masters, 1981). Table 4.2 reveals that the indices of cases and item separation (i.e. reliability) are close to 0.85, indicating that the separability of each scale is relatively satisfactory. Moreover, for each scale, the infit mean squares and the outfit mean squares are 1 and the values of the infit t scores and the outfit t scores are approximately zero. Looking at the actual values of the infit and outfit of each item, one can identify that all items have item infit with the range 0.82–1.25, and item outfit with the range of 0.71–1.38. In addition, it was found that all the values of infit t for both students and items are greater than –2.00 and smaller than 2.00. This implies that in each analysis, there is a good fit to the Rasch model.

In this respect, for each student participant in the experimental and control group, it was possible to generate two different scores of SCTI by calculating the relevant Rasch person estimates that emerged in the two measurement periods (i.e. before and after the intervention). These Rasch person estimates (scores) were taken into account when measuring the impact of the intervention upon the improvement of student critical-thinking outcomes.

Descriptive Statistics for Pre-Test and Post-Test Critical-Thinking Performances

In the following Tables (see Tables 4.2, 4.3 and 4.4), results of descriptive statistics (mean, standard deviation, minimum, maximum) are presented for the two scales, namely student critical-thinking performance, as measured by the SCTI in the pre- and post-test for the whole sample and for each group.

Table 4.2 presents the descriptive statistics for the whole sample. The mean of student critical-thinking performance as measured in the pre-test is 0.01, while the mean in the post-test is 0.41. Their standard deviations are small, which indicates that the values of the individuals do not differ from the mean value of the whole sample. The maximum value that students reached during the post-test (max=2.64) is bigger than the maximum value of the pre-test (max=1.67), something that initially indicates an improvement in the students' critical-thinking outcomes.

Table 4.2

Descriptive Statistics for the Pre-Test and Post-Test Scales (Student Critical Thinking Performance as Measured by the SCTI) for the Whole Sample of the Study

	N	$\overline{X}$	SD	Minimum	Maximum
Student Critical-Thinking Performance (Pre-Test)	395	.01	.52	-1.97	1.67
Student Critical-Thinking Performance (Post-Test)	395	.41	.73	-2.34	2.64

Note: Using the Rasch model, it was possible to measure the critical-thinking performance in logits

Table 4.3 presents the descriptive statistics for the pre-test scale for each of the two groups. As far as the control group is concerned, the mean of the student critical-thinking performance as measured in the pre-test is 0.08. The standard deviation is small (SD=0.51), which indicates that the values of the individual students in the control group do not differ from the mean value of the group. With regard to the experimental group, the mean of the student critical-thinking performance as measured in the pre-test is -0.05. The standard deviation is small (SD=0.51), which again indicates that the values of the individual students in the experimental group do not differ from the mean value of the group. Students of both groups have reached the same maximum value in the pre-test (max=1.67), while their minimum values are very close.

Table 4.3

Descriptive Statistics for the Pre-Test Scales (Student Critical Thinking Performance as Measured by the SCTI in the Pre-Test) for Each of the Two Groups of the Study

Group		N	$\overline{X}$	SD	Minimum	Maximum
Control Group	Student Critical-Thinking Performance (Pre-Test)	190	.08	.51	-1.97	1.67
Experimental Group	Student Critical-Thinking Performance (Pre-Test)	205	-.05	.51	-1.82	1.67

Note: Using the Rasch model, it was possible to measure the critical-thinking performance in logits

Table 4.4 presents the descriptive statistics for the post-test scale for each group. As far as the control group is concerned, the mean of the student critical-thinking performance as measured in the pre-test is -0.07. The standard deviation is small (SD=0.54), which indicates that the values of the individual students in the control group do not differ from the mean value of the group.

Table 4.4

Descriptive Statistics for the Post-Test Scale (Student Critical Thinking Performance as Measured by the SCTI in the Post-Test) for Each of the Two Groups of the Study

Group		N	$\overline{X}$	SD	Minimum	Maximum
Control Group	Student Critical-Thinking Performance (Post-Test)	190	-.07	.54	-2.34	1.22
Experimental Group	Student Critical-Thinking Performance (Post-Test)	205	.86	.59	-0.29	2.64

Note: Using the Rasch model, it was possible to measure the critical-thinking performance in logits

With regard to the experimental group, the mean of the student critical-thinking performance as measured in the post-test is 0.86. The standard deviation is small (SD=0.59), which again indicates that the values of the individual students in the experimental group do not differ from the mean value of the group. Students of the experimental group have reached a bigger maximum value (max=2.64) than their counterparts in the control group (max=1.22). The minimum value for students in the control group was smaller (min=-2.34) than the minimum value for students in the experimental group (min=-0.29). Tables 4.3 and 4.4 initially indicate an improvement in the students' critical-thinking outcomes. The analyses that follow will provide support for whether or not the observed pattern of improvement is statistically significant and whether there are statistically significant differences between the two groups.

Comparisons between Groups (Pre- and Post-Test Scaled Scores)

Hypothesizing that the professional development programme in teaching for critical thinking in which the teachers of the experimental group were engaged did cause an effect on student critical-thinking outcomes, an independent sample t-Test was used so as to compare the means between the groups for pre-test and post-test. Considering that the significance level associated with the value under the heading *Levene's Test for Equality of Variances* tests the hypothesis that the variances of the two groups are equal (i.e. groups have unequal variances if $p<0.05$; groups have equal variances if $p>0.05$), t-test statistics either in the row labeled *Equal Variances Assumed* or in the row labeled *Equal Variances not Assumed* were accordingly used. The following results concern the first research question of the present study:

> *1. Whether (and to what extent) did the teacher professional development programme in teaching for critical thinking contribute to student critical-thinking outcomes?*

With regard to the student critical-thinking scores in the pre-test, the independent-samples *t* test between the experimental and control group (see Table 4.5) indicates that the critical-thinking performance of students in the control group as measured in the pre-test was statistically significantly higher ($t=-2.72$, $df=393$, $p < 0.05$) than the critical-thinking performance of their counterparts in the experimental group. In that sense, although the mean scores of the two groups are very close, as Table 4.5 presents, and one could claim that the difference is minor, that difference is still statistically significant.

Table 4.5

Independent Sample t-Test between Groups (Critical-Thinking Pre-Test Score)

	Group	N	$\bar{X}$	*SD*	T	df	Sig. (2-tailed)
Student Critical-Thinking Performance (Pre-Test)	Experimental Group	205	-.05	.51	-2.72	393	.007
	Control Group	190	.08	.51			

As far as the student critical-thinking scores as measured in the post-test are concerned, the independent-samples *t* test between the experimental and control group (see Table 4.6) provides support that the critical-thinking performance of students in the experimental group as measured in the post-test was statistically significantly higher ($t =16.31$, $df=393$, p<0.05) than the critical-thinking performance of their counterparts in the control group. In particular, as presented in Table 4.6, their mean difference is 0.93 (SD = 0.05).

Table 4.6

Independent Sample t-Test between Groups (Critical-Thinking Post-Test Score)

	Group	N	$\bar{X}$	*SD*	t	df	Sig. (2-tailed)
Student Critical-Thinking Performance (Post-Test)	Experimental Group	205	.86	.59	16.31	393	.000
	Control Group	190	-.07	.54			

Comparisons between Groups (Interim-Test Score)

Hypothesizing that the professional development programme in teaching for critical thinking in which the teachers of the experimental group were engaged did cause an effect on student critical-thinking outcomes, an independent sample t-Test was used so as to compare the means between the groups with regard to their interim-test scores.

Table 4.7 presents the mean scores of the two groups, as measured in the interim testing, which was a midway point between the pre- and post-test.

Table 4.7

Independent Sample t-Test between Groups (Student Critical-Thinking Interim-Test Score)

	Group	N	$\bar{X}$	*SD*	T	df	Sig. (2-tailed)
Student Critical-Thinking Performance (Interim-Test)	Control Group	184	1.87	.81	-7.773	384	.000
	Experimental Group	204	2.52	.83			

Using the t-test statistics in the row labeled *Equal Variances not Assumed* (p=0.037<0.05), the independent-samples *t* test between experimental and control group indicates that the critical-thinking performance of students in the experimental group as measured in the interim-test was statistically significantly higher (t=-7.773, df = 384, p<.05) than the critical-thinking performance of their counterparts in the control group with a mean difference of 0.65.

Comparisons within Groups (Pre-Test and Post-Test Scaled Scores)

In order to test the hypothesis that there are differences between student critical-thinking performance as measured in the pre-test and post-test within the experimental group, a t-test paired sample was used. The same analysis was used for the control group in order to test if there were differences between student critical-thinking performance as measured in the pre- and post-test. In that sense, the results that are presented in Tables 4.8 and 4.9 concern the second research question of the present study:

> *2. What was the contribution of the teacher professional development programme in teaching for critical thinking to student critical-thinking outcomes?*

Tables 4.8 and 4.9 present the mean scores of each group respectively, as measured in the pre- and post-tests.

Table 4.8

T-test Paired Samples Statistics Comparing Pre-Test and Post-Test Critical-Thinking Scores within the Experimental Group

Group		$\bar{X}$	*SD*	T	Df	Sig. (2-tailed)
Experimental Group *(N=205)*	Student Critical-Thinking Performance (Pre-Test)	-.05	.51	-30.437	204	.000
	Student Critical-Thinking Performance (Post-Test)	.86	.59			

With regard to the experimental group (see Table 4.8), the *t* statistic (t=-30.437, df=204) and its associated significance level ($p<0.05$) indicate that the hypothesis is confirmed, since there is a statistically significant difference between pre-test and post-test scores among the students in the experimental group. In particular, students in the experimental group have increased their scores from pre-test to post-test (observed mean difference = 0.91, SD = 0.43, SE Mean = 0.03).

With regard to the control group (see Table 4.9), the t statistic (t = 6.751, df =189) and its associated significance level ($p < 0.05$) again indicate that there is a statistically significant difference between pre-test and post-test scores among the students in the control group. But, what differs from the experimental group is that students in the control group have decreased their scores from pre-test to post-test (observed mean difference = 0.16, SD = 0.32, SE Mean = 0.02).

Table 4.9

T-test Paired Samples Statistics Comparing Pre-Test and Post-Test Critical-Thinking Scores within the Control Group

Group		$\overline{X}$	*SD*	T	Df	Sig. (2-tailed)
Control Group *(N=190)*	Student Critical-Thinking Performance (Pre-Test)	.08	.51	6.751	189	.000
	Student Critical-Thinking Performance (Post-Test)	-.07	.54			

Based on the correlations resulted from the *t*-test paired sample, there is a positive correlation between student critical-thinking performance as measured in the pre-test and post-test for the experimental group (*r*=0.705), which is statistically significant ($p < 0.005$). The same applies for the control group since there is a positive correlation between student critical-thinking performance as measured in the pre-test and post-test (*r*=0.811), which is statistically significant ($p < 0.005$) and provides support to the predictive validity of the test (SCTI).

The Quality of Teaching for Critical Thinking as Measured by the CTOT

For answering the third research question of the study concerning the improvement of the teaching quality, that is teachers' effectiveness in teaching for critical thinking, there was a need to determine each teacher's teaching quality, as measured by the Critical-Thinking Observation Tool (CTOT), three times for each teacher. To this end, Rasch Analysis Psychometric Techniques were used. The aim of using the Rasch Analysis Psychometric Techniques was twofold: a) Firstly, to evaluate the measurement functioning of the CTOT; b) Secondly, to construct interval-level measures, meaning that each teaching quality as measured by the CTOT (three times for each teacher) was computed into a score.

On a first level, the data obtained during the classroom observations, that is, the 69 measurement occasions (23 teachers x 3 times each), were analyzed with the whole teacher sample (N=23) and all the 30 measures – items (15 teaching criteria & 15 frequencies) of the initial version of the CTOT together. Based on these initial results, 10 measures – items (5 teaching criteria & 5 corresponding frequencies) were removed either because the gap between their thresholds was too big or too small, and thus they didn't fit the model (…), or because they were (re)considered as too general teaching criteria; thus, their contribution to the promotion of critical thinking in class was rather ambivalent. These five teaching criteria, along with their frequencies that were excluded from the model and further analysis, concerned: i) Purposefully using the lesson content so as to encourage thinking (frequency thresholds = -1.31 – 1.45); ii) Enriching the lesson content with relevant and authentic material (frequency thresholds = 0.70 – 1.53); iii) Using cooperative learning (frequency thresholds = -0.38 – 3.76); iv) Encouraging interaction between students during group work (frequency thresholds = -0.28 – 4.58); v) Encouraging students to think aloud (frequency thresholds = -0.28 – 2.02).

The results of the various approaches used to test the fitting of Rasch model to the data revealed that there was a good fit to the model when teachers' performance in the other 20 teaching items was analyzed. So, on a second level, the analysis was repeated with the data obtained during the classroom observations, that is, the 69 measurement occasions (23 teachers x 3 times each), with the whole teacher sample (N=23) and the remaining 20 measures – items (10 teaching criteria & 10 frequencies) of the final version of the CTOT together. From these 20 items, there was no item that did not fit the model, and the analysis therefore enabled the testing of the meaning, targeting, validity, and reliability of the CTOT.

Model fit

Effectiveness in Teaching for Critical Thinking: Teaching Quality Scale

Figure 4.3 illustrates the scale for the 20 items of the CTOT concerning the teaching quality, namely teacher effectiveness in teaching for critical thinking as measured during the three classroom observations. Both item difficulties and teachers' measures are calibrated on the same scale. Figure 4.3 reveals that the items have a good fit to the measurement model, indicating a mutual consistency in the teacher effectiveness scores of the 23 teachers located at different positions on the scale, across nearly all 20 items. Logits for teacher effectiveness scores were calculated by aggregating the person estimates. Only two teacher effectiveness scores are located on the upper positions of the scale, which is rather justified, since those belong to teachers in the experimental group, whose quality of teaching gradually improved, as a result of their engagement in the professional development programme in teaching for critical thinking. Moreover, almost all items are well targeted against the teachers' measures since teachers' scores range from -0.60 to 2.00 logits, whereas the item difficulties range from -1.51 to 1.28 logits. Logits for items were calculated by aggregating the items' thresholds. However, logits for 6 items are located in the lower positions of the scale, which is partly justified by the fact that these items particularly concerned general teaching methodology criteria (e.g. questioning, formative assessment), which are rather more (easily) used by teachers.

Psychometric Properties of the CTOT

The analysis of teacher performance on the 20 items of CTOT (three observations for each teacher) revealed that the CTOT had relatively satisfactory psychometric properties. Table 4.10 provides a summary of the statistics of the scale for the whole sample. Reliability is calculated by the Item Separation Index and the Person Separation Index. Separation indices represent the proportion of the observed variance considered to be true. A value of 1 represents high separability in which errors are low and item difficulties and teacher measures are well separated along the scale (Wright & Masters, 1981). Table 4.10 reveals that the indices of cases and item separation (i.e. reliability) are close to 0.80, indicating that the separability of the scale is relatively satisfactory. Moreover, for the scale, the infit mean squares and the outfit mean squares are 1 and the values of the infit t scores and the outfit t scores are approximately zero. Looking at the actual values of the infit and outfit of each item, one can identify that all items have item infit with the range 0.77–1.25, and item outfit with the range of 0.64–1.80. In addition, it was found that all the values of infit t for both teachers and items are greater than –2.00 and smaller than 2.00. This implies that in the analysis, there is a good fit to the Rasch model.

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High Teacher Effectiveness Scores      Difficult CT Teaching Criteria - Items
  3.0                               |
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  2.0                          X    |
                                    |
                               X    |
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                                    |
                                    |
                                    |
                                    |      20
                              XX    |
                              XX    |
                               X    |
  1.0                          X    |      14   18
                              XX    |       4
                               X    |
                                    |       2
                               X    |
                               X    |      10
                                    |      16   19
                                    |       6
                                    |      12
                              XX    |
                              XX    |      13   17
   .0                          X    |       3
                             XXX    |       8
                                    |
                                    |
                                    |
                                    |
                               X    |
                               X    |
                                    |
                                    |
                                    |      15
 -1.0                               |
                                    |       7    9
                                    |       1
                                    |      11
                                    |       5
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                                    |
                                    |
 -2.0                               |
Low Teacher Effectiveness Scores      Easy CT Teaching Criteria - Items
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Note. Each X represents 1 teacher
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Figure 4.3. Scale for Teaching Quality - Effectiveness in Teaching for Critical Thinking

In this respect, for each teacher participant in the experimental and control groups, it was possible to generate three teacher effectiveness scores by calculating the relevant Rasch person estimates that emerged in the three measurement periods (i.e. November 2016, February 2016 and April/May 2016). This procedure is justified theoretically and is used in studies on teacher evaluation (e.g. Wang & Cheng, 2001). Specifically, the Rasch model put teachers and tasks on the same scale and enabled the study to examine the range of the teaching practice scale to see if the items/tasks within it form a continuum of teaching practice from ‘‘easy to perform’’ to ‘‘difficult to perform’’. These Rasch person estimates (teacher effectiveness scores) were taken into account in measuring the impact of the intervention upon the improvement of teaching quality.

Table 4.10

Statistics Related to the Teaching Quality Scale of the CTOT for the Whole Sample

		Scale (Teaching Quality)
Mean	Items	0.0
	Persons	0.59
Standard Deviation	Items	0.88
	Persons	0.99
Separability	Items	0.78
	Persons	0.86
Mean Infit mean square	Items	1.00
	Persons	1.00
Mean Outfit mean square	Items	1.01
	Persons	1.01
Infit t	Items	-0.04
	Persons	-0.04
Outfit t	Items	0.05
	Persons	-0.02

With regard to the 20 items of the CTOT, all items have item infit with the range 0.77–1.25, and item outfit with the range of 0.64–1.80. Table 4.11 presents their actual values.

Table 4.11

Actual Values of Item infit and Item outfit in the CTOT

Items	INFT MNSQ	OUTFT MNSQ
1. Setting a purposeful critical-thinking context (i.e. understanding material, making judgment, solving a problem, making a decision).	0.90	0.64
2. *Frequency = How many times?*	0.82	0.83
3. Providing the critical-thinking objective(s) of the lesson and challenging students to identify them through certain activities.	0.79	0.68
4. *Frequency = How many times?*	0.78	0.68
5. Using purposeful questioning so as to provoke thinking.	0.94	0.67
6. *Frequency = How many times?*	0.77	0.75
7. Encouraging short discussions so that students express their point of view on issues, concepts and ideas.	1.01	1.74
8. *Frequency = How many times?*	1.28	1.80
9. Providing students with opportunities to practice critical thinking in structured challenging tasks and critical-thinking rich activities.	0.92	0.69
10. *Frequency = For how long?*	1.00	0.95
11. Using formative assessment *for* thinking in terms of providing purposeful feedback in students' critical-thinking outcomes.	0.92	0.66
12. *Frequency = How many times?*	1.09	1.05
13. Modelling discrete thinking-skills processes through thinking diagrams by stressing the language of the thinking processes and using explicit critical-thinking verbal prompts.	0.79	0.70
14. *Frequency = For how long?*	1.01	0.98
15. Modeling discrete thinking-skills processes through the "thinking aloud" technique by stressing the language of the thinking process (the teacher as a thinking model).	1.07	1.29
16. *Frequency = For how long?*	1.24	1.25
17. Motivating and encouraging students to think critically.	1.25	1.40
18. *Frequency = How many times?*	1.18	1.20
19. Building a learning environment of thoughtfulness encouraging students to be positively disposed towards critical thought and self-reflection.	0.97	0.91
20. *Frequency = How many times?*	1.21	1.31

Comparisons between Groups (Teaching Quality 1 and Teaching Quality 3)

Hypothesizing that the teacher professional development programme in teaching for critical thinking did cause an effect in the quality of teaching performed by teachers, who were engaged in the programme (experimental group), an independent sample *t*-Test was used so as to compare the means between the groups with regard to the teaching quality 1 (as recorded during the first classroom observation) and teaching quality 3 (as recorded during the third classroom observation). Considering that the significance level associated with the value under the heading *Levene's Test for Equality of Variances* tests the hypothesis that the variances of the two groups are equal (i.e. groups have unequal variances if $p<0,05$; groups have equal variances if $p>0,05$), t-test statistics either in the row labeled *Equal Variances Assumed* or in the row labeled *Equal Variances not Assumed* were accordingly used. The following results concern the third research question of the present study:

> *3. Whether did the teacher professional development programme in teaching for critical thinking improve teachers' teaching quality with regard to the promotion of critical thinking?*

With regard to the (critical-thinking) teacher effectiveness scores (as obtained by the first observation), the independent-samples *t* test between experimental and control group (see Table 4.12) indicates that the teaching quality of teachers in the experimental group as measured during the first classroom observation was not statistically significantly higher (t=-1.37, df = 373, $p < 0.05$) than the teaching quality of their colleagues in the control group. In that sense, teachers were equally effective in teaching for critical thinking during the first classroom observation since their mean scores are very close.

Table 4.12

Independent Sample t-Test between Groups with regard to the Teaching Quality 1 as Measured during the First Classroom Observation

	Sex	N	$\bar{X}$	*SD*	T	Df	Sig. (2-tailed
Teaching Quality 1 (First Observation)	Control Group	11 teachers (190 students)	.01	.37	-1.37	373	.171
	Experimental Group	12 teachers (205 students)	-.04	.50			

Note: Using the Rasch model, it was possible to measure the quality of teaching in logits

Table 4.13 presents the mean scores of the two groups with regard to the teaching quality 3 as measured during the third classroom observation. With regard to the teacher effectiveness scores as obtained during the third observation, the independent-samples *t* test between experimental and control group (see Table 4.13) indicates that the teaching quality of teachers in the experimental group as measured during the third classroom observation was statistically significantly higher (t=51.63, df = 393, p < 0.05) than the teaching quality of teachers in the control group (t-test statistics in the row labeled *Equal Variances Assumed* were used since p=.854>0.05). As Table 4.13 presents, the mean difference between the two groups in the third observation was high (1.67), meaning that teachers in the experimental group have improved their teaching quality and become more effective in teaching for critical thinking.

Table 4.13

Independent Sample t-Test between Groups with regard to the Teaching Quality 3 as Measured during the Third Classroom Observation

	Sex	N	$\bar{X}$	*SD*	T	df	Sig. (2-tailed)
Teaching Quality 3 (Third Observation)	Control Group	11 teachers (190 students)	.06	.41	-51.63	393	.000
	Experimental Group	12 teachers (205 students)	2.23	.42			

Note: Using the Rasch model, it was possible to measure the quality of teaching in logits

Information given in both Tables 4.12 and 4.13 initially indicates that the mean scores of both groups have increased from the first to the third classroom observation. Subsequent analyses of *t*-test paired samples reveal whether this improvement is statistically significant for both groups.

Comparisons within Groups (Teaching Quality 1 and Teaching Quality 3)

In order to test the hypothesis that there are differences in terms of improvement between the teaching quality as measured during the first classroom observation and the third classroom observation within each group, a *t*-test paired sample was used. Results are presented in Tables 4.14 and 4.15.

With regard to the experimental group (see Table 4.14), the *t* statistic (t=86.176, df=204), which is exceptionally high, and its associated significance level ($p < 0.05$) indicate that the hypothesis is confirmed, since there is a statistically significant difference between the teaching quality as measured the first time and the teaching quality as measured the third time among the teachers in the experimental group. In particular, teachers in the experimental group have increased their teaching skills related to the teaching for critical thinking from the first to the third observation (observed mean difference = 2.27).

Table 4.14

T-test Paired Samples Statistics comparing Teaching Quality as Measured during the First and the Third Classroom Observation within the Experimental Group

Group		$\bar{X}$	*SD*	T	Df	Sig. (2-tailed)
Experimental Group *(N=205)*	Teaching Quality 3 (Third Observation)	2.23	.42	86.176	204	.000
	Teaching Quality 1 (First Observation)	-.04	.51			

Note: Using the Rasch model, it was possible to measure the quality of teaching in logits

With regard to the control group (see Table 4.15), the t statistic (t=6.412, df=189) and its associated significance level ($p<0.05$) again indicates that there is a statistically significant difference between the teaching quality as measured the first time and the teaching quality as measured the third time among the teachers of the control group. Despite the statistically significant difference, what differs from the pattern observed in the experimental group is that teachers in the control group have not increased their teaching quality from the first observation to the third (observed mean difference = 0.05) to the same extent as teachers of the experimental group did. The improvement cannot be attributed to training or support, since teachers of the control group were not engaged in professional development; it could, rather, be attributed to the "Hawthorne effect", based on which teachers of the control group may have altered their teaching behavior due to their awareness of being observed.

Table 4.15

T-test Paired Samples Statistics Comparing Teaching Quality as Measured during the First and the Third Classroom Observation within the Control Group

Group		$\overline{X}$	*SD*	T	Df	Sig. (2-tailed)
Control Group *(N=190)*	Teaching Quality 3 (Third Observation)	.06	.41	6.412	189	.000
	Teaching Quality 1 (First Observation)	.01	.37			

Note: Using the Rasch model, it was possible to measure the quality of teaching in logits

Based on the correlations, which resulted from the *t*-test paired sample, there is a positive correlation between the teaching quality 1 as measured by the CTOT the first time and the teaching quality 3, as measured by the CTOT the third time for the experimental group (r=0.68), which is statistically significant ($p < 0.005$). The same applies for the control group, since there is a positive correlation between the teaching quality 1 as measured by the CTOT the first time and the teaching quality 3, as measured by the CTOT the third time (r=0.98), which is statistically significant ($p < 0.005$), something that provides support for the predictive validity of the Critical-Thinking Observation Tool (CTOT).

Investigating how well the Treatment Group (Independent variable) Predicts the Value of the Teaching Quality (Dependent Variable)

To explore whether and the extent to which the teacher professional development in teaching for critical thinking improved the quality of teaching in relation to other teacher background characteristic (predictor variables), Linear Regression Analysis was used. In that vein, results presented below concern the third research question of the present study:

> *3. Whether did the teacher professional development programme in teaching for critical thinking improve teachers' teaching quality with regard to the promotion of critical thinking?*

A regression was calculated to predict the quality of teaching as measured in the third classroom observation (teaching quality 3) based on the treatment group, the quality of teaching as measured in the first classroom observation and additional teacher background characteristics as predictors. Those teacher background characteristics concerned the total years of teaching experience, the total years of teaching experience in class (in the 5^{th} or 6^{th} grade), the teacher education level, and the previous teacher training in critical thinking. At this point, the stepwise method was used so that only "significant" predictors to be included in the regression model and the weakest correlated variables are to be removed. The analysis determined five models. One was chosen as the best, since it accomplished a desired level of explanation or prediction with as few predictor variables as possible.

Table 4.16 includes information about the quantity of variance that is explained by the predictor variables in each of the five models. Model 2 was chosen as the best one. For Model 1, the R statistic, which is the multiple correlation coefficient between the predictor variable and the dependent variable, is 0.934, something that indicates that there is a great deal of variance shared by the treatment group (independent variable) and the teaching quality (dependent variable). The R Square value, which is used to describe the goodness-of-fit or the amount of variance explained by the predictor variable, is 0.872, which indicates that 87.2% of the variance in the teaching quality is explained by the treatment group in the model. In that sense, a significant regression equation was found ($F(1,393)=2665.60$, $p < .000$), with an R^2 of .872, meaning that the treatment group (experimental or control) can be used, or strengthens the possibility of the model, to predict the teaching quality as measured during the third classroom observation, that is the teacher's effectiveness in teaching for critical thinking at the end of the programme.

Therefore, it is more possible for teachers in the experimental group to perform better in their effort to teach for critical thinking than teachers in the control group.

Table 4.16

Linear Regression Analysis: Models and Teacher-Related Variables (Predictors) Explaining the Amount of Variance in the Dependent Variable (Teaching Quality 3)

Model	R	R Square	Adjusted R Square	SE of the Estimate
1	.934[a]	.872	.871	.42
2	.976[b]	.952	.952	.25
3	.982[c]	.965	.965	.22
4	.983[d]	.967	966	.22
5	984[e]	968	967	.97

a. Predictors: (Constant): Treatment Group

b. Predictors: (Constant), Treatment Group, Teaching Quality 1

c. Predictors: (Constant),Treatment Group, Teaching Quality 1, Teaching Experience

d. Predictors: (Constant), Treatment Group, Teaching Quality 1, Teaching Experience, Teacher Education

e. Predictors: (Constant), Treatment Group, Teaching Quality 1, Teaching Experience, Teacher Education, Previous Training in CT

Dependent Variable: Teaching Quality 3

For Model 2, the R statistic is 0.976, which indicates that there is a great deal of variance shared by the independent variables, that is, the treatment group and the quality of teaching as measured in the first classroom observation, and the dependent variable. The R Square, which is used to describe the goodness-of-fit or the amount of variance explained by the predictor variable, is 0.952, which indicates that 95.2% of the variance in the dependent variable, namely the quality of teaching, is explained by the two independent variables, namely the treatment group and the quality of teaching as measured in the first classroom observation. In that sense, a significant regression equation was found ($F(2,392)=3916.58$, $p < .000$), meaning that the treatment condition (experimental or control), along with the teaching quality as measured at the beginning of the programme, can be used to predict the teaching quality as measured during the third classroom observation, that is the teacher's effectiveness in teaching for critical thinking at the end of the programme.

Table 4.17 provides information about the effects of individual predictor variables for these two models. For Model 1, teacher participants' predicted teaching quality score is equal to 0.056 + 2,177 x (treatment group) + 0.934. The Beta coefficient for Treatment

Group (=0.934) and its associated significance value (p <0.05) indicate that the treatment group is obviously a good predictor of the teaching quality as measured in the third classroom observation. For model 2, teacher participants' predicted teaching quality score is equal to 0.045 + 2.222 x (treatment group) + 0.743 x (teaching quality 1) + 0.953. The relative strengths (Beta coefficients) for Treatment Group (=0.953) and Teaching Quality 1 (=0.285) and their associated significance value (p <0.05) indicate that the treatment group and the teaching quality as measured in the first classroom observation are good predictors of the teaching quality as measured in the third classroom observation, with the treatment group obviously having a bigger strength.

Table 4.17

Standardized Coefficients Beta, t Values and Significance Values of the two Models Predicting the Teaching Quality 3 (Outcome Variable)

Model		Unstandardized Coefficients	Beta	*T*	Sig.
1	Constant	0.056		1.843	.066
	Group	2.177	.934	51.629	.000
2	Constant	0.045		2.438	.015
	Group	2.222	.953	86.227	.000
	Teaching Quality 1	0.743	.285	25.785	.000

a. Dependent Variable: Teaching Quality 3

All other models did not offer much towards the explanation or prediction of the dependent variable and thus they were rejected. In particular, for Model 3, the R statistic was 0.982, which indicates that there is a great deal of variance shared by the independent variables, that is, the treatment group, the quality of teaching as measured in the first classroom observation and the teaching experience, and the dependent variable. The R Square, which is used to describe the goodness-of-fit or the amount of variance explained by the predictor variable, was 0.965, which indicates that 96.5% of the variance in the dependent variable, namely the teaching quality 3, is explained by the three independent variables entered in Model 3. Nevertheless, not all of the predictors seemed to contribute positively to the quality of teaching, since based on the beta coefficients, the total years of teaching experience contributed negatively to the quality of teaching for critical thinking (b=-0.115). The beta coefficients of the treatment group (b=.935) and teaching quality 1 (b=0.267) remained high.

For Model 4, the R statistic is 0.983, which again indicates that there is a great deal of variance shared by the independent variables, that is, the treatment group, the quality of teaching as measured in the first classroom observation, the teaching experience and the teacher education, and the dependent variable. The R square was 0.967, which indicated that 96.7% of the variance in the dependent variable, namely the teaching quality 3, was explained by the four independent variables in Model 4. However, the total years of teaching experience again seemed to contribute negatively to the quality of teaching (b=-0.96), while the strength (beta coefficient) of the fourth predictor in the Model 4, namely the teacher education (b=0.050), was relatively small. The beta coefficients of the treatment group (b=.916) and teaching quality 1 (b=0.265) remain high.

For Model 5, the R statistic was 0.984, which again indicated that there is a great deal of variance shared by the independent variables, that is, treatment group, the quality of teaching as measured in the first classroom observation, the teaching experience, the teacher education and the previous training in critical thinking, and the dependent variable. The R square was 0.968, which indicated that 96.8% of the variance in the dependent variable, namely the teaching quality 3, is explained by the five independent variables in Model 5. However, the total years of teaching experience (*b*=-0.82) and the previous training in critical thinking (b=-0.44) seem to contribute negatively to the quality of teaching, while the strength (beta coefficient) of the teacher education predictor in the Model 5 is relatively small (b=0.059). The beta coefficients of the treatment group (b=.899) and teaching quality 1 (b=0.287) remained high. What is interesting is that the total years of teaching experience in class (in the 5^{th} or 6^{th} grade) was excluded by all five models in the Linear Regression Analysis.

Contribution of Student Background Characteristics on the Student Critical-Thinking Performance (Post-Test)

Several student and teacher background characteristics were used to examine whether these significantly contribute to the improvement of student critical-thinking performance as measured in the post-test. These variables were initially used for chi-square tests and T-test analyses, while the most important results in terms of their significance level are presented in this section. The same variables were used as explanatory variables to predict the student critical-performance in the post-test in the multilevel modeling regression techniques, the results of which follow in the chapter and are in line with the initial indications presented in this section. In this respect, results in this section concern the fourth research question of the present study:

4. What proportion of variance in student critical-thinking outcomes was attributable to students' background characteristics, teachers' characteristics, and the professional development programme effects?

Student-Related Variable: Sex

Student Sex and Treatment Group. Table 4.18 presents the synthesis of the student sample in terms of sex and treatment group. The very small Chi Square Statistic (R=0.061) and its large significance level (p=0.805) indicate that it is very unlikely that the two variables are dependent on each other. In addition, the fact that these two variables are not related is confirmed by the value of the Kendall's tau-b (-.012, SE=0.05, p=0.805>0.05).

Table 4.18

Sex and Treatment Group Crosstabulation

			Group		
			Experimental	Control	Total
Sex	Boy	Count	91	82	173
		within Sex	52,6%	47,4%	100,0%
		within Group	44,4%	43,2%	43,8%
	Girl	Count	114	108	222
		within Sex	51,4%	48,6%	100,0%
		within Group	55,6%	56,8%	56,2%
Total		Count	205	190	395
		within Sex	51,9%	48,1%	100,0%
		within Group	100,0%	100,0%	100,0%

Student Sex and Critical-Thinking Performance (Post-Test). An independent sample t-Test was used so as to compare the means between the males and females with regard to their critical-thinking performance in the post-test, firstly for the whole sample and secondly for each group separately.

With regard to the whole sample, the independent-samples *t* test between males and females (see Table 4.19) indicates that the critical-thinking performance of girls as measured in the post-test was statistically significantly higher ($t=-2.551$, $df=393$, $p<0.05$) than the critical-thinking performance of boys. In that sense, although the mean scores of boys and girls are very close, as Table 4.19 presents, and one could claim that the difference is minor, that difference is stillstatistically significant.

Table 4.19

Independent Sample t-Test between Boys and Girls with regard to their Critical-Thinking Performance as measured in the Post-Test (Whole Sample)

	Sex	N	$\overline{X}$	*SD*	T	Df	Sig. (2-tailed)
Student Critical-Thinking Performance (Post-Test) *(N=395)*	Boys	173	.30	.75	-2.551	393	.011
	Girls	222	.49	.71			

With regard to the experimental group, the independent-samples *t* test between males and females (see Table 4.20) indicates that the critical-thinking performance of girls as measured in the post-test was not statistically significantly higher ($t=-1.864$, $df=203$, $p>0.01$) than the critical-thinking performance of boys. In that sense, the mean scores of boys and girls are very close, as Table 4.20 presents.

Table 4.20

Independent Sample t-Test between Boys and Girls with regard to their Critical-Thinking Performance as Measured in the Post-Test (Experimental Group)

	Sex	N	$\overline{X}$	*SD*	t	Df	Sig. (2-tailed)
Student Critical-Thinking Performance (Post-Test)	Boys	91	.77	.56	-1.864	203	.064
	Girls	114	.93	.61			

With regard to the control group, the independent-samples *t* test between males and females (see Table 4.21) indicates that the critical-thinking performance of girls as measured in the post-test was statistically significantly higher ($t=-3.239$, $df=188$, $p<0.05$) than the critical-thinking performance of boys. In that sense, the girls from the control group performed better than the boys from the control group in the post-test.

Table 4.21

Independent Sample t-Test between Boys and Girls with regard to their Critical-Thinking Performance as Measured in the Post-Test (Control Group)

	Sex	N	$\overline{X}$	*SD*	t	Df	Sig. (2-tailed)
Student Critical-Thinking Performance (Post-Test)	Boys	82	-.21	.56	-3.239	188	.001
	Girls	108	.03	.50			

Student-Related Variable: Reading Books

Reading Books and Student Critical-Thinking Performance (Post-Test). After performing correlation bivariate analysis, an initial positive correlation between student critical-thinking performance as measured in the post-test and “reading books” was found. The Pearson’s correlation coefficient ($r=0.320$) expresses a positive linear relationship between the two variables which is statistically significant ($p<0.01$), such that the more books a student reads, the better he/she performs in critical-thinking tasks and activities. Nevertheless, this relation might be inverse since the order of the elements could be switched. So, there are two interpretations: a) the more books a student reads, the better he/she performs in critical-thinking; b) the more competent a student is in critical thinking, the more books h/she reads.

Student-Related Variable: Critical-Thinking Performance in the Interim-Test

Student Critical-Thinking Performances in the Post-Test and Interim-Test. The student critical-thinking performance as measured in the interim-testing, that was a midway point between pre-test and post-test, was used for correlation analyses, as well as an explanatory variable for the multilevel modeling regression techniques, which follow in the chapter.

With regard to the whole sample, a positive correlation between student critical-thinking performances as measured in the post-test and interim-test was found. The positive correlation coefficient (r=0.592) expresses that there is a statistically significant ($p<0.001$) linear relationship between these two variables such that the better a student performs in critical-thinking as measured in the interim testing, the better a student performs in critical-thinking as measured in the post-test.

With regard to each group separately, a positive correlation between student critical-thinking performances as measured in the post-test and the interim-test was also found, something that applies for both groups (r=0.547 for the control group; r=0.461 for the experimental group).

Investigating the Proportion of Variance in Student Critical-Thinking Performance (Post-Test) Explained by the Teacher Professional Development Programme

To further investigate the impact of the teacher professional development in teaching for critical thinking as measured by student critical-thinking instrument(s) (pre-test, interim-test, and post-test) and classroom observations on student critical-thinking outcomes, multilevel modelling regression techniques were used to disentangle the student, class/ teacher, and school variance components, since the data were nested; namely, students within classes/teachers. In that vein, multilevel analyses answer the fourth research question while they further inform the inquiry of the first two questions of the study:

1. Whether (and to what extent) did the teacher professional development programme in teaching for critical thinking contribute to student critical-thinking outcomes as compared to the critical-thinking outcomes of students in the control group?

2. What was the contribution of the teacher professional development programme in teaching for critical thinking to student critical-thinking outcomes?

4. What proportion of variance in student critical-thinking outcomes was attributable to students' background characteristics, teachers' characteristics, and the professional development programme effects?

The main aim of multilevel analyses was to explore the extent to which the differences in student critical-thinking performance, as measured in the post-test, between the experimental and control groups were accountable for by factors related either to the school, class/teacher or student characteristics, since multilevel analysis allows the use of covariates measured at any of the levels of a hierarchy (Huang & Moon, 2009; Kyriakides & Charalambous, 2004). In addition, a likelihood ratio test (LRT) was also conducted to test model fit when more parameters were added, using the −2 log likelihood (−2LL). The null hypothesis of the LRT was that the change between models was zero, given by comparing the differences in the −2LLs, with the degrees of freedom corresponding to the number of added explanatory variables (parameters or predictors) between models. A rejection of the null hypothesis indicated that the model provided a better fit than the preceding model (Huang & Moon, 2009).

Under this framework, for the analysis of the data the first step in the analysis was to determine the variance at individual (student), class (teacher), and school level without explanatory variables (empty model or model 0) to determine the variance at each level (see Model 0 in Table 4.22). Since the number of schools involved in the research study was relatively small (*N*=14), it was decided to distinguish two levels (i.e. class/teacher and student). According to the results (see Table 4.22), the variance for student critical-thinking performance was 41.56% at the teacher level and 58.44% at the student level. The variance at each level was statistically significant, and this implies that multilevel analysis can be carried out in order to identify the impact of each factor.

The second step in the analysis was to add to the empty model student-related explanatory variables, namely the student critical-thinking performance as measured in the pre-test, the student critical-thinking performance as measured in the interim test as well as other student background characteristics (e.g. sex, academic achievement) (model 1). As observed from the figures of the third column of Table 4.22 for Model 1, both student critical-thinking performance as measured in the pre-test and student critical-thinking performance as measured in the interim test had a statistically significant effect at the .05 level on students' critical–thinking outcome (post-test). And further, reading books (as a student background characteristic) was the only student-related variable that had an effect at the .05 level on student critical-thinking performance in the post-test, as well. In addition, in model 1 only few students were lost due to the missing values from the interim test and thus there was no need for imputation, namely attributing scores to these students. Model 1 explained 34.51% of the total variance of student critical-thinking performance in the post-test and most of the explained variance was at the teacher level (42.86%). In that sense, Model 1 was found to fit better than the empty model. For model 1, the following equation is obtained:

- *Model 1:* Student Critical Performance (CT Post-Test Score) = 0.516 + 0.73 (CT Pre-Test Score) + 0.131 (Interim Score) + 0.068 (Reading Books)

At the next step of the analysis, for the student critical-thinking outcome in the post test, different versions of Model 2 were established. In each version of Model 2, different teacher-related variables were added one by one to the Model 1. In particular, the teaching quality score (as emerged from the aggregation of the three teacher effectiveness scores obtained for each teacher through the Rasch analysis) was added to Model 2a. Subsequently, the teaching quality score was removed and the treatment group (experimental or control) was added to Model 2b, while both the teaching quality score (as emerged from the aggregation of the three teacher effectiveness scores obtained for each teacher) and the treatment group (experimental or control), as independent variables, were added to Model 2c. The fitting of each of these models (2a, 2b and 2c) was tested against Model 1. Table 4.22 presents the parameter estimates and the standard errors that emerged by adding the teaching quality scores and the treatment group measures. In particular, for

Model 2a, the teaching quality score (as emerged from the aggregation of the three teacher effectiveness scores obtained for each teacher) was found to be associated with student critical-thinking performance in the post test, while Model 2a explained 57.7% of the total variance. For model 2b, the treatment group (experimental or control) was also found to be associated with student critical-thinking performance in the post test, while Model 2b explained 75.14% of the total variance. Subsequently, Model 2c explained 75.51% of the total variance. However, when both the teaching quality score (as emerged from the aggregation of the three teacher effectiveness scores obtained for each teacher) and the treatment group were added in Model 2c, not both of them were found to be associated with the student critical-thinking performance as measured in the post-test. Based on the results of the analysis for Model 2c, only the treatment group (experimental or control) had a statistically significant effect at the .05 level on students' critical–thinking outcome (post-test), with a parameter estimate of 1.046 (0.093) The teaching quality score (as emerged from the aggregation of the three teacher effectiveness scores obtained for each teacher) was not found to be associated with students' critical–thinking outcome in the post-test (parameter estimate = -0.092). This can be attributed to the phenomenon of multicolinearity (Creemers, Kyriakides & Sammons, 2010), since the predictor variable of teaching quality score (as emerged from the aggregation of the three teacher effectiveness scores obtained for each teacher) in this multiple regression model can be linearly predicted from the second predictor variable, that is, the treatment group (experimental or control) with a substantial degree of accuracy. Besides, the gradual improvement of teaching quality oriented to the promotion of critical thinking was the outcome of teachers' engagement in the teacher professional development programme. What is important is that each version of Model 2 explains more than 50% of the total variance of student critical-thinking performance in the post-test. For the two versions of Model 2, the following equations are obtained:

- *Model 2a:* Student Critical Performance (CT Post-Test Score) = 0.422 + 0.735 (CT Pre-Test Score) + 0.125 (Interim Score) + 0.067 (Reading Books) + 0.509 (Teaching Quality-Aggregation)
- *Model 2b:* Student Critical Performance (CT Post-Test Score) = -0.078 + 0.74 (CT Pre-Test Score) + 0.117 (Interim Score) + 0.058 (Reading Books) + 0.945 (Treatment Group)

Under this framework, Model 2b best explains the proportion of variance in student critical-thinking outcomes that is mostly attributable to the experimental condition, that is, the teacher professional development programme in critical thinking.

Table 4.22

Parameter Estimates and (Standard Errors) for the Multilevel Analysis of the Student Critical-Thinking Performance in the Post-Test Considering the Impact of the Different Predictor Variables at the Student Level and the Teacher Level.

	Student Critical-Thinking Performance (Post-Test Scores)			
	Model 0	Model 1	Model 2a	Model 2b
Fixed Part (intercept)				
Cons	0.412 (0.103)	0.416 (0.102)	0.422 (0.071)	-0.078 (0.043)
Student Level				
Critical-Thinking Performance (Pre-Test Scores)		0.73 (0.042)	0.735 (0.042)	0.74 (0.041)
Critical-Thinking Performance (Interim-Test Scores)		0.131 (0.027)	0.125 (0.027)	0.117 (0.026)
Reading books		0.068 (0.024)	0.067 (0.024)	0.058 (0.023)
Teacher Level				
Teaching Quality (Aggregate: Qual1_Qual2_Qual3)			0.509 (0.103)	
Treatment Group				0.945 (0,062)
Variance Components				
Teacher	41.56%	42.86%	19.85%	2.23%
Student	58.44%	22.63%	22.45%	22.63%
Explained		34,51%	57.7%	75.14%
Significance Test				
Log-likelihood:	723,298	363,163	346,172	305,699
Reduction		360135	16,991	57,489
Degrees of Freedom		3	1	1
p value		0.001	0.001	0.001
Units: Teacher	23	23	23	23
Units: Student	395	388	388	388

Teachers' Perceived Ability to Promote Critical Thinking and Meaning-Making towards Teaching for Critical Thinking

Thematic analysis was used to analyze data obtained by the teacher reflections' questionnaire, which was filled in by the 12 teachers of the experimental group. Based on the analysis, repeated patterns of meaning (themes) within the data were identified, reported, analyzed and interpreted (Braun & Clarke, 2006). What counted as a theme depended on whether it captured something important in relation to the fifth research question of the study while all themes identified formed an accurate reflection of the content of the entire data set (Braun & Clarke, 2006). In that sense, the following results concern the fifth research question of the present study:

> *5. Did the teacher professional development programme in teaching for critical thinking empower teachers and enhance their perceived ability to promote critical thinking, as well as their meaning-making towards teaching for critical thinking?*

Based on the thematic analysis employed for the entire data set, the main themes identified, were: (1) Effective Components of Teaching for Critical Thinking, and (2) Means for Effective Professional Development. Under those distinctive themes, particular subthemes were indentified, as Figure 4.4 presents. The main subthemes identified are presented below, along with some verbatim statements which are indicative of the subthemes and ideas. The themes and subthemes are subsequently discussed.

1. Effective Components of Teaching for Critical Thinking

(a) Purposefully Designing and Teaching for Critical Thinking → Facilitating the Teacher and the Teaching Process

"I realized that sometimes I was integrating critical-thinking skills in my teaching empirically or maybe intuitionally; now I understand that it is important to organize them in my mind and purposefully integrate critical-thinking skills in a lesson, drawing upon a solid theoretical base" (T2);

"The programme helped me to cautiously and consciously aim at integrating critical-thinking skills in my teaching, something that I wasn't doing, or at least I wasn't purposefully trying to do" (T6);

"I clarified what critical thinking is and I can now design a Language Arts lesson more effectively through which I can purposefully promote critical-thinking skills" (T7);

"*Clarifying the concept of critical thinking aided me in purposefully integrating critical thinking into my teaching"* (T8);

"Through the programme certain practices or activities were framed by critical-thinking objectives. I realize that even questioning or some usual activities we do with students can be purposefully chosen during the lesson design and enacted during instruction so as to provoke students' thinking" (T9);

"The experience of co-teaching helped me to understand how you can purposefully use learning strategies or questioning to teach for certain critical-thinking skills" (T6);

"Many of the critical-thinking skills presented in the programme (e.g. explanation) can be easily integrated in many other subject areas apart from the subject area of Language Arts, especially in Mathematics. What I understood is that you need to do it purposefully. You cannot enter class and just teach critical thinking. You need a plan" (T1).

(b) Explicitly Teaching for Critical Thinking → Facilitating the Student and the Learning Process

"I noticed that students were assisted in analyzing sources I was giving them when I was using strategies, especially thinking diagrams, and critical-thinking vocabulary" (T5);

"The more students recognize the critical-thinking skills and strategies they use, the better they can use them and the more critically they can think" (T2);

"I understand that the teacher needs to use and stress the appropriate language related to the critical-thinking processes and outcomes, so that students realize what they are doing during their homework" (T3);

"I was very careful in my oral communication; I was consciously using discourse related to critical-thinking skills and processes I have learned in the programme to help students to acquire those skills" (T11);

"Students were facilitated in using critical-thinking skills, since we had wall-charts and posters summarizing the main critical-thinking skills and related vocabulary. In addition, I used graphic organizers that enabled them to become more effective when using certain critical-thinking skills. For example, whenever students were engaged in an argumentative essay, they had in front them an OAEC (Opinion-Argument-Example-Conclusion) chart (ΑΕΠΣ in Greek) indicating a sort of structure for their essay" (T10).

(c) Reflection upon Teaching (Reflective Teaching)

"The principles and teaching criteria/qualities of a critical-thinking based instruction that were discussed during the programme made the reflection upon my teaching easier" (T9);

"The programme guided me to reflect upon my teaching in relation to the promotion of critical thinking. Knowing what to aim for facilitated my reflection" (T4);

"Critical-thinking objectives were also included in the summative assessment employed in my lessons; that helped me think about my teaching more effectively and reflect upon my practices so as to allow for better planning and lesson designs in the future" (T6);

"The teacher reflection tool on teaching for critical thinking was helpful since I used it as a checklist after a Language Arts lesson, whenever possible, of course; I could check whether students were engaged in certain critical-thinking activities and therefore whether I managed to attain my teaching objectives" (T3);

"I know that it is important to reflect upon your teaching, this is what professionalism is all about. I was never intentionally doing it for critical thinking in particular. I am glad that now I can do it" (T1).

2) Means for Effective Professional Development

(a) Sound Theoretical Framework

"I have clarified what critical thinking is. I feel that I can now design clear-cut activities promoting critical-thinking skills by knowing the theoretical background" (T2);

"The theoretical framework given helped me a lot to clarify the concept of critical thinking and its content. Being aware of the six core critical-thinking skills facilitates my efforts to integrate them whenever possible in my lessons" (T8);

"Although the theory on critical thinking was very helpful, I would like more practical advice for using critical-thinking skills in my teaching" (T4);

"The critical-thinking skill of inference we have studied through the theoretical framework of the programme applies, I believe, to a lot of lessons and needs to be taught especially in the higher grades of the elementary school" (T9).

(b) Interactive Tools (Strengthening Teachers' Confidence in Teaching for Critical Thinking)

"Observing the lesson of my colleague, a lesson that we had planned and designed together, was a very insightful experience. At the end, we analyzed what went well and

what didn't go well and we made some amendments accordingly. I liked it and it would be good to have more opportunities for lesson study and visits to colleagues' classrooms, given that we had more time, of course" (T12);

"I would like to visit the class of another colleague, who also participated in the professional development programme. Teaching scenarios helped me a lot, thus I assume that live action would help me even more. But, I can understand the difficulties of organizing classroom visits and moving from one school to another" (T2);

"I enjoyed the co-teaching with the principal researcher. More co-teaching sessions would make me more confident with teaching for critical thinking, I believe" (T6);

"For the Language Arts course we have certain school textbooks. We cannot just teach the texts included believing that we promote critical thinking. Units and lessons need restructuring in order to teach for critical thinking. It is amazing what you can do with a text in the framework of critical thinking: analyze the main ideas, evaluate the title based on criteria, draw conclusions on characters based on text proofs and evidence, compare it with another text, multimodal or not. Redesigning and restructuring units and lessons within the programme helped me a lot" (T9);

"Having the principal researcher in my class and discussing with her after the lesson helped me specify what critical thinking is all about, and how I can promote it. We are talking about skills, so the fact that she was telling me what I could do more or how I could change an activity so as to make it more challenging in terms of critical thinking requirements, helped me a lot. Now I am more confident with my teaching" (T1).

(c) (Self)-Reflection (upon Theory) → Facilitating the Reflection upon Teaching

"The principles and teaching criteria/qualities of a critical-thinking based instruction that were discussed during the programme made the reflection upon my teaching easier" (T9);

"The programme guided me to reflect upon my teaching in relation to the promotion of critical thinking. Knowing what to aim for facilitated my reflection" (T4);

"Reflecting upon my own knowledge and perceptions about critical thinking was challenging every time I was presented with something new" (T1);

"The resource material that was given to us in the programme helped me to reflect upon the work sheets I was giving to my students. I was trying to figure out which critical-thinking skill is promoted in each task or assignment based on what we have learned" (T12)

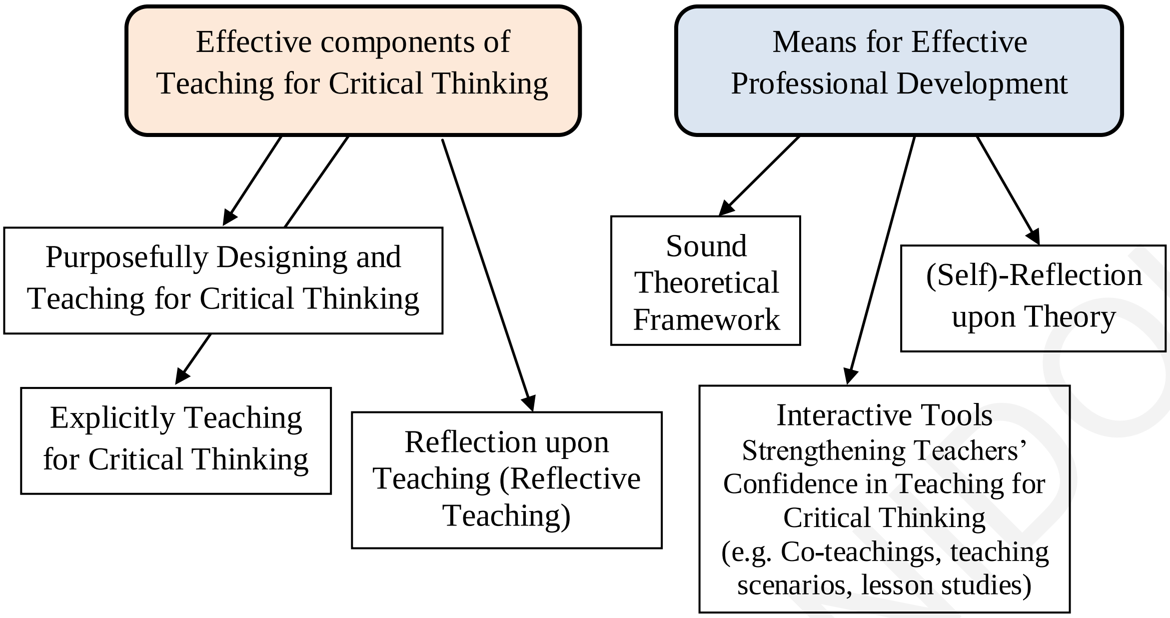

Figure 4.4. The Themes and Subthemes Identified from the Thematic Analysis Performed in Data Obtained by the Teacher Reflections' Questionnaire

By performing thematic analysis in the data, there was an effort to identify teachers' learning experiences in the programme, on the one hand, and unravel the surface of their learning experiences, on the other (Braun & Clarke, 2006). Based on the main themes and subthemes indentified in the data obtained by the teacher reflections' questionnaire, teachers' perceived ability to teach for critical thinking has improved in terms of purposefulness, explicitness and reflection. All these elements concern their meaning making towards teaching for critical thinking, as well. In particular, teacher participants became more effective in purposefully designing their lessons oriented towards the critical-thinking objective. In that sense, they realized that there is always a need to purposefully choose learning strategies, tasks and activities aimed at certain critical-thinking skills and processes. And further, based on their reflections they seem to have realized that a purposeful design leads to a purposeful instruction, which facilitates the process of teaching and the enhancement of critical thinking. In addition, teachers have understood that purposeful instruction needs to be explicit so that critical-thinking skills and abilities are skillfully developed, exercised and internalized by students. What's interesting is that teachers also placed emphasis on the need to reflect upon their teaching with regard to the promotion of critical thinking. As they reckon, reflection upon teaching should be based on principles and qualities of a critical-thinking based instruction, such as the ones familiarized themselves with during the professional development programme.

With regard to the second theme that emerged from the thematic analysis of the data, teachers referred to aspects of professional development that they considered effective. In particular, they placed emphasis on certain interactive activities and tools used in the professional development programme such as lesson studies, co-teachings and redesigning existing units and/or lessons from the Language Arts school textbooks, which might have somehow shaped their perceived ability to teach for critical thinking. In addition, it was explicitly stated or strongly implied that the theoretical framework on critical thinking was helpful for teachers in that they could clarify what critical thinking was. And further, reflection upon what teachers were learning and doing during the programme was also mentioned; thus, reflection in relation to the emphasis placed in reflective teaching was assumed as a key-element that has skillfully shaped teachers' perceived ability to teach for critical thinking.

Reflecting upon the Reflective Journal: Misconceptions, Deficiencies, Difficulties, Presuppositions and Conditions for Teaching for Critical Thinking

Thematic analysis was also used to analyze the rich data obtained by the reflective journal of the principal researcher. Based on the analysis, repeated patterns of meaning (themes) within the data were inductively identified, reported, analyzed and interpreted (Braun & Clarke, 2006). In that sense, the research question that is answered by the analysis of the reflective journal's data evolved, as data were inductively analyzed and coded (which maps onto the inductive approach for thematic analysis). That research question is, of course, strongly related to the main purpose of the present study and thus further informs the inquiry: *What are the main presuppositions, conditions, and difficulties in teaching for critical thinking in the elementary subject area of Language Arts?*

During the thematic analysis, what counted as a theme depended on whether it captured something important in relation to the main purpose of the study, while all themes identified formed an accurate reflection of the content of the entire data set (Braun & Clarke, 2006). The main themes identified somehow represent teacher participants' needs which are merely justified if one takes into account that the initial goal of the reflective journal was to gradually confront and address those needs by accordingly revising the professional development programme, its activities and the aspects on which emphasis was placed. Under this framework, the main themes, which emerged are the following:

a) Misconceptions of critical thinking;

b) Deficiencies related to the use of the Language Arts Curriculum, developed within the recent reform of National Curricula in Cyprus (November, 2016), for determining critical-thinking objectives;

c) Deficiencies related to the design of lessons that purposefully and explicitly aim at teaching for critical thinking;

d) Difficulties encountered in teaching for critical thinking;

e) Important elements and/or presuppositions of a critical-thinking based instruction that facilitate the teaching for critical thinking in the elementary Language Arts course.

Those main themes are further analyzed below on the basis of ascientific knowledge base from the fields of curriculum studies and teacher education that have long shared a concern over teacher professional development, the intersection of which is materialized especially in their challenge against the distinction between theory vs practice and through the theorization of "the practical" and "the teacher as a reflective practitioner" tradition.

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a) Misconceptions of Critical Thinking. Teachers' misconceptions of critical thinking were mostly recorded during the programme's first training sessions when trying to inductively reach a comprehensive conceptualization of critical thinking. Instances of conceptualizing critical thinking in a rather confusing and misleading way were recorded throughout the lifespan of the programme but not as frequently or intensively as at the beginning of the programme. Based on the operational definition of critical thinking adopted in the present study, which considers critical thinking as a reasonable reflective thinking that focuses on deciding what to believe or do in a given context by using a set of cognitive skills and subskills, such as analysis, interpretation, evaluation, inference, explanation as well as self-regulation processes (Ennis, 1987, 1989, 1991; Facione, 1990a), the teachers' main misconceptions of critical thinking were:

- *Critical thinking interpreted as a purely subjective judgment* = Most of the teacher participants referred to the need for encouraging students to express themselves, their feelings and beliefs through discussion; however, they did not mention criteria, critical-thinking processes or skills that could possibly determine good quality thinking;
- *Critical thinking interpreted as argumentation* = Some teacher participants identified critical thinking solely as argumentation considering that critical thinking solely concerns the development and presentation of arguments; however, they did not mention any other critical-thinking skills, processes and/or dispositions;

- *Critical thinking interpreted as questioning, judging and having doubts about everything* = Most of the teachers believed that critical thinking has to do with not passively accepting information that is heard, said or presented, especially through the media, and having the ability to judge and doubt it; they did not talk about processes and skills that could facilitate and determine good quality judgment, such as analysis, querying evidence, evaluation based on criteria and/or drawing conclusions about what to believe or not.
- *Critical thinking as a complex kind of thinking related to "thinking a lot"* = Some teachers could not clearly articulate a definition for critical thinking, and thus they identified critical thinking with the quantity of knowledge and/or education a person has, or with the extent to which that person over-analyzes issues and information.
- *Critical thinking as problem solving or problem-based learning* = Many teachers could more easily conceptualize critical thinking as a problem solving process with certain steps referring to the analysis and synthesis of data so as to find a solution; they did not take into consideration that problem solving offers just a context or an arena, just like decision-making or inquiry based learning, for students to incorporate certain critical-thinking skills.

b) Deficiencies related to the use of the Language Arts curriculum, developed within the recent reform of National Curricula in Cyprus (November, 2016), for determining critical-thinking objectives. Based on the argumentative discourse put forth with regard to the new Language Arts Curriculum during the training sessions, the main teacher deficiencies related to the use of that curriculum identified were:

- *Lack of understanding of the philosophy and objectives of the new Language Arts Curriculum.* Teachers could not understand the relevant success indicators – attainment targets and their respective competence indicators – teaching targets falling under the three main axes of the new Language Arts Curriculum (i.e. content, structure and evaluation of a written, oral or multimodal "text") either for determining critical-thinking objectives or for the design of their lessons oriented towards critical thinking. From the teachers' point of view, this was due to two main reasons: a) too complicated language and scientific discourse used in the curriculum such that they could not easily understand the meaning of some attainment and teaching targets; b) mismatch between the school textbooks already used in class and the curriculum such that they felt that they needed to restructure every unit so as to make it in line with the curriculum targets. In that sense, the curriculum and its objectives were not clear enough for teachers; thus they were not acceptable and rather ineffective.

- *Teachers' confidence in intuition and teaching experience.* Even if they were aware of the recent reform of the National Curricula in Cyprus, some teachers had consciously decided not to use the new Language Arts Curriculum; conversely, they relied on their empirical knowledge and teaching experience in terms of planning, designing, and teaching. Their attitude was strengthened by the elementary teachers' Union POED (Pancyprian Greek Teachers Organization), which encouraged teachers to act as desired with regard to the New Curricula. In this respect, during the school year 2016-2017 in which the present study was taking place, most elementary teachers acted on a mandate from their Union. In that sense, at the beginning of the programme they would not even make an effort to distinguish critical-thinking objectives from the new Language Arts curriculum, something that was attributed to their vague conception of critical thinking, as well.

c) Deficiencies related to the design of lessons that purposefully and explicitly aim at teaching for critical thinking. Based on the learning experiences generated from the interaction with the teacher participants during the professional development programme, their main deficiencies and difficulties related to the design of lessons that purposefully and explicitly aim at teaching for critical thinking were:

- *Determining teaching-and-learning objectives related to critical thinking.* At first, teachers were not aware of the critical-thinking skills and subskills so as to easily determine critical-thinking objectives. During the programme, after they worked on the Critical-Thinking Curriculum, their difficulty lay in deciding which attainment and/or teaching targets were right for a given content, text and/or learning material.
- *Designing activities and tasks aiming at certain critical-thinking objectives.* Although teachers designed challenging activities in their effort to be creative, they could not easily map them onto critical-thinking objectives, at least at first; they were, rather, designing or choosing rich thinking tasks and activities based on their intuition and teaching experience, ignoring the intentional, purposeful and explicit character of a critical-thinking based instruction.
- *Restructuring – Redesigning units, lessons and/or activities and tasks included in the Language Arts school textbooks with an explicit emphasis on critical thinking.* At first, some teachers considered restructuring to be very demanding and time-consuming.

Therefore, there was a need to be convinced of the added value of restructuring and that there weren't any teaching 'recipes' on how to teach for critical thinking (that would be given to them). And further, although teachers were positively disposed to try restructuring, in the beginning they had difficulties in purposefully modifying materials, tools and/or tasks included in the school textbooks with an emphasis on critical thinking so that students could think their way through the material (e.g. encouraging students to use textual information and looking for meanings between and beyond the lines to infer and draw conclusions). To address that difficulty, there was an effort to use restructuring in a gradual way during the programme. Therefore, we initially started redesigning a task or an activity included in the school textbook, we continued with a series of tasks or activities, then with a lesson, and at the end with whole units.

d) Difficulties encountered in teaching for critical thinking. On the basis of the minimal requirements and principles for a critical-thinking based instruction (e.g. Ennis, 1989; McGuinness, 1999; Newmann, 1991; Plath et al., 1999; Swartz, 2003; Zohar et al., 1994) adopted in the present study, the main difficulties that teachers encountered in their efforts to teaching for critical thinking identified in the data obtained by the principal researcher's reflective journal concerned:

- *Purposefully framing the lesson / setting a context (e.g. making an evaluative judgment, solving a problem, making a decision) through which students could purposefully use critical-thinking skills.* Teachers used to start the lesson aiming at raising their students' interest by using a stimulus, that is, a picture, a photo, a video or even the title of a text. Although this could potentially incorporate an environment of thoughtfulness, students were not purposefully oriented towards achieving specific (critical-thinking) goals (e.g. understanding the given material and querying evidence throughout the lesson so as to develop arguments; making an evaluative judgment at the beginning and reconsidering it at the end of the lesson based on the multiple sources of information they had analyzed). To address that difficulty, the programme placed emphasis on analyzing and understanding the four main contexts (e.g. understanding some material; making an evaluative judgment; solving a problem; making a decision) that could be used as lesson frames through examples and teaching scenarios.

- *Making good use of teaching strategies and modelling enabling students to use the right type of thinking at the right time on a regular basis*. Teachers used learning strategies and modellling (e.g. thinking diagrams) to explain certain procedures and/or skills, especially in essay-writing situations. However, sometimes they used them in a non contextualized way, and they were not explicitly using the appropriate language and/or prompting of critical-thinking processes and skills. To address that difficulty, the professional development programme placed emphasis on analyzing direct explicit teaching strategies and the relevant explicit critical-thinking prompts that teachers needed to use so that students could make the appropriate distinctions, and corresponding them with the relevant critical-thinking skills involved (e.g. using a Venn diagram to examine ideas within two texts and analyze their similarities and differences; using an argumentative chart to analyze arguments by identifying premises, reasons, examples, and conclusion).
- *Opportunities for productive thinking through challenging and rich critical-thinking tasks and activities.* In the beginning, teachers seemed to be overexcited with triggering questioning and discussions with their students when analyzing a text. As a result, limited or no time was left for productive student work. During the professional development programme emphasis was placed on alternative instructional choices and practices that could enhance critical thinking. Teachers have come to realize that things they used to do orally could be performed more effectively in written form, individually, in pairs or even in groups so that students can be more actively involved in challenging critical-thinking tasks and activities. For example, while teachers used to orally prompt students to formulate hypotheses about the kind or the content of a text, throughout the programme they were trying to use alternative practices for encouraging students to formulate and justify their hypotheses based on evidence (e.g. "Guess the story" technique which is based on a story chain with clues). Their students' performance in class made teachers realize that opportunities for productive thinking in challenging and rich critical-thinking tasks and activities were helpful since students were became more aware of the processes that were involved each time and thus they could improve their critical-thinking skills gradually.

e) Important elements and/or presuppositions of a critical-thinking based instruction that facilitate the teaching for critical thinking in the elementary Language Arts course

- *The principle of purposeful instruction oriented towards the critical-thinking objective.* While the programme was in progress, teachers were challenged to purposefully choose learning strategies, tasks and activities aimed at certain critical-thinking skills and processes. In that sense, their purposeful design and lesson plans helped them to purposefully teach for critical thinking.

- *The principle of infusing critical thinking into content instruction stressing the explicit instruction of specific critical-thinking skills as a key-element in teaching for critical thinking.* While the programme was in progress, teachers were challenged to explicitly use learning strategies, tools, behaviors and prompting aimed at encouraging their students to think about what they are learning, and become aware of what critical-thinking processes this involves. In that sense, explicit teaching for critical thinking was considered as a presupposition, since critical-thinking skills and abilities were skillfully developed, exercised and internalized by students throughout the year.
- *Teaching time.* Teachers were stimulated to teach purposefully for critical thinking (sometimes differently from what they were used to) so as to achieve gains in students' critical-thinking outcomes. In order to attain that, namely to gradually improve their quality of teaching and their own critical thought (Paul, 2005), they needed time. Time was something that the subject area of Language Arts provided them with, since the Language Arts course in an elementary school in Cyprus is taught approximately twice a day (nine 40-minute periods for 5th grade and ten 40-minute periods for 6th grade).

CHAPTER V

DISCUSSION OF THE RESULTS

This chapter delineates the results of the study in more detail and outlines the processes, which led to the effects noted. This is done in relation to each of the five research questions in an effort to summarize the level of achievement of the research purpose and the related objectives of the study. The chapter discusses primary data findings and results by comparing them to the literature review findings. At the end, chapter is comprised of an acknowledgement of the limitations of the present study.

Introduction

Considering that critical thinking is a major educational objective (e.g. Abrami et al., 2008; Bailin & Siegel, 2003; Ku, 2009; Marin & Halpern, 2011; Swartz, 2003; Willingham, 2007), which is thought to be the result of purposeful teaching and practice (e.g. Angeli & Valanides, 2009; Halpern, 1989; Swartz, 2003; van Gelder, 2005), the quality of teaching should be assessed based on the extent to which student critical-thinking outcomes are enhanced. Research findings reveal that teachers can indeed improve the quality of their teaching and have a significant impact on student learning outcomes, if they undergo appropriate treatment and participate in effective professional development programmes (Antoniou et al., 2011; Kyriakides et al., 2017a; Munro, 1999).

Under this framework, the present study assumed that a concerted and mindful teacher professional development programme in teaching for critical thinking developed based on an integrated approach to professional development (Creemers et al., 2013) could strengthen teachers' knowledge of, commitment to and improvement of, teaching for critical thinking and bring on positive effects on student critical-thinking outcomes. In that sense, the purpose of the study was twofold: Firstly, to develop a teacher professional development programme in teaching for critical thinking; secondly, to empirically examine its effects on elementary students' critical-thinking in order to shed light on the presuppositions, conditions and difficulties in teaching for critical thinking in the subject area of Language Arts. The findings of the study particularly refer to the impact of the teacher professional development, upon three dependent variables: i) the student critical-thinking outcomes, ii) the quality of teaching for critical thinking, and iii) teachers' reflections upon their perceived ability to teach for critical thinking.

To achieve the purpose of the study, three interrelated objectives were set. At first, given that critical thinking is a complex construct to study (e.g. Abrami et al., 2008; Brookfield, 2003; Daniel et al., 2005; Fasko, 2003; Nieto & Saiz, 2008), for which teachers are not well informed (e.g. Astleitner, 2002; Barak et al., 2007; Paul, 2005; Paul et al., 1997; Ruggiero, 2003; Stapleton, 2011), there was a need to adopt a clear operational definition of critical thinking that would form a strong theoretical underpinning for the teacher professional development programme (Creemers et al., 2013; McGuinness, 1999). On the other hand, adopting a clear operational definition of critical thinking was a necessary condition for measuring and assessing the student critical-thinking performance (Ennis 1991; Halpern, 2001) through valid measures, which are naturalistic in kind, developed and well-tested for their psychometric properties within the study.

On a second level, there was a need to determine and empirically examine the teaching skills or criteria that determine effectiveness in teaching for critical thinking provided that there is no solid knowledge on best teaching techniques or strategies that enhance critical thinking (McMillan, 1987; Newmann, 1991; Tsui, 2002). Determining those teaching criteria was necessary for measuring and assessing the quality of teaching for critical thinking through valid measures developed and well-tested for their psychometric properties within the study. For, most studies incorporating teacher training and empowerment on teaching for critical thinking (e.g. Dewey & Bento, 2009; Zohar et al., 1994) relied on self-reported data rather than observational data to investigate any change or improvement in teaching practice. Nevertheless, observational data are needed (Tsui, 2002) so as to make the self-report measures more valid (Halpern, 2001) and to thoroughly examine the effects of teacher professional development on the improvement of the quality of teaching.

On a third level, there was a need to empirically examine the effects of the teacher professional development programme on student learning (Creemers et al., 2013), which was interpreted as critical-thinking performance within the study. The effects were investigated by comparing the student critical-thinking performance within and between the groups (control and experimental) before and after the completion of the programme. For, firstly, any teacher professional development programme aimed at supporting teachers to teach for critical thinking should be able to empirically examine whether the effort is achieving the desired effects (Barnes, 2005). And further, taking into account that the data were nested, namely, students within classrooms/teachers, there was a need to explore the extent to which the differences in student critical-thinking performance between the experimental and control groups were accountable for by factors related either to the class and teacher or student characteristics through multilevel analysis, which is widely used during the last decade by research studies in the field of education, some of which incorporate teacher professional development (e.g. Huang & Moon, 2009; Kyriakides et al., 2017a; Kyriakides et al., 2017b). Secondly, research in the field of critical thinking records limited studies in the elementary education while it appears that there is a considerable gap in our knowledge about the conditions under which elementary teachers could be activated on, and supported towards teaching for critical thinking for enhancing students' learning outcomes (Munro, 1999). Thirdly, the limited studies recorded in the elementary education do not avoid falling into limitations, such as not including a control group by which to compare findings (e.g. Malamitsa et al., 2009) something that is discouraged in the research field of critical thinking when using an experimental design (e.g. Ennis et al., 2005).

Under this framework, the five research questions of the study were determined according to the purpose of the study and the three interrelated objectives aforementioned. Findings and results that follow are discussed with regard to each of the five research questions.

The Student Critical-Thinking Performance

The present study considered two important key-elements for determining the student critical-thinking performance. Firstly, although the concept of critical thinking has been developing over hundreds of years (Fisher, 2001), it remains an ill-defined concept (Kennedy et al., 1991) and has been defined in many ways and directions based on different theoretical paradigms (e.g. Ennis, 1987, 1989; Facione, 1990a; Halpern, 1998, 2002; Kurfiss, 1988; Lipman, 1988; Paul, 1981, 1992; Siegel, 1985; Sternberg, 1986). Secondly, and despite the variety of definitions, any research effort that aims to measure and assess critical thinking, needs to adopt a clear operational definition of critical thinking to determine the intended student critical-thinking outcomes (Ennis 1991; Halpern, 2001). Besides, clarifying educational objectives, referred to as intended student outcomes is necessary for measuring student performance (Ennis, 1991; Wolcott et al, 2002).

Under this framework, certain critical-thinking skills, as intended student critical-thinking outcomes, attainment targets or goals to be addressed within the study, had been purposefully chosen to measure the student critical-thinking performance. These critical-thinking skills reflect the conceptualization of critical thinking, as it is described in the Delphi Report on critical thinking, which was the outcome of a two-year Delphi research project involving 46 experts in thinking (Facione, 1990a). The particular definition was mindfully chosen since it conceptualizes critical thinking in a coherent way while it was initially intended as a guide to curriculum development and critical thinking assessment (Facione, 1990a). Although critical thinking in the Delphi report is conceptualized as a two-factor model combining both critical-thinking skills and dispositions, the present study placed emphasis on skills as intended student critical-thinking outcomes, an emphasis that other empirical research studies (e.g. Angeli & Valanides, 2009; Frijters et al., 2008; Marin & Halpern, 2011; Zohar et al., 1994) have also chosen. The core critical-thinking skills, which were chosen because of their frequent use in everyday life in general and in the field of critical thinking in particular (e.g. Ennis, 1989, 1991; Facione, 1990a; Halpern, 1998; Lipman, 1988; Paul, 1992; Swartz, 2003), concerned interpretation, analysis, evaluation, inference, explanation and self-regulation along with their respective sub-skills (Facione, 1990a).

Along this line of reasoning, these six core critical-thinking skills guided the construction of the Student Critical-Thinking Instrument (SCTI). For clearly and validly determining, measuring and assessing the student critical-thinking performance, the construction of the SCTI was subject to control for reliability and validity. To this end, the Extended Logistic Model of Rasch was used to analyse the data obtained by the 21 items of the SCTI at the beginning and the end of the programme. Based on the results of the analysis, all items appeared to fit the model and students performing the critical-thinking items included in the SCTI were ordered according to their performance in the critical-thinking construct under investigation. Thus, for each student participating in the study, it was possible to generate two different scaled scores (pre-test and post-test scores) of critical-thinking performance by calculating the relevant Rasch person estimate. Scaled scores are indeed especially suitable for comparing group performance over time (Huang & Moon, 2009) while Rasch is widely used by studies that similarly aim at testing the extent to which the data meet the requirement that both the performances on each item of an instrument and the difficulties of the relevant items form a stable sequence along a single continuum (e.g. Creemers & Kyriakides, 2010; Kyriakides et al., 2014; Kyriakides et al., 2017a).

With regard to the pre-test scale of student critical-thinking performance, it was found that the critical-thinking skills included in the SCTI were well targeted against the students' measures (students' scores range = -1.97 to 1.67 logits; item difficulties range = -0.80 to

1.20 logits). Although students' measures seem higher, only a very small number of students (see Figure 4.1) have reached the upper positions of the scale. With regard to the items, what's interesting is that items seem to have been equally distributed in three groups of difficulty or complexity (see Figure 4.1). Six items that seem to fall in the first group, of higher difficulty, are almost all open-ended except (item 8), which concerns interpretation. All other open-ended items falling in this first group concern explanation (items 12 and 19), self-regulation (item 21), analysis (item 4) and inference (item 14). From the eight items that seem to fall in the second group, of medium difficulty, most of them concern evaluation (items 10, 16, 18) and inference (items 9, 15, 17) while two of them concern interpretation (item 7) and explanation (item 3). From the seven items that seem to fall in the third group, of lower difficulty, three of them concern analysis (items 1, 2, 6), two of them concern self-regulation (items 13, 20), one concerns interpretation (item 5) and one concerns evaluation (item11). Another interesting aspect emerging is that the critical-thinking skills of explanation and inference seemed to be more difficult for students to handle with since none of the SCTI' items targeting explanation or inference fell in the lower positions of the scale.

With regard to the post-test scale of student critical-thinking performance, it was found that the critical-thinking skills included in the SCTI were well targeted against the students' measures (students' scores range = -2.34 to 2.64 logits; item difficulties range = -0.91 to 1.43 logits). However, while more students have reached the upper positions of the scale (see Figure 4.2) compared to the pre-test scale, which is rather justified by the experimental condition, there weren't enough items of higher difficulty targeting those students' measures. Based on that finding, probably items of higher difficulty would be needed to target the students (probably from the experimental group), whose critical-thinking performance might have been improved. What's interesting is that items 12 and 4 targeting explanation and analysis respectively remained in the upper positions of the scale while almost all items (1, 2, 5, 11, 13, 20) that seemed to have fallen in the group of lower difficulty in the pre-test scale, remained in the same lower positions. On the contrary, most of the items included in the SCTI were positioned in the middle of the post-test scale, targeting well most of the students' measures.

Under this framework, the two different scaled scores (pre-test and post-test scores) of critical-thinking performance generated for each student participating in the study, were determined by his/her competence in using the critical-thinking skills of analysis, evaluation, interpretation, inference, explanation and self-regulation for deriving from what he/she reads and perceives and expressing in what he/she writes and says quantity and quality of meaning. In fact, that kind of competence is strongly related to deep understanding and substantive writing, both creating situations which require critical thinking (Bean, 2011; Lipman, 1988; Paul, 2005).

In addition, reporting an overall score on student critical-thinking ability confirms that those skills are not used in any order but they rather exist conjointly and complementarily (e.g. Bernard et al., 2008; Ennis et al. 2004; Facione, 1990a, 2000), something that manifests the non-linear character of critical thinking (e.g. Ennis et al., 2005, 2004, 1985; Facione, 2000; Facione & Facione, 1996; Prawat, 1991). In proof of that, there are studies that do record an overlapping among skills of critical thinking when performed in a critical-thinking skills test, such as the study of Zohar et al. (1994). Instead of reporting an overall critical-thinking score, Zohar et al. (1994) used a varimax factor analysis to yield factor mean scores from the data obtained by the General Critical Thinking Test (GCT) developed within their study. The test consisted of 14 items assessing performance in seven inquiry skills included in the Biology Critical Thinking project (Zohar et al., 2014). Based on the factor analysis results, only 10 of the 14 items were clustered in the five factors while some items were found to be classified as representing skills of more than one factor in relation to each item' s corresponding skill established *a priori* (Zohar et al., 1994). In that sense, some overlapping among skills of critical thinking appeared, which was not surprising, as Zohar et al. (1994) admitted, since when solving a problem one uses a number of skills simultaneously and it may be difficult to identify the unique effect of each skill separately (Bailin et al., 1999a; Bernard et al., 2008; Ennis, 1991; Ennis et al., 2005, 2004, 1985; Facione, 2000; Facione & Facione, 1996; Swartz, 2003). For avoiding that risk, the present study concentrated on critical thinking as a collection of highly interrelated skills, all of which are needed for understanding some material and making an evaluative judgment, tasks that were incorporated in the SCTI. Besides, one engages in critical thinking when he/she is asked to perform certain tasks, such as understanding some material, making an evaluative judgment, solving a problem or making a decision (e.g. Ennis, 1989, 1991; Fischer et al., 2009; Shim & Walczak, 2012).

The interdependence among core critical-thinking skills in the actual process of critical thinking is reflected in many widely known standardized critical-thinking instruments (e.g. California Critical-Thinking Skills Test, Cornell Critical Thinking Test, Watson-Glaser Critical Thinking Appraisal) that also chose to report an overall score of a person's critical-thinking skills, even if these skills are differently weighted and interpreted in each instrument. For example, the California Critical-Thinking Skills Test (CCTST) reports an overall score on one's critical-thinking skills since the CCTST score is the simple sum of the items correct (Blattner & Frazier, 2002; Jacobs, 1995). In a similar way, both for the Level X and Level Z of the Cornell Critical Thinking Test, one total score was recommended using the formula rights minus one-half the number wrong (Ennis et al., 2005, 2004, 1985). Similarly, Bernard et al. (2008), who aimed to investigate the psychometric properties of the W-GCTA, they found that no clear subscale structure is discernable by analyzing 60 sets (data from pre-tests and post-tests) of subscale means contained in 60 studies. In addition, exploratory factor analysis yielded one (critical-thinking) factor, which confirms the unidimensional structure of the WGCTA, for which other researchers (e.g. El Hassan & Madhum, 2007) argue, as well. Various interventional research studies (e.g. Angeli & Valanides, 2009; Blattner & Frazier, 2002) using similar instruments, either standardized or "naturalistic" in kind, like the SCTI developed within the present study, have chosen to report an overall score on students' critical-thinking skills. For example, in the study of Angeli and Valanides (2009) the CCTST was administered along a written essay and both individually reported an overall score on student critical-thinking performance.

First Research Question – The contribution of the teacher professional development programme in teaching for critical thinking to student critical-thinking outcomes: Comparison between Groups

The present study assumed that the critical-thinking outcomes of students, whose teachers were engaged in the teacher professional development throughout the year, would be higher, when compared with the critical-thinking outcomes of their counterparts whom teachers were not purposefully empowered towards teaching for critical thinking. Based on the results of the study, the assumption was confirmed.

In particular, at the beginning of the intervention, the mean scores of the students in the control and the experimental group were not the same since results have revealed a statistically significant difference in the critical-thinking performance between the experimental and the control groups. Although the difference between the mean scores of the two groups appeared relatively small, it was statistically significant. Specifically, students in the control group scored higher ($\overline{X}$ = 0.08) than the students of the experimental group ($\overline{X}$ = -0.05) during the pre-test. Nevertheless, at the end of the intervention, results have revealed statistically significant differences between the critical-thinking performances of the two groups. In that sense, students in the experimental group significantly improved their critical-thinking performance ($\overline{X}$ = 0.86) compared to their counterparts in the control group ($\overline{X}$ = -0.07) with a mean difference of 0.93. The same pattern appeared when comparing the interim-test score means between the two groups. Results have revealed a statistically significant difference between the experimental and the control group in relation to their critical-thinking performance as measured in the interim-testing that was used as a midway point between the pre- and post-test. In that sense, students in the experimental group significantly improved their critical-thinking performance ($\overline{X}$ = 2.52) while the professional development programme was in progress compared to their counterparts in the control group ($\overline{X}$ = 1.87) (mean difference = 0.65).

The aforementioned findings of the study clearly indicate that students' critical-thinking performance both in the interim-test and the post-test was differentiated depending upon the treatment group in which they were assigned. Students of the experimental group had significantly better critical-thinking performance on the critical-thinking items included in the SCTI and on the controversial issue (i.e. school-based scenario on punishment) of the Reasoning Essay than students assigned to the control group. These findings are very important if we consider that the intervention enacted as teacher professional development aimed at enhancing teachers' knowledge of, and commitment to, teaching for critical thinking so as to improve student critical-thinking outcomes. Besides, the improvement of student learning is an ultimate goal of teacher professional development (Creemers et al., 2013; Desimone, 2009; Guskey, 2003; Kyriakides et al., 2017a; Munro, 1999). The findings initially suggest that elementary teachers' professional development in teaching for critical thinking actually had a significant impact on their students' critical-thinking outcomes compared with the critical-thinking outcomes of students in the control group whose teachers were not engaged in professional development. In particular, teachers of the experimental classes participated in a series of 24 80-minute training sessions that were offered on a school basis throughout a 6-month period.

Studies in the research field of critical thinking that incorporated similar experimental designs including a kind of teacher professional development or training have reached similar findings. For example, in the study of Zohar et al. (1994), who aimed at exploring whether a series of critical thinking activities infused into a relevant biological topic studied for about 24 periods could contribute, among other things, to the development of critical thinking skills, a significant difference was observed in the posttest between the experimental and control groups. In particular, the mean scores in the general skills posttest were M*experimental* = 78.7 and M*control* = 46.5. This difference was statistically significant and the effect size was very large (E.S.=2.0) (Zohar et al., 1994). In the study of Zohar et al. (1994), the teachers of the experimental classes participated in a preparation course (eight meetings of 3 hours each) that included theoretical (e.g. "what is critical thinking?") and practical issues focusing on how to teach the critical thinking activities in the subject are of Biology. Similarly, the study of Dewey and Bento (2009) revealed that the experimental group made significantly greater gains in cognitive ability (critical-thinking) skills over a two year period compared to the waiting list control. In the study of Dewey and Bento (2009), teachers participated in a two-day initial training seminar focusing on the taxonomy of thinking from Swartz and Parks (1994) and infusion lesson design, and subsequently in another two-day training seminar focusing on metacognition, language, and social collaboration, respectively (Dewey & Bento, 2009). The training encouraged teachers to identify lessons across the curriculum in which they could teach content alongside an emphasis on a specific thinking skill from the taxonomy of thinking from Swartz and Parks (1994), which delineates, among others, the thinking skill of critical thinking.

In rather a similar way, the study of Frijters et al. (2008) that involved some kind of teacher training in the subject of Biology, has shown that the dialogic learning condition (experimental group), compared to the non-dialogic (control group), resulted in a more positive effect on the critical-thinking competences of students, both in terms of generative fluency of reasoning and quality of value orientation. In particular, students involved in the dialogic approach of teaching scored higher in reasoning skills in terms of producing more positions, supportive arguments and more coordinated and subordinated arguments, than students in the non-dialogic approach. What's worth noting is that the particular study of Frijters et al. (2008) did not aim at teacher professional development since teacher training involved was simply a necessary implementation measure of the study. In this respect, teacher's training was limited to providing teachers with a detailed manual on certain instruction strategies for use in the two lesson series for teaching value-loaded critical thinking in the school subject of Biology, upon which teachers were trained for two hours.

Considering the teacher professional development programme as the condition, namely the intervention of the study (independent variable), findings related to comparisons of critical-thinking outcomes between groups (receiving different treatment) comply also with findings revealed by several experimental studies in the field of critical thinking incorporating different conditions and treatments. For example, the study of Angeli and Valanides (2009) revealed that college students assigned to the Infusion and Immersion teaching groups significantly outperformed those assigned to the control group. When, in particular, the critical-thinking performance of students in the Infusion group was compared with students' performance in the control group by using Cohen's *d* effect size, the effect size (Cohen's *d* = 1.10) was found to be very high indicating that the critical-thinking performance of the average dyad in the Infusion group was at 1.10 standard deviations above the mean critical-thinking performance in the control group. In a similar way, the study of Marin and Halpern (2011) has shown that high-school students receiving explicit instruction in specific critical-thinking skills through a Web-based Critical Thinking Workshop showed much larger gains than those in the imbedded instruction group (control group) enacted as an Introduction to Psychology Workshop.

Second Research Question – Contribution of the teacher professional development programme in teaching for critical thinking to student critical-thinking outcomes: Comparison within Groups

The present study assumed that the critical-thinking outcomes of students, whose teachers were engaged in the teacher professional development throughout the year, would be higher at the end of the programme, when compared with their own initial level of critical thinking at the beginning of the programme. Results have provided support for accepting the assumption.

In particular, at the end of the intervention, the critical thinking-performance of students in the experimental group was statistically significantly improved. In particular, students in the experimental group scored higher ($\overline{X}$ = 0.86) in the post-test measurement than in the pre-test measurement ($\overline{X}$ = -0.05) with a mean difference of 0.91. The same pattern was not observed in the assessment scores of the control group. Although results have revealed a statistically significant difference between the pre-test and post-test scores among the students of the control group, students in the control group scored lower ($\overline{X}$ = -0.07) in the post-test measurement than in the pre-test-measurement ($\overline{X}$ = 0.08) with a mean difference of 0.16. Although the difference between the pre-test and post-test scores among the students of the control group appears relatively small, it was statistically significant.

The aforementioned findings of the study clearly indicate that the students in the experimental group improved their critical-thinking performance compared to their own initial level at the beginning of the intervention. The study of Zohar et al. (1994) has reached a similar finding since the difference in the mean scores of the experimental group was statistically significant with a considerably large gain observed in their critical thinking skills at the end of the Biology Critical Thinking Project ($\overline{X}$ = 78.2, Gain = 36.7). Another study that incorporated teacher professional development, the study of Dewey and Bento (2009), has also revealed an increase in the cognitive-ability mean scores over time for the experimental group over the waiting list control. Such a fact was shown with the mean scores at the end of the ACTS (Activating Children's Thinking Skills) project being higher for the experimental group compared to the waiting list control. In particular, Dewey and Bento (2009) found an effect of condition/intervention and cognitive ability mean scores within subjects, which accounted for 2.4% of the variance. Although small effect sizes were noted, Dewey and Bento (2009) suggested that the two-year ACTS intervention was linked to consistent enhanced performance on cognitive ability tests. The present study makes the same suggestion since the teacher professional development programme in teaching for critical thinking was linked to students' enhanced critical-thinking performance. In that sense, the experimental condition was beneficial for students. In a rather similar way, the study of Frijters et al. (2008), which involved some kind of teacher training in terms of providing teachers with a detailed manual on certain instruction strategies for use, revealed that for students with a relatively high level of reasoning skill, a Dialogic condition (experimental group) was more beneficial than a Non-Dialogic condition (control group). However, the study of Frijters et al. (2008) did not implement a pretest-posttest design for the dependent variable of generative fluency of reasoning by which to make clear comparisons of pre-to-post test scores within the groups.

The fact that the critical thinking-performance of students in the experimental group was significantly improved from the pre-test to post-test may relate to features of the experimental condition. The aim of the programme was to stimulate teachers to teach purposefully for critical thinking (sometimes differently from what they have been used to) so as to improve students' critical thinking. Besides, the improvement of student learning is an ultimate goal of teacher professional development (Creemers et al., 2013; Desimone, 2009; Guskey, 2003; Kyriakides et al., 2017a; Munro, 1999). In that sense, teachers were explicitly using teaching strategies for modeling certain critical-thinking skills while students were given opportunities to master those skills and engage in challenging and rich critical-thinking activities and tasks. As a consequence, the experimental condition did have a relatively strong effect on the critical-thinking performance of students, meaning that the teacher professional development in teaching for critical thinking had a significant impact on students' critical-thinking outcomes compared to their own initial level.

With regard to the control group, the overall picture is surprisingly clear-cut. Although the difference in their pre-test and post-test mean scores was also statistically significant, what is interesting is that their critical-thinking mean score in the post-test (= -0.07) was decreased from their critical-thinking mean score in the pre-test (= 0.08). In an effort to explain this result, one could claim that experimental mortality could account for the decrease in the critical-thinking mean score from pre-test to post-test among the students of the control group. However, even if experimental mortality is a problem that may arise in an experimental design, it is hard to examine whether and how it could count for the results of any study (e.g. Logan, 1976). The present study maintained a standardized administration between one testing session, in a class, and the next, in another class, irrespective of whether the class was experimental or control, so as to safeguard the SCTI's reliability (Groth-Marnat, 2009; Cohen et al., 2008). Nevertheless, the lower scores in the post-test measurement can be attributed to a possible mortality effect, if students of the control group, who were interested in participating in the study at the beginning, and critical thinkers enough, as it seemed, (= 0.08) did not remain as interested at the end of the study (= -0.07). However, the possible problem of experimental mortality neither invalidates the findings of the statistically significant (or virtually significant) difference between the pre-test and post-test mean scores within the control group nor does it provide any reasonable alternative explanation for that difference. A completely different finding was revealed in the study of Zohar et al. (1994), since after the pretest-posttest comparisons within each group it was evident that the difference in the critical-thinking mean scores was statistically significant in both groups. Although the gain was considerably larger for the experimental group, the results indicated that students in the control group had also improved their critical-thinking skills to some extent (Zohar et al., 1994). As Zohar et al. (1994) explained, this result can be attributed to the textbook both groups used, which followed an inquiry approach, and the opportunities that the school textbook was giving them to practise (to some extent) several skills similar to those of the Biology Critical-Thinking project. However, this cannot be assumed with certainty for the present study since, although the experimental and control groups were indeed using the same school textbooks in the Language Arts course, the school textbooks did not seem to follow an approach to critical thinking. The teacher professional development experience of the present study has shown that lots of units, lessons, tasks and/or activities included in the Language Arts school textbooks needed restructuring so as to be oriented towards the critical-thinking perspective. In another perspective, data from interviews with students or self-reported data with regard to their experience in the research could explain the lower scores that students in the control group exhibited in the post-test measurement, something that the present study did not employ mainly due to time constraints. In the study of Angeli and Valanides (2009), when student participants were asked to participate in a debriefing session one month after the intervention to reflect upon their experience, students from the control group stated the misconceptions they had about the research intervention, and they seemed in most cases to be disappointed with their performance.

The Quality of Teaching for Critical Thinking

The present study considered three important key-elements for determining the quality of teaching for critical thinking. Firstly, empirical research has minimum consistency as to best teaching techniques or strategies that effectively enhance students' critical thinking (McMillan, 1987; Newmann, 1991; Tsui, 2002). Secondly, research in the field of critical thinking considers that there are minimal requirements or principles for a critical-thinking based instruction (Newmann, 1991; Swartz, 2003). Thirdly, teaching criteria or instructional qualities need to be clearly determined so as to evaluate the extent to which critical thinking is promoted in class (Newmann, 1991) and included in an observation scheme that could be accordingly used to make the measurement of the quality of teaching valid (Halpern, 2001; Tsui, 2002). The need for pursuing the latter was even more strengthened by the fact that most studies incorporating teacher training and empowerment on teaching for critical thinking (e.g. Dewey & Bento, 2009; Shim & Walczak, 2012; Zohar et al., 1994) relied on self-reported data rather than observational data to investigate any change or improvement in teaching practice. In particular, in the study of Zohar et al. (1994), teachers both in the experimental and control groups reported one lesson per week, data of which were processed by computing the frequency with which each factor appeared in the lessons of each group. Factors derived from the framework of the Biology Critical Thinking Project and mostly concerned teaching and learning by inquiry (Zohar et al. 1994). In a similar way, self-reported data were obtained by teacher participants in the study of Dewey and Bento (2009) following the first and second year of the ACTS intervention. Although teachers indicated gains in their knowledge and teaching skills, there weren't any classroom observations focused on the quality of the lessons delivered, something that complicates the discussion of the results since the extent to which teachers were integrating the principles of teaching thinking into all aspects of their practice could not be ascertained.

Under this framework, certain principles of a critical-thinking based instruction have been purposefully chosen and accordingly filtered and coded as teaching criteria to be addressed in the study, so as to measure the quality of teaching for critical thinking. In particular, those principles concerned: (a) the explicit teaching of critical thinking (Ennis, 1989; Marin & Halpern, 2011; McGuinness, 1999; McTighe, 1985; Swartz, 2003; Zohar et al., 1994), (b) the integration of critical thinking into content instruction (Plath et al., 1999; Swartz, 2003; Zohar et al., 1994), (c) the setting of a certain context (i.e. material understanding, making an evaluative judgment, solving a problem or making a decision) under which one would engage in critical thinking (e.g. Ennis, 1989, 1991; Facione, 2011; Fischer et al., 2009; Shim & Walczak, 2012), (d) providing students with opportunities to practice critical thinking in structured challenging tasks and critical-thinking rich activities (Plath et al., 1999; Swartz, 2003; van Gelder, 2005), (e) enabling students to use the right type of thinking at the right time for skillful critical-thinking performances (Swartz, 2003; Willingham, 2007) by using teaching strategies and stressing the language of the thinking process and using explicit prompts and critical concepts (Bailin et al., 1999a; Swartz, 2003), and (f) building a learning environment of thoughtfulness and self-reflection (Newmann, 1991; Plath et al., 1999; Swartz, 2003), related to the enhancement of an aporetic side of thought (Papastephanou & Angeli, 2007) as well.

These principles guided the construction of the Critical-Thinking Observation Tool (CTOT). For clearly and validly determining, measuring and assessing the quality of teaching for critical thinking, the construction of the CTOT was subject to control for reliability and validity. To this end, the Extended Logistic Model of Rasch was used to analyse the data obtained for the 20 items of the CTOT by the 69 classroom observations that took place during the teacher professional development programme of the study (23 teachers x 3 observations = 69 observation occasions). Based on the results of the analysis, all items of the CTOT appeared to fit the model and teachers performing the critical-thinking teaching criteria included in the CTOT were ordered according to their performance in teaching for critical thinking. Therefore, on a first level, for each teacher participating in the study, it was possible to generate three different scaled scores (teacher effectiveness scores obtained by the three classroom observations) of teaching quality by calculating the relevant Rasch person estimates. Scaled scores are indeed especially suitable for comparing group performance over time (Huang & Moon, 2009) while Rasch is widely used by studies that similarly aim at testing the extent to which the data meet the requirement that both the performances on each item of an instrument and the difficulties of the relevant items form a stable sequence along a single continuum (e.g. Creemers & Kyriakides, 2010; Kyriakides, Creemers & Anotniou, 2009; Kyriakides et al., 2014; Kyriakides et al., 2017a). On a second level, for each teacher participating in the study, it was possible to generate one scaled score since logits for teacher effectiveness scores were calculated by aggregating the person estimates (three for each teacher). In the same way, logits for items were calculated by aggregating the items' thresholds.

With regard to the teaching quality scale (as aggregated), results have revealed that the critical-thinking related teaching criteria included in the CTOT were fairly targeted against the teachers' measures/performances (teachers' scores range = -0.60 to 2.00 logits; item difficulties range = -1.51 to 1.28 logits). In particular, results have shown that two teacher participants were located in the upper positions of the scale while six items/teaching criteria were located in the lower positions of the scale without targeting any teacher performance. This is somehow peculiar provided that research in teacher professional development and teacher effectiveness records a different picture with teachers' scores ranging lower than the difficulties of the teaching skills included in the measure (e.g. Kyriakides et al., 2009). In the case of the present study, though, this pattern can be partly explained. Firstly, the particular items (see Figure 4.3), that were located in the lower positions of the scale, although they were oriented towards critical thinking, they were related to general teaching methodology criteria, namely questioning (item 5), short discussions in class (item 7), opportunities to practice (item 9), and formative assessment for thinking (item 11) (see Table 4.12) which were rather more used and "consumable" by elementary teachers. Secondly, provided that the teacher sample in the present study was not randomly chosen from the population, since all of them volunteered to participate in the study because they were truly interested in, and sympathetic to teaching for critical thinking, which is an important success-factor of any research intervention in critical thinking (e.g. Barnes, 2005; Ennis, 1997), we can assume that teacher participants were good performers of these teaching criteria. Thirdly, what needs to be taken into consideration is that what differentiated very good performers from just good ones in terms of these teaching criteria was the frequency of their use. For example, all teachers may have used challenging activities oriented towards critical thinking, as it seems, but what differentiated one teacher from another is for how long he/she provided students with such opportunities for practice, which is considered important for the enhancement of critical thinking (e.g. Plath et al., 1999; Swartz, 2003; van Gelder, 2005). In that sense, if we take a look at the frequency of these teaching criteria, that is, the respective items 6, 8, 10 and 12 on the scale (see Figure 4.3), we can see that these are located in the higher positions of the scale targeting mainly performances of teachers in the experimental group. Placing emphasis on the dimension of frequency that appeared to differentiate the teacher performances is in line with the dynamic model of educational effectiveness that assumes that each teaching factor should be defined and measured in relation to frequency, among other dimensions (Creemers & Kyriakides, 2008; Kyriakides et al., 2017b). In addition, placing emphasis on the frequency of each teaching criterion observed corresponds with what Torff and Warburton (2005) did in their study where observation schemes were used for making assessments of critical thinking use in the classroom activity once per minute using a 5-point Likert-type scale (5=a great deal, 4= a lot, 3=some, 2=a little, 1=not much or a rating of 'no teaching'). However, measurement of teachers' use of critical thinking on a minute-by-minute basis is considered rather difficult as well as sensitive to changes in classroom activities even if ongoing assessment is provided. In the same context, while item 1 (setting a context) and item 15 (think aloud technique) (see Table 4.12) are located in the lower positions of the scale, their respective frequency items, that is, items 2 and 16 respectively, are located higher on the scale (see Figure 4.3). In addition, the fact that two teacher effectiveness scores are located on the upper positions of the scale is rather justified, since those belong to teachers in the experimental group, whose quality of teaching was gradually improving, as a result of their engagement in the professional development programme in teaching for critical thinking. Those teachers, in particular come from the same school, and they were collaborating during the lifespan of the programme in teaching for critical thinking.

Under this framework, the study managed through the CTOT to report a valid score on the quality of teaching for critical thinking, which was determined by the teacher's competence to perform well, both in terms of quality (properties of the criterion itself as discussed in the literature) and frequency (how many times or for how long present), on certain teaching criteria. Those teaching criteria concerned: (a) Setting a purposeful critical-thinking context, (b) Providing the critical-thinking objective(s) of the lesson and challenging students to identify them through certain activities, (c) Using purposeful questioning so as to provoke thinking, (d) Encouraging short discussions so that students express their point of view on issues, concepts and ideas, (e) Providing students with opportunities to practice critical thinking in structured challenging tasks and critical-thinking rich activities, (f) Using formative assessment for thinking in terms of providing purposeful feedback in students' critical-thinking outcomes, (g) Modelling discrete thinking-skills processes through thinking diagrams by stressing the language of the thinking processes and using explicit critical-thinking prompts, (h) Modelling discrete thinking-skills processes through the "thinking aloud" technique by stressing the language of the thinking process, (i) Motivating and encouraging students to think critically, and (j)

Building a learning environment of thoughtfulness encouraging students to be positively disposed towards critical thought and self-reflection.

In that sense, generating a valid score for the quality of teaching for critical thinking for each teacher participant was of great importance for the purposes of the study since changes or improvements in the teaching practice throughout the programme could be subsequently investigated.

Third Research Question – Contribution of the teacher professional development programme in teaching for critical thinking in the teachers' quality of teaching with regard to the promotion of critical thinking

Any approach to professional development is based on the assumption that teacher improvement efforts should aim at the development of teaching skills that relate to positive student learning outcomes (Creemers et al., 2013; Kyriakides et al., 2017a). In that sense, the professional development programme of the study aimed at developing teaching skills related to the promotion of critical thinking for achieving gains in student critical-thinking outcomes. Based on the integrated approach to professional development, the main elements of which concerned providing teachers with the scientific knowledge base on the one hand, and encouraging their critical reflection upon that knowledge, on the other (Creemers et al., 2013), the programme focused on progressive improvement of instruction through developing teachers' critical thought (Paul, 2005). The results of the study have shown that on completion of the professional development programme in teaching for critical thinking, teachers of the experimental group have indeed improved the quality of their teaching with regard to the promotion of critical thinking.

In particular, at the beginning of the intervention, the mean scores of the teachers in the control and the experimental group were almost the same and results did not reveal a statistically significant difference at .05 level between the experimental ($\overline{X}$ =-0.04) and control ($\overline{X}$ =0.01) groups in relation to the quality of their teaching skills. In that sense, teachers were located approximately at the same level of teaching quality at the beginning of the intervention. At the end of the intervention, results revealed statistically significant differences at .05 level between the teacher performances related to the enhancement of critical thinking of the two groups. In that sense, the teaching skills of teachers in the experimental group ($\overline{X}$ = 2.23), who were engaged in professional development, gradually improved from the beginning of the intervention till the end of the professional development programme compared with the teaching skills of teachers in the control group ($\overline{X}$ = 0.06), who did not receive any training or support. In a similar way, but based on the qualitative analysis of self-reported data obtained by teachers in the experimental and control groups, the study of Zohar et al. (1994) has shown that the high-school teachers of the experimental group have improved their quality of teaching in terms of emphasizing the inquiry aspects in the Biology lessons compared with the teachers in the control group, who emphasized the more descriptive ones. Similarly, the study of Gul et al. (2014) has shown that faculty members in the experimental group have improved their facilitation skills related to the teaching of critical thinking but when compared with the control group, the improvement observed was statistically significant only for two teaching criteria, the ones concerning "encouraging students to ask questions" and "reduction in dictation of notes." Furthermore, the finding of the present study is in accordance with findings reported by similar studies incorporating teacher professional development, mainly from the field of teacher effectiveness, that reveal bigger effects for teachers undergoing professional development on improving their teaching skills compared with teachers in a control group (e.g. Kyriakides et al., 2017a). In particular, the study of Kyriakides et al. (2017) has shown that during the three school years of the teacher professional development based on the dynamic approach, none of the teachers of the control group managed to move from one stage of effective teaching to another.

In addition, results of the present study revealed that teachers of the experimental group managed to improve the quality of their teaching towards critical thinking ($\overline{X}$ =2.23) compared to their own initial level ($\overline{X}$ =-0.04) at the beginning of the intervention with a statistically significant difference at .05 level (observed mean difference = 2.27). According to the results, the exceptionally high *t* statistic ($t = 86.176$, $df = 204$, $p < .000$) shows that teachers in the experimental group significantly improved their teaching quality from the first to the third classroom observation and performed better, both in terms of quality and frequency, on the teaching criteria included in the CTOT. The exceptionally high *t*-statistic may relate to features of the experimental condition and therefore it can be explained by two particular key-elements of the teacher professional development programme: (a) the activities in which teachers were engaged during the training sessions in relation to the source material provided, and b) the role of the programme's facilitator. On the one hand, during the training sessions teachers were engaged in challenging practical activities through which they could apply the new knowledge and/or obtain practical examples of how this new critical-thinking knowledge could be used in class. At the same time, they were encouraged to experiment with different teaching strategies, tactics and/or material to teach for critical thinking in their classes. And further, they could analyze their findings collaboratively (either with the principal researcher and/or with colleagues – teacher participants in the programme) so as to re-orient their teaching practice and gradually explicate their own personal theory of teaching for critical thinking. In addition, teachers were encouraged to systematically reflect and analyze their existing knowledge of critical thinking as well as their understanding of teaching for critical thinking throughout the programme. On the other hand, the facilitator of the programme was supportive in that she was providing assistance with a variety of resources while she had an ongoing communication with the teachers of the experimental group via telephone, emailing, Skype meetings and/or meetings during afternoon hours, if requested, for further assistance. In addition, during the classroom observations, the facilitator provided teachers with constructive feedback and concrete, practical suggestions while discussing with them any difficulties faced during their teaching; thus a kind of trust was built among teacher participants and the facilitator. Moreover, the facilitator was always available to support teachers in teaching for critical thinking since she was completely devoted to the programme. Provided that research has proven that there is a strong and significant relationship between professional development and teachers' practices while dramatic changes emerge only when experiences become deeper and more sustained (Supovitz & Turner, 2000), the study assumes that the professional development experience employed was indeed intense and beneficial for teachers. Under this framework, teachers in the experimental group managed to improve their teaching quality compared to their own initial level, meaning that they became more effective in orienting their lesson towards critical thinking, engaging students in productive critical-thinking work, using teaching strategies for modeling critical-thinking skills and processes and building a learning environment of thoughtfulness. This finding is highly consistent with the findings of several studies in the research field of critical thinking incorporating one way or another teacher training (e.g. Dewey & Bento, 2009; Gul et al., 2014; Yeh, 2006), that report improvement in personal teaching efficacy. In particular, the study of Yeh (2006) has revealed that guided practices, which were integral parts of the “Computer Simulation for Teaching General Critical-Thinking Skills” programme and led to reflective teaching and mastery experiences, substantially contributed to the preservice teachers’ improvement in personal teaching efficacy within the context of critical-thinking based instruction during the simulated teaching based on a pretest vs posttest score on personal teaching efficacy. Similarly, based on the analysis of self-reported data obtained by teachers in the experimental group, the study of Dewey and Bento (2009) revealed that teachers identified a range of new teaching techniques which they felt had enhanced their practice, such as thinking diagrams, the use of structured group work and a protected time for children to think. In a similar way, the study of Gul et al. (2014) revealed positive changes in the pedagogical skills of educators in the experimental group while a statistically significant increase was noted in the educators' ability to use higher-order questions after they had completed the intervention.

Apart from analyses (*t*-test paired samples) used to examine the improvement of the quality of teaching throughout the year, a linear regression was calculated so as to investigate how well the treatment group in relation to other teacher background characteristics (e.g. teaching experience, teacher education level) predicted the value of the teaching quality. Findings revealed that more than four fifths (87.2%) of the variance in the teaching quality was explained by the treatment group, meaning that the teacher professional development programme in teaching for critical thinking strengthened the possibility of, or was linked to, the improvement of the quality of teaching for critical thinking. Therefore, the experimental condition was beneficial for teachers provided that the aim of the programme was to stimulate them to teach purposefully for critical thinking (sometimes differently or more purposefully from what they have been used to) in order to enhance their students' critical thinking. To further inform the inquiry, the first teacher effectiveness score (teaching quality 1), as measured in the first classroom observation and additional teacher-related explanatory variables (i.e. total years of teaching experience, years of teaching experience in 5^{th} or 6^{th} grade, education level, previous training in critical thinking) were used along with the treatment group to examine how well they predict the teaching quality. Results have revealed that the treatment group remained a very good predictor while the teaching quality as measured in the first classroom observation appeared to be a good predictor of the final teaching quality (as measured in the third classroom observation) as well. Nevertheless, the treatment group had obviously a bigger strength (b=0.953) than the initial teacher performance (teaching quality 1) (b=0.285). Furthermore, although all other teacher background characteristics were found to be related to the quality of teaching for critical thinking, their strengths (beta coefficients) were relatively small, in relation to the strength of the treatment group, thus their contribution to the prediction of the teaching quality was minor. Importantly, not all predictors were found to contribute positively to the quality of teaching. In particular, results have shown that teaching experience contributed negatively to the quality of teaching. The fact that the total years of teaching experience was negatively associated with the quality of teaching for critical thinking while the number of years teaching at a particular grade (5^{th} or 6^{th} grade) was not at all related, is quite interesting. A similar finding was found in the study of Huang and Moon (2009), who concluded through multilevel analyses that the teacher variables of education level and total years of teaching experience were not statistically significant. However, Huang and Moon (2009) found that more than five years of teaching at the grade level was statistically significant for student achievement gains. Their finding suggests that experienced teachers teaching at a specific grade level could have a large effect in countering the effects of the widening achievement gaps (Huang & Moon, 2009). With regard to the overall years of teaching experience, findings from the study of Supovitz and Turner (2000) have also shown that teaching experience was negatively associated with the classroom culture while it was not associated with the quality of teaching related to inquiry-based teaching practices in the framework of their study. And further, Supovitz and Turner (2000) have found that teachers' content preparation and positive disposition towards reform and professional development were the most powerful influences on the teaching practice, elements that the present study also pursued. Besides, teacher participants' positive disposition towards self-direction of change in practice provided an impetus for their involvement in the programme, something which is praised in the field of professional development in general (e.g. Barnes, 2005; Karagiorgi & Symeou, 2007; Koutselini, 2015; Munro, 1999). In that vein, the logic that maintains that the more years of experience a teacher has, the more effective the teacher should be in teaching does not seem to apply in the framework of teaching for critical thinking. This is in line with what Facione (1990c) claimed years ago, that who teaches critical thinking, in terms of teaching experience or educational level in the case of the present study, is less important than knowing how to teach it. In another sense, teacher participation in professional development courses is needed despite how long their teaching experience is (Kyriakides et al., 2017a), something that the present study applauds. The finding of the present study related to the strong impact of the teacher professional development programme on the quality of teaching for critical thinking stresses that need. And further, this finding is in line with what research in the field of professional development as well as teacher effectiveness has proven: Teacher professional development programmes have a positive impact on strengthening teachers' knowledge of the concept under study, be it critical thinking or learning in general, and the application of this knowledge to practice (e.g. Barnes, 2005; Dewey & Bento, 2009; Kyriakides et al., 2017a; Munro, 1999; Supovitz & Turner, 2000) provided that teachers are truly interested in the concept under study (e.g. Barnes, 2005), positively disposed towards professional development (e.g. Karagiorgi & Symeou, 2007) and fully committed. In addition, the fact that the improvement in the quality of teaching was an outcome of the treatment, that is, the teacher professional development programme developed in the present study, provides further support for what research have years ago shown; when teachers are given ongoing developmental opportunities to (re)act and (re)think in actual classrooms on how to teach for critical thinking, instructional effects become even stronger (Barnes, 2005; Flores et al., 2012; McGuinness, 1999; Paul 2005).

Another interesting finding of the present study concerned the statistically significant improvement observed in the teaching quality of the control group at the end of the intervention. Nevertheless, what differed from the improvement pattern observed in the experimental group was that teachers in the control group did not increase their teaching quality from the first observation ($\overline{X}$ =0.01) to the third ($\overline{X}$ =0.06) (observed mean difference = 0.05) to the same extent as teachers of the experimental group did. The improvement cannot be attributed to training or support, since teachers of the control group were not engaged in professional development in teaching for critical thinking. Therefore, the observed improvement could be attributed to their teaching experience. However, teaching experience alone without any kind of teacher professional development does not contribute to the improvement of teaching skills (Çakir & Bichelmeyer, 2016; Kyriakides et al., 2017a). To this end, the improvement of the teaching quality of teachers in the control group could be rather attributed to the "Hawthorne effect", based on which teachers of the control group may have altered their teaching behavior due to their awareness of being observed. Although teachers in the control group (as well as in the experimental group) were not aware of the critical-thinking requirements filtered as teaching criteria included in CTOT, the possibility of the Hawthorne effect during the three classroom observations could not be ruled out as the participants were not blinded to the purpose of the research study. Besides, from an ethical perspective, all 23 teacher participants were informed of the purpose from the very beginning of the study and the research procedures so as to assure that only those who shared the same interest with the principal researcher with regard to teaching for critical thinking would participate.

Fourth Research Question – Proportion of variance in student critical-thinking outcomes attributable to student background characteristics, teacher characteristics, and the professional development programme effects

To ascertain if the improvement of students' critical-thinking outcomes was a function of the impact of the intervention and/or the teaching quality gradually improving, in relation to other student background characteristics, a multilevel analysis was employed. For, data were nested, namely, students within classrooms/teachers, thus there was a need to explore the extent to which the differences in student critical-thinking performance between the experimental and control groups were accountable for by factors related either to the class and teacher or student characteristics through multilevel analysis. That kind of analysis enabled the exploration into the nature of improvement between the groups across the period of the professional development programme. In that sense, the use of multilevel modelling disentangled the student, classroom (teacher), and school variance components. Multilevel modelling has become increasingly applied to education studies, explicitly taking into account the nested nature of the data, avoiding issues such as aggregation bias and the misestimating of standard errors (e.g. Huang & Moon, 2009; Kyriakides et al., 2009; Kyriakides et al., 2017a; Kyriakides et al., 2017b). In the present study, students (level-1) were nested within classrooms/teachers (level-2).

According to the results of multilevel analysis, a large proportion of variation in student critical-thinking performance in the unconditional model (model zero) indicated that the bulk of variance was attributable to student characteristics (58.44%) and teacher characteristics (41.56%). Surprisingly the variance at the teacher level was high enough, something that is not usually seen in educational studies partitioning the variance among students, classrooms and teachers (e.g. Huang & Moon, 2009; Kyriakides et al., 2017b). Subsequently, in model 1, results have shown that adding students' critical-thinking score in the pre-test as well as students' critical-thinking score in the interim-test almost effectively halved the variance at the student-level (22.63%), significantly improving the model fit, since model 1 explained 34.51% of the total variance of the student critical-thinking performance. And further, most of the explained variance was at the teacher-level (42.86%). Using the students' critical-thinking performance as measured in the pre-test showed the importance of controlling for previous achievement in assessing value-added models, since a large part of the variance can be attributed to factors that occurred in prior years, as Huang and Moon (2009) assert. In a similar way, Angeli and Valanides (2009) have controlled for students' prior achievement in critical thinking and have used it as a covariate so as to examine whether it affects the students' critical-thinking outcome at the end of the intervention. Based on the results of a one-way analysis of covariance, the covariate was found to be significant, $F(1, 67)=7.56$, $P < 0.01$, partial $\eta^2 =0.10$, indicating that students (dyads) with better critical-thinking scores (as measured by the CCTST, a 34-item multiple-choice test) had better critical-thinking performance than students (dyads) with lower critical-thinking pre-scores (Angeli & Valanides, 2009). Similarly Bensley et al. (2010) have controlled for psychology students' prior learning experiences related to the number of psychology courses taken and have used it as a covariate so as to examine whether it affects students' argument analysis at the end of the intervention. Based on their results, the covariate was found to significant, $F(2, 40) = 12.24$, $p < .001$, $\eta^2 =.38$, indicating that the CT-infused class having taken more psychology courses had significantly greater gains in argument analysis. In another sense, using the students' critical-thinking performance as measured in the interim-test was also important since it somehow revealed that a large part of the variance was attributed to factors occurring throughout the lifespan of the teacher professional development programme. Besides, the interim test was used as a midway point between the pre- and post-test mainly for reflectively exploring whether students were improving their critical-thinking skills while the programme was still in progress. In addition, for model 1, other student background characteristics (e.g. sex, academic achievement, free-time activities, and parents' education level) that were available were taken into account, since in appraising instructional effects there is a need to emphasize the impact of these effects in relation to various student-related characteristics (e.g. sex, academic performance), as Tiruneh et al. (2014) underline. In the same vein, after finding a statistically significant variability among effect sizes of different studies in the meta-analysis (Q-statistic=137.96, p-value=0.000), Niu et al. (2013) examined whether certain variables (e.g. treatment length, participants, experiment context) accounted for the variability in the effect sizes. Similarly, the validation studies of the CCTST (Facione, 1990c) examined whether certain instructor-related variables (e.g. gender, the number of years of college level teaching experience), could act as factors that might plausibly have an effect on the development of students' critical thinking skills by performing one-way analysis of variance. However, in the present study, none of the student-related variables that were entered one by one were found to have an effect on students' critical-thinking performance apart from the variable "reading books", the parameter estimate and standard error of which were 0.068 (0.024). With regard to this finding, research in the field of critical thinking links literacy to critical thinking ability (Marin & Halpern, 2011). In fact, a student's reading comprehension and facility with language and writing conventions may be closely connected with his/her ability to demonstrate, develop, and apply critical-thinking skills (Marin & Halpern, 2011; Paul, 1992). In this respect, mastery of language contributes significantly to critical thinking (Paul et al., 1997). In that vein, findings of the present study suggest that reading literature can help students to develop certain critical-thinking skills. This is in accordance with the conceptualization of critical-thinking performance that the study adopted, which is determined by the quantity and quality of meaning that the student derives from what he/she reads and perceives (deep understanding) and that he/she expresses in what he/she writes and says (substantive writing) (Bean, 2011; Lipman, 1988; Paul, 2005) by competently using a combination of core critical-thinking skills. Based on the results of multilevel analyses for model 1, the use of both students' pre-test critical-thinking performance and student background characteristics, such as reading books during their free-time, illustrated why it was important to include these student-related variables in assessing instructional effects, as these variables accounted for a quite respectable proportion of variance, which needed to be attributed correctly.

Results emerged from the subsequent different versions of model 2 that were established to examine whether the student critical-thinking performance was accountable for by factors related to teacher characteristics, namely the quality of teaching, and other available teacher-related variables (e.g. teaching experience, previous training in critical thinking), as well as the treatment were quite interesting. Firstly, in model 2a, results have shown that adding the quality of teaching for critical thinking (as emerged from the aggregation of the three teaching qualities – effectiveness scores for each teacher) effectively increased the explained variance of student critical-thinking performance (57.7%) with the variance at the teacher level (19.85%) and the student level (22.45%) being almost the same. In this respect, the teaching quality was found to be strongly associated with student critical-thinking performance showing that way the importance of the contextual – instructional effects on student learning. This finding is in line with several educational studies that revealed positive effects of instruction on student critical-thinking outcomes, especially when teachers are given on-going opportunities for reflection and action (e.g. Flores et al., 2012; McGuinness, 1999; Paul 2005). In addition, that finding is strongly related with a common assumption in the field of critical thinking, that critical thinking can be developed or can fail to improve depending on the quality of the instruction (Insight Assessment, 2015). Besides, teachers, if supported, can design their instruction so as to motivate their students' impulsive initiation in a more self-conscious way, such that good critical-thinking practice is encouraged and poor practice is dropped (Bailin et al., 1999a; Swartz, 2003). In addition, this finding should be considered by taking into account research outcomes and conclusions stressing that the teacher and consequently the teaching quality account for more than the school or the educational system in student achievement (e.g. Creemers & Kyriakides, 2008). However, this finding should be interpreted cautiously taking into consideration the profile of teacher participants as well as the small teacher and student sample size of the present study. On the one hand, teacher participants were truly interested in, sympathetic to teaching for critical thinking, and willing to (learn how to) do so, which is required for better results and instructional effects (e.g. Barnes, 2005; Ennis, 1997) and on the other hand, they were positively disposed towards professional development and self-direction of change, something that makes the professional development experience more beneficial (Barnes, 2005; Karagiorgi & Symeou, 2007; Munro, 1999) in terms of improving the quality of teaching.

Despite the fact that the quality of teaching was found to be strongly associated with student critical-thinking performance none of the teacher background characteristics that were entered one by one were found to have an effect on the students' critical-thinking outcomes. This finding is in line with findings from several educational studies showing that certain teacher characteristics such as teaching experience, degree, and primary teaching field do not have effects on student achievement (Çakır & Bichelmeyer, 2016; Huang & Moon, 2009). Or, to put it in another way, teaching experience alone without any kind of teacher professional development does not contribute to the improvement of student performance and/or teaching skills (Çakir & Bichelmeyer, 2016; Kyriakides et al., 2017a). Based on that assumption, it's not a coincidence that findings of the present study have shown that a big proportion of the variance in the teaching quality was explained by the treatment group, meaning that the teacher professional development programme in teaching for critical thinking strengthened the possibility of the improvement of teacher participants' practice in class.

Secondly, in model 2b, results have shown that removing the quality of teaching for critical thinking and adding the treatment group (experimental or control) effectively increased the explained variance of student critical-thinking performance (75.14%) with the variance at student level (22.63%) being almost the same as in model 2a and the variance at the teacher level (2.23%) to fall since a high proportion of variance was explained. In this respect, the treatment group was found to be highly associated with student critical-thinking performance, meaning that the experimental condition did a relatively strong appeal on students' critical-thinking outcomes, showing that way the importance of the contextual effects on student learning. In that sense, the teacher professional development in teaching for critical thinking had actually a significant impact on students' critical-thinking outcomes. Thirdly, in model 2c, results have shown that adding both the quality of teaching for critical thinking and the treatment group (experimental or control) did not change the explained variance of student critical-thinking performance (75.51%). The fact that in model 2c the teaching quality was not found to be associated with student critical–thinking performance can be attributed to the phenomenon of multicolinearity (Creemers et al., 2010) since the predictor variable of teaching quality could be linearly predicted from the second predictor variable, that is, the treatment group (experimental or control) with a substantial degree of accuracy. The gradual improvement of the quality of teaching towards critical thinking was the outcome of teachers' engagement in the teacher professional development programme. In this respect, Model 2c was rejected.

The intervention did reach an optimal point since multilevel analyses have shown that almost 75% of the total variance of student critical-thinking performance as measured in the post-test was explained while most of the explained variance was at the level of the student, who participated either in the control or experimental group. Results emerged have shown that the treatment group (experimental or control) had a statistically significant effect at the .05 level on student critical–thinking performance (post-test). This finding suggests that the experimental condition was beneficial for students since teachers in the experimental classes were stimulated to teach purposefully for critical thinking (sometimes differently from what they have been used to) in order to enhance their students' critical-thinking skills. Besides, research has shown that although critical thinking is significantly anchored within curricula, it is not supported and taught systematically in daily instruction since teachers are not educated in critical thinking or have no instructional resources to integrate critical thinking into teaching (Astleitner, 2002). The fact that the teacher professional programme of the study aimed to support teachers to systematically, purposefully and explicitly teach for critical thinking in class in order to enhance their students' critical thinking by providing them with instructional resources to do it, appears to explain the statistically significant effect.

Nevertheless, the exceptionally high variance of the student critical-thinking performance that is explained by the treatment group can relate, or be attributed, to certain features of the experimental condition. On the one hand, most of the teachers in the experimental classes were strongly committed to the programme since from the very beginning they volunteered to participate because they were truly interested in, sympathetic to teaching for critical thinking, and willing to (learn how to) do so (Barnes, 2005; Ennis, 1997). Research has shown that when teachers are positively disposed towards professional development and self-direction of change and development in practice, the professional development experience becomes more beneficial (Barnes, 2005; Karagiorgi & Symeou, 2007; Munro, 1999). On the other hand, and because of the teachers' positive disposition, experimental classes incorporated an environment of thoughtfulness, something that helped students to be more positively disposed towards critical thinking. In fact, research has shown that the more the classroom incorporates an environment of thoughtfulness and self-reflection, the more open students will be to valuing good thinking (Newmann, 1991; Papastephanou & Angeli, 2007; Plath et al., 1999; Swartz, 2003). In addition, teachers designed lessons for explicitly teaching for critical thinking in order to help their students acquire and use in-depth knowledge and critical-thinking skills so as to solve higher-order tasks and challenges (Newmann, 1991). And further, students in the experimental classes were purposefully given ongoing opportunities to practice critical thinking through challenging and rich critical-thinking activities, something that turned out to be beneficial as well (Plath et al., 1999; Swartz, 2003; van Gelder, 2005). In another aspect, the frequent presence of the principal researcher – facilitator in the experimental classes not only for observation purposes but also for co-teachings with teachers could have motivated students towards thinking more critically or at least towards being more actively disposed to do it. Besides, as Tsui (2002) maintains, some student background characteristics, such as motivation or academic preparation may enable students, who report the greatest growth in critical thinking, to be most affected by the critical-thinking based instruction. Nevertheless, students' attitudes, motivations, or self-perceptions of themselves as learners during the intervention, that could possibly interpret (or not) the variance of the student critical-thinking performance explained by the treatment group, were not obtained within the present study. In the study of Angeli and Valanides (2009), when students were asked to participate in a debriefing session one month after the intervention to express their thoughts and reflect upon the intervention, most of them were positively disposed towards their experience and admitted that they had gained insights about the dynamics involved in the critical-thinking process. The same study revealed that students assigned to the three teaching groups (general, infusion, immersion) exhibited more precise understandings of critical thinking than students assigned to the control group (Angeli & Valanides, 2009). Dewey & Bento (2009), who took care to act in a similar way and get students' reflections, surprisingly concluded that children in both the experimental and control groups had more negative self-perceptions of themselves as learners at the end of the intervention. In either case, data from interviews with students or self-reported data could explore the depth and the quality of students' experience in the programme and explain that way, the high variance of the student critical-thinking performance explained by the treatment group.

In addition, the exceptionally high variance of the student critical-thinking performance that is explained by the treatment group can be attributed to other factors that were not thoroughly examined in the present study. Although data with regard to student background characteristics were obtained and provided information about parent-related variables, some of those variables were not manipulated as aspects of, and/or sound composite measures for estimating, the socioeconomic status (SES) that could probably have an effect on students' critical-thinking outcomes. On the contrary, these student-related (e.g. leisure time, educational opportunities) and parent-related variables (e.g. mother and father's education level, mother and father's job, quality time with parents) were entered one by one in the multilevel analysis, results of which showed that they had no statistically significant effect on student critical-thinking performance apart from the variable "student reading books." If these variables were used as composite measures aiming to incorporate several domains of information into a singular (i.e. scalar) quantity for estimating SES, results might have been different. For, SES, as a nuisance variable, should be controlled for or eliminated as a potential explanation of research findings since it remains as one of the most commonly used contextual variables in education research (e.g. Creemers & Kyriakides, 2010; Huang & Moon, 2000).

Despite the exceptionally high variance of the student critical-thinking performance explained by the treatment group, which should be viewed with caution, what the present study's findings actually revealed is that a well-planned and concerted teacher professional development programme based on an integrated approach to professional development (Creemers et al., 2013) can have an impact on student critical-thinking outcomes. This is consistent with meta-analytic studies' findings that confirm that critical-thinking teaching interventions can gradually improve students' critical-thinking skills (e.g. Abrami et al., 2008; Bangert-Drowns & Bankert, 1990; Niu et al., 2013).

Fifth Research Question – Contribution of the teacher professional development programme in teaching for critical thinking in the teachers' perceived ability to, and meaning-making towards, teaching for critical thinking

Qualitative data obtained by the responses of teachers in the experimental group in the teacher reflections' questionnaire as well as by the reflective journal of the principal researcher evidences a positive impact of the professional development programme in teaching for critical thinking on teachers across a range of aspects from new and alternative teaching practices to changes in professional perceptions. Such findings resonate with research in the field of critical thinking and professional development growth (e.g. Dewey & Bento; 2009; Zohar et al., 1994; Yeh, 2006) and research in the field of teacher professional development in general (e.g. Antoniou et al., 2011; Kyriakides et al., 2017a).

On a first level, qualitative data analysis offered rich evidence on the presuppositions or minimal requirements and principles of a critical-thinking based instruction. The most important ones that emerged concerned the principle of *purposeful instruction oriented towards the critical-thinking objective*, and the principle of *explicit instruction of critical thinking skills infused directly into content instruction.* On the one hand, teachers have come to realize that there is always a need to purposefully teach for critical thinking, in terms of purposefully choosing learning strategies, tasks and activities aiming at certain critical-thinking skills and processes. This finding is consistent with theoretical and empirical claims stressing that students will not eventually and spontaneously become good critical thinkers unless there is a deliberate critical-thinking based instruction (Angeli & Valanides, 2009; Astleitner, 2002; Garside, 1996; Halpern, 1998; Kennedy et al., 1991; Prawat, 1991; Swartz, 2003). This is because a purposeful lesson design leads to a purposeful instruction, which in turn facilitates the process of teaching for critical thinking for better critical-thinking outcomes (e.g. Barak et al., 2007; Nickerson, 1984; Sternberg & Bhana, 1986). On the other hand, the qualitative data highlighted that teachers felt that the principle of explicit teaching for critical thinking was key in integrating critical-thinking objectives in their lessons. . Teachers became more aware of the need to teach critical thinking explicitly by using teaching strategies (e.g. thinking diagrams) and appropriate language of the critical-thinking processes and explicit prompts, which was identified as assisting that kind of teaching. This is highly consistent with theoretical claims and research findings indicating that stressing the language of the thinking process and using explicit verbal prompts and critical-thinking concepts are helpful for the enhancement of students' critical thinking (Bailin et al., 1999a; Shim & Walczak, 2012; Swartz, 2003). In addition, teachers have come to realize that students need opportunities to practise critical-thinking skills in challenging ways and activities other than discussions in class, which are usually "consumable" in a Language Arts lesson. In accordance to that, research has shown that the more supported and challenged students are to practise the critical-thinking skills, the stronger these skills become (Keeley et al., 1982; Insight Assessment, 2015). Moreover, this finding is in line with theoretical claims determining the explicit teaching for critical thinking as a minimum requirement for a critical-thinking based instruction (Ennis, 1989; McGuinness, 1999; McTighe, 1985; Swartz, 2003). And further, this finding is highly consistent with findings from several research studies (e.g. Angeli & Valanides, 2009; Besnley et al., 2010; Marin & Halpern, 2011; Zohar et al., 1994) and meta-analyses in the field of critical thinking (e.g. Abrami et al., 2008; Tiruneh et al., 2014) that provided support for the effectiveness of explicitly teaching for critical-thinking skills infused directly into content instruction. For, as research findings reveal, the teaching for critical-thinking skills should be transparent and followed by guided practice and use in a range of contexts (Dewey & Bento, 2009) while teachers have a coaching role (McGuinness, 1999).

From another point of view, in an effort to understand how teacher participants explored their conceptions about (teaching for) critical thinking and refined critical-thinking principles into practice, rich qualitative data on teachers' misconceptions of (teaching for) critical thinking in general, and in the context of the elementary subject area of Language Arts in particular, were obtained. On a first level, instances of teachers' conceptualizing critical thinking in a rather confusing and misleading way, which were recorded throughout the lifespan of the professional development programme, revealed important teacher misconceptions mostly related to the interpretation of critical thinking as a purely subjective judgment, as solely argumentation, as questioning, judging and having doubts about everything, as a complex kind of thinking related to "thinking a lot", as problem solving or problem-based learning. This finding is not surprising; on the contrary, it is highly consistent with findings reported by studies in the field of critical thinking stressing that precise understandings of critical thinking and teaching requirements to promote critical thinking by teachers remain unclear (Astleitner, 2002;Paul et al., 1997; Stapleton, 2011). And further, research has shown that teachers are not well-informed or educated on how to foster critical thinking in their students (e.g. Astleitner, 2002; Paul, 2005; Paul et al., 1997; Stapleton, 2011) and/or resistant to teaching for critical thinking (e.g. Ruggiero, 2003; Savage, 1998).

In this respect, revealing and understanding teachers' misconceptions of critical thinking was important not for replacing them with appropriate expert knowledge but for adapting and/or changing them through reflection and critical thought (Paul, 2005), which is in line with the constructivist premise that learning is all about adapting prior knowledge in a personal and meaningful way (Koutselini, 2008b, 2013, 2015). From another view, adapting teachers' prior knowledge on critical thinking was an impetus for changing their teaching practices towards critical thinking since, when teachers have a vague notion of critical thinking they cannot easily design effective teaching lessons for promoting critical thinking (Paul et al., 1997; Paul, 2005). During the programme, an increased awareness of what critical thinking entails was noticed across all teacher participants. This in turn meant that teachers were gradually placing a greater value, than before, on explicitly integrating core critical-thinking skills within the existing Language Arts curriculum, which enabled them to successfully remodel lessons by infusing critical-thinking objectives. This was of great importance provided that most teacher participants were negatively disposed towards the use of the new Language Arts Curriculum, which was developed under the recent reform of the National Curricula in Cyprus. On the contrary, at the beginning of the programme most of them expressed a strong reliance on their empirical knowledge and teaching experience in terms of planning, designing, and teaching for critical thinking. Nevertheless, research has shown that teaching experience is negatively associated with the quality of teaching (Huang & Moon, 2009; Supovitz & Turner, 2000) for which findings of the present study (see third research question) provide support. Gradually placing a value on explicitly integrating critical thinking in their teaching by using the existing Language Arts Curriculum as well as the Critical-thinking Curriculum developed within the study shaped their perceived ability to teach for critical thinking to a large degree. This is in accordance with what Behar-Horenstein and Niu (2011) maintained that to emulate critical thinking in their teaching practice, teachers should be able to differentiate ordinary thinking from critical thinking, and they should be able to "understand processes that constitute critical thinking" (p. 27) so as to employ appropriate teaching strategies. In fact, an underlying consistency across the qualitative data concerned the use of new and alternative teaching techniques and strategies for enhancing students' critical thinking. In accordance to that, research findings have shown that students' critical thinking can be enhanced only when teachers have in-depth understanding of what critical thinking entails or is about and consequently can effectively integrate critical-thinking principles in their teaching (Facione, 1990c; Flores et al., 2012; Paul, 2005). In addition, during the programme teachers became more self-reflective of their teaching in terms of identifying and evaluating the critical-thinking skills integrated in their teaching. This finding is in line with the finding revealed in the study of Dewey and Bento (2009) in that teachers became more evaluative of their professional practice.

Limitations of the Study

As with all experimental studies, there are several limitations in the present study. Firstly, limitations are inherent in the use of a quasi-experimental research design, which do not permit the causal attributions afforded in longitudinal research involving a single group of participants examined over time (Behar-Horenstein & Niu, 2011). Nevertheless, the quasi-experimental was a necessary condition in the present study. For, a call for teacher professional development in teaching for critical thinking was launched at the beginning of the school year 2016-2017 in 50 public primary schools in Nicosia and Larnaca, which were chosen due to their distance from the University of Cyprus, where the principal researcher was working. As a result, by the end of September 2016, 23 teacher participants from 14 different public primary schools volunteered to participate in the programme. In that sense, the present study did not use a random sample, something that does not allow the generalization of results and findings. The limitation of the quasi-experimental design was partly addressed by the random assignment of the 23 teachers (and their students), who volunteered to participate, into two groups, that is, the control and the experimental. In addition, for controlling the variables of age and curriculum content, only teachers of 5th & 6th grade were targeted. Yet, limitations are also inherent in the use of a rather small teacher and student sample which is not representative of the general population.

Secondly, teachers and students were aware of the presence of the observer (principal researcher) during the three classroom observations and that could have affected their performance. While the possibility that some teachers of both the experimental and the control group might have prepared a "special" class in anticipation of the visit cannot be completely discounted, by all indications this did not seem to be the case, since in the case of the control group teachers' performance and quality of teaching did not dramatically change from the first observation to the second or the third. This limitation was partly addressed by not familiarizing teacher participants (in both groups) with the teaching criteria included in the Critical-Thinking Observation Tool and the kinds of information being recorded during the classroom observations.

Thirdly, another limitation of the present study is that classroom observations were carried out by only one observer and thus, they may be possibly influenced by biases of the observer (e.g. Hiebert & Grouws, 2007). In the present study, the observer was the principal researcher since due to lack of resources and time constraints it was not possible to accordingly train more observers in the formal use of the Critical-Thinking Observation Tool (CTOT) prior to conducting the observations. In that sense, inter-observer reliability could not be calculated since there was only one observer conducting the observations. For partly addressing that limitation, the CTOT was pilot-tested two times in two different classes. In particular, the principal researcher along with another observer, who was accordingly trained (before the programme), visited two classes during a period of one week and informally used the tool. During the visits, although the two observers were together, they made separate assessments without access to each other's ratings so as to later on test the level of their agreement. After the observations, the two observers exchanged their observational records and compared their assessments based on which they discussed how easy or difficult the use of the observation tool was. Under this framework, some expressions or prompting used in the criteria included in the CTOT were edited, while a frequency scale for the teaching criteria observed (e.g. how many times or for how long) was added. In that sense, the observation protocol was accordingly worked out and what to observe (i.e. teaching skills, strategies and/or behaviors conducive to promoting critical thinking) was decided in advance. In another sense, if there had been a possibility to train more observers for conducting the classroom observations, it would have been wise to carry out the observations without knowing the group (experimental or control) in which a teacher was allocated, to avoid bias during the observations.

Fourth, although student-related variables (e.g. father's education level, mother's education level, father's job mother's job) were available, the present study did not proceed with calculating standardized values of these variables to estimate a SES indicator. If these variables were used as composite measures aiming to incorporate several domains of information into a singular (i.e. scalar) quantity for estimating SES, results might have been different. For, SES, as a nuisance variable, should be controlled for or eliminated as a potential explanation of research findings since it remains as one of the most commonly used contextual variables in education research (Creemers & Kyriakides, 2010; Huang & Moon, 2000). Reversely, these variables were entered one by one in the multilevel analysis, results of which showed that they had no statistically significant effect on student critical-thinking performance apart from "student reading books." In addition, the financial situation of the family, as another important SES variable, was not obtained through the Student Demographics' Questionnaire, which would be probably necessary for the estimation of SES since it is usually used in educational studies (e.g. Creemers & Kyriakides, 2010).

CHAPTER VI

CONCLUSIONS

This chapter critically presents the conclusions of the present study as resulted from the discussion of the results and lays emphasis on the contribution of the study on a theoretical, methodological and practical level. At the end, implications for future research into empowering teachers' knowledge of, commitment to and improvement of, teaching for critical thinking are given.

Conclusions of the Study

The present study focused on developing a well-planned teacher professional development programme in teaching for critical thinking and empirically examining its effects on elementary students' critical-thinking outcomes, teachers' quality of teaching for critical thinking, and teachers' reflections upon their perceived ability to teach for critical thinking. The study managed to achieve the aim by pursuing and accomplishing three interrelated objectives highly consistent with three important components of the educational reality: the curriculum, the teacher and the student. Firstly, the study has come to a conclusion with regard to a clear operational definition of critical thinking, based on which the student critical-thinking performance has been determined. In addition, based on the same definition, student critical-thinking measures holistically assessing critical thinking were developed and well-tested for their psychometric properties within the study. Secondly, the study has determined a set of teaching criteria or instructional qualities related to effectiveness in teaching for critical thinking. Based on these criteria, a critical-thinking observation tool for assessing the quality of teaching for critical thinking has been developed and well-tested for its psychometric properties within the study, as well. Thirdly, the study has mindfully developed a teacher professional development programme in teaching for critical thinking explicitly based on a substantive concept of critical thinking and focused on progressive improvement of instruction through developing teachers' critical thought about having an effect on student critical-thinking outcomes.

On a first level, provided that critical thinking is ill-defined in curriculum discussions since it is considered rather controversial when made explicit (Beyer, 1988; Ennis, 1997; Newmann, 1991), the study inferred a substantive concept of critical thinking that might be used as an operational definition for critical thinking in curriculum development. The particular concept of critical thinking was interpreted as, and analyzed in, skills – attainment targets (the expected critical-thinking outcomes for students) and subskills – teaching targets (the minimum knowledge and skills that teachers need to teach for the attainment of attainment targets). The same concept was used to define the student critical-thinking performance, which was determined by the competence of the student to use the critical-thinking skills, and the related subskills, of analysis, interpretation, evaluation, inference, explanation and self-regulation for deriving from what he/she reads and perceives and expressing in what he/she writes and says quantity and quality of meaning (Bean, 2011; Lipman, 1988; Paul, 2005). Under this framework, the study managed to develop valid measures for holistically assessing the student critical-thinking performance, which were well-tested for their psychometric properties within the study. In that sense, the critical-thinking instrument(s) developed within the study might be used by teachers, researchers and/or practitioners for diagnosing strengths and weaknesses of students' critical-thinking skills. Besides, lack of knowledge about the critical-thinking skills elementary students can apply, if directed by teachers, could be largely attributed to the absence of suitable assessment tools for these elementary-student populations (Ennis & Weir, 1985). In addition, the study infers that the student critical-thinking instruments developed within the study can also become instructional and be used as teaching materials, such as other widely known instruments (e.g. Ennis & Weir, 1985).

On a second level, provided there are poor student critical-thinking outcomes at all levels of education (Flores et al., 2012; Paul, 1992, 2005; Pithers & Soden, 2000; Tsui, 2002; van Gelder, 2005), which are mostly related to deficient instructional environments (e.g. Lai, 2011; Nickerson, 1988) often comprising inefficient instructional variables (Tiruneh et al., 2014), the study concluded in determining some minimal requirements of a critical-thinking based instruction for enhancing students' critical thinking. Taking into account that there is no solid knowledge on best teaching techniques or strategies that enhance critical thinking (McMillan, 1987; Newmann, 1991; Tsui, 2002), the present study established a theory-driven and evidence-based approach to improving the quality of teaching for critical thinking. For, the study has come to a conclusion with regard to certain instructional qualities or teaching criteria that may determine the quality of teaching in terms of effectiveness in teaching for critical thinking. In that sense, the study concluded that the quality of teaching for critical thinking may be determined by the effectiveness of the teacher to apply certain teaching skills, namely: i) setting a purposeful critical-thinking context (i.e. solving a problem, making a decision), ii) providing the critical-thinking objective(s) of the lesson and challenging students to identify them through challenging activities, iii) using purposeful questioning so as to provoke thinking, iv) encouraging short discussions so that students express their point of view on issues, concepts and ideas, v) providing students with opportunities to practice critical thinking in structured challenging tasks and critical-thinking rich activities, vi) using formative assessment for thinking in terms of providing purposeful feedback in students' critical-thinking outcomes, vii) modelling discrete thinking-skills processes through thinking diagrams by stressing the language of the thinking processes and using explicit critical-thinking verbal prompts, viii) modelling discrete thinking-skills processes through the "thinking aloud" technique by stressing the language of the thinking process, ix) motivating and encouraging students to think critically, and x) building a learning environment of thoughtfulness encouraging students to be positively disposed towards critical thought and self-reflection. Under this framework, the study managed to develop a valid measure for empirically examining those teaching criteria that determine the quality of teaching for critical thinking. The measure has been well-tested for its psychometric properties within the study. In that sense, the critical-thinking observation tool developed within the study may be used by teachers, researchers and/or practitioners as a reflective tool for diagnosing instructional strengths and/or weaknesses related to the teaching for critical thinking.

On a third level, provided that teachers are not (always) well-informed or educated on how to foster critical thinking in their students (e.g. Astleitner, 2002; Paul, 2005; Paul et al., 1997; Stapleton, 2011) and/or resistant to teaching for critical thinking (e.g. Ruggiero, 2003; Savage, 1998) and/or focused on delivering the prescribed curriculum (e.g. Chatzigeorgiou, 2001; Koutselini, 2006, 2008a, 2008b, 2013; Papastephanou & Koutselini, 2006; Paul, 1992), the study managed to provide evidence and support for the conditions under which elementary teachers could be activated on, and supported towards teaching for critical thinking. Those conditions derive from the concerted and well-planned teacher professional development programme in teaching for critical thinking developed within the study. The programme has been developed based on an integrated approach to professional development according to which teachers receive ongoing training and support in teaching for critical thinking through meaningful learning experiences (Creemers et al., 2013). In addition, the programme has been explicitly based on a substantive theoretical framework for critical thinking and focused on progressive improvement of instruction through developing teachers' critical thought (Paul, 2005). The programme was successful since multilevel analyses that were used to analyze data obtained from the 395 students and 23 teachers from the 14 elementary schools have shown that teachers' engagement in the teacher professional development programme in teaching for critical thinking had a positive effect on students' critical-thinking performance, in both critical-thinking instruments used asking students to demonstrate critical-thinking skills through purposeful written products. At the same time, the findings of the present study have shown that the teacher professional development programme had an impact on the quality of teaching in terms of enhancing teachers' knowledge of, and commitment to, purposefully and explicitly teaching for critical thinking in their classes. In that sense, the critical-thinking skills of elementary students can be enhanced, if directed by teachers, who are well-informed about critical thinking and empowered when it comes to how teach for critical thinking.

Under this framework, the study suggests a teacher professional development programme, namely, an organic curriculum for empowering teachers in teaching for critical thinking. Provided that the study addressed the need for change in the teachers' training culture emphasized during the last few years (Antoniou & Kyriakides, 2011; Creemers et al., 2013; Karagiorgi & Symeou, 2007; Koutselini, 2008b, 2015; Kyriakides et al., 2017a), the design, content and activities incorporated in the programme provide a scientific theoretical background on effective professional development in teaching for critical thinking that can be used for the development of similar training schemes and/or modules in the future. What's important to note is that the present study acknowledges that developing a teacher professional development programme in teaching for critical thinking was both a challenge and an opportunity. The challenge lay in the fact that there were none or very few comprehensive or up-to-date programmes to build on or adopt. Therefore, the scientific knowledge base on critical thinking had to be accordingly filtered and turn into goals, content, instructional material and activities distributed in sequenced school-based training sessions for elementary teachers. And further, the subject area of elementary Language Arts, which was chosen as the framework for the programme, along with all the relevant material (e.g. New Curriculum of 2016 in Cyprus, Course Guidelines – Manual on Instructional Tools used for Developing Oral and Written Language, School Textbooks) needed to be carefully considered. From another point of view, developing the teacher professional development programme was also an opportunity because, if well-planned, the programme could benefit teachers in terms of improving their teaching quality towards the promotion of critical thinking as well as students in terms of becoming competent in using critical-thinking skills in various learning situations (e.g. reading and writing) in the context of Language Arts. And further, it was precisely the opportunity that the task of the programme development presented that made the challenge so worthwhile. Along this line of reasoning, the programme, namely the organic curriculum, developed within the study is considered fully contextualized since it was monitored and revised while implemented based on the teacher participants' needs, something that may partly explain its success. Besides, "curriculum development and teaching are fundamentally practical activities. Their aim is not primarily to produce new knowledge but, to get something done. Getting something done is a practical activity that requires an extraordinary sensitivity to context that is predicated on the individual's ability to weigh alternative courses of action, to deal with inevitable trade-offs and, the expectation that each situation will be significantly unique" (Eisner, 2000. p.354). In that sense, any future use of the programme and/or its training or instructional material is subject to adaptation since it cannot be used as it is but rather adapted to local, national or regional needs.

Despite the strong contextualization inherent in the present study, which does not allow for generalization of results and findings, certain conclusions with regard to teacher professional development in teaching for critical thinking in particular, are drawn: a) the integrated approach to professional development, the main elements of which concern providing teachers with the scientific knowledge base on the one hand, and encouraging their critical reflection upon that knowledge, on the other (Creemers et al., 2013) is effective; b) if critical thinking is to be taught, you need to engage available (given the political, economical, educational conditions), and ones who are sympathetic to teaching for critical thinking and willing teachers to (learn how to) do so (Barnes, 2005; Ennis, 1997); c) empowering teachers' knowledge of, and commitment to, teaching for critical thinking is worthwhile given that teachers undergo appropriate (multi)treatment through effective professional development. Accepting the fact that teachers may spend their days isolated from their colleagues (Onosko, 1991), there is a reason to believe that their engagement in professional development may give them the opportunity to collaborate, with both teacher colleagues and the programme's facilitator (or even a research team), so as to face similar instructional concerns related to teaching for critical thinking.

Implications for Future Research

The findings of the present study particularly concern elementary students of 5th and 6th grade, aged 10-11, who participated in the research study after their teachers' willingness to engage in a teacher professional development programme in teaching for critical thinking. Besides, the study assumed that if critical thinking is to be taught, available (given the political, economical, educational conditions), and willing teachers who are sympathetic to teaching for critical thinking to (learn how to) do so need to be reached (Barnes, 2005; Ennis, 1997). Further research, however, is needed to test the generalisability of the present study's findings especially since the number of the participants was relatively small. In that sense, it would be interesting to examine whether results might remain the same or differ (and to what extent) with (i) a bigger random sample of elementary teachers and students, or even with (ii) younger elementary students and their teachers, and/or (iii) older students and their teachers in the same or in another context – subject area. With regard to the latter, it would be interesting to examine the effects of teacher professional development in teaching for critical thinking if a different subject other than the Language Arts, possibly less structured, was chosen as a context.

From another point of view, provided that the issue of transferring critical-thinking skills still needs to be sorted out with empirical data (e.g. Ennis, 1997), it would be interesting to examine whether teacher participants, who were – or will be – empowered in teaching for critical thinking through professional development, could transfer that knowledge and teaching skills, in other lessons and/or subject-matter(s) other than the Language Arts. And further, it would be interesting to determine the sustainability of the effects and make a follow-up measurement of teaching skills, one year after the end of the intervention, in order to reveal further improvement or decline, something that the study of Kyriakides et al. (2017a) pursued. Moreover, it would be challenging for future research studies to examine whether students could transfer observed gains in critical-thinking outcomes in lessons and/or subject-matter(s) other than the Language Arts, as well. Besides, transfer to other types of material as well as context is an important goal of critical-thinking skills based instruction (Halpern, 1998).

In another sense, it would be interesting to investigate the magnitude of the instructional effects if more experimental groups (more than one) were used along with a control group. Those experimental groups' engagement in professional development could be based on the two dominant approaches to teacher training and professional development, that is, the competency-based approach and the holistic approach (Creemers et al., 2013), apart from the integrated approach used in the development of the programme in the present study.

In addition, future research could aim to test if students of different ability levels in terms of academic achievement would benefit differently in terms of critical-thinking gains from their teachers' engagement in professional development. In that sense, it would be interesting to consider differentiation of teaching and learning as a content element of teacher professional development programme along with critical-thinking principles. Along the same line of reasoning, it would be interesting to model the one-year growth patterns of student critical-thinking performance by using latent growth curve analysis. From another point of view, future research studies could examine whether teachers who have been engaged in the professional development programme could be classified into different groups or stages of effective teaching for critical thinking structured in a developmental order, something that several studies have incorporated during the last decade (Kyriakides et al., 2009; Kyriakides et al., 2017a).

In another sense, further studies would be needed so as to test the generalisability of the present study's findings, as well as to expand the proposed theoretical framework of the teacher professional development programme in teaching for critical thinking. Such studies may reveal that in supporting teachers to improve their skills in teaching for critical thinking, other school-related factors such as the school policy regarding teaching and/or the school culture should be considered. Such results may not only contribute to the further development of the framework related to the use of the integrated approach to professional development in teaching for critical thinking, but may also help explain more widely the variation of student critical-thinking achievement.

The present study identified and empirically examined a combination of instructional qualities consistent with the teaching-for-critical-thinking goal. Those instructional qualities were included as teaching criteria in the Critical-Thinking Observation Tool, which was well-tested for its psychometric properties within the study. Future validation investigations may indicate the extent to which this set of instructional qualities examined needs to be modified. In addition, while the present study may have shed light on certain instructional parameters or qualities of teaching for critical thinking, it would be interesting to examine whether certain teaching criteria relate to, or work for the development of certain critical-thinking skills, and thus their effects may be differentiated.

From another point of view, taking into consideration that the critical-thinking skills of students may improve if there is direct deliberate instruction by teachers, who are proficient in those skills (Paul et al., 1997), it would be interesting to measure teacher participants' critical-thinking abilities and/or beliefs with regard to critical thinking in the beginning of the professional development. In that sense, those measurements could be related to the observed gains in student critical-thinking outcomes.

REFERENCES

Abrami, P. C., Bernard, R. M., Borokhovski, E., Wade, A., Surkes, M. A., Tamim, R., & Zhang, D. (2008). Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis. *Review of Educational Research*, *78*(4), 1102-1134.

Angeli, C., & Valanides, N. (2009). Instructional effects on critical thinking: Performance on ill-defined issues. *Learning and Instruction, 19*(4), 322-334.

Angeli, C., Valanides, N., & Papastephanou, M. (2011). The role of the authority of the text on critical thinking. *Interchange, 42*(3), 307-328.

Antoniou, P., & Kyriakides, L. (2011). The impact of a dynamic approach to professional development on teacher instruction and student learning: Results from an experimental study. *School Effectiveness and School Improvement, 22*(3), 291-311.

Antoniou, P., Kyriakides, L., & Creemers, B. (2011). Investigating the effectiveness of a dynamic integrated approach to teacher professional development. *CEPS Journal: Center for Educational Policy Studies Journal, 1*(1), 13-41.

Astleitner, H. (2002). Teaching critical thinking online. *Journal of Instructional Psychology, 29*(2), 53-76.

Bailin, S. (2002). Critical thinking and science education. *Science & Education, 11*(4), 361-375.

Bailin, S., Case, R., Coombs, J. R., & Daniels, L. B. (1999a). Conceptualizing critical thinking. *Journal of Curriculum Studies, 31*(3), 285-302.

Bailin, S., Case, R., Coombs, J. R., & Daniels, L. B. (1999b). Common misconceptions of critical thinking. *Journal of Curriculum Studies, 31*(3), 269-283.

Bailin, S., & Siegel, H. (2003). Critical thinking. In N. Blake, P. Smeyers, R. Smith, & P. Standish (Eds.), *The Blackwell Guide to the Philosophy of Education* (pp. 181-193). Blackwell Publishing.

Bangert-Drowns, R. L., & Bankert, E. (1990). *Meta-analysis of effects of explicit instruction for critical thinking.* Paper presented at the annual meeting of the American Educational Research Association Boston, MA. (ERIC Document Reproduction Service No. ED 328614)

Barak, M., Ben-Chaim, D., & Zoller, U. (2007). Purposely teaching for the promotion of higher-order thinking skills: A case of critical thinking. *Research in Science Education, 37*(4), 353-369.

Barnes, C. A. (2005). Critical thinking revisited: Its past, present, and future. *New Directions for Community Colleges*, *130*, 5-13.

Bean, J. C. (2011). *Engaging ideas: The professor's guide to integrating writing, critical thinking, and active learning in the classroom*. San Francisco: John Wiley & Sons.

Behar-Horenstein, L., & Niu, L. (2011). Teaching critical thinking skills in higher education: A review of the literature. *Journal of College Teaching & Learning*, *8*(2), 25-42.

Bensley, D. A., Crowe, D. S., Bernhardt, P., Buckner, C., & Allman, A. L. (2010). Teaching and assessing critical thinking skills for argument analysis in psychology. *Teaching of Psychology*, *37*(2), 91-96.

Bernard, R. M., Zhang, D., Abrami, P. C., Sicoly, F., Borokhovski, E., & Surkes, M. A. (2008). Exploring the structure of the Watson–Glaser Critical Thinking Appraisal: One scale or many subscales?. *Thinking Skills and Creativity*, *3*(1), 15-22.

Blattner, N. H., & Frazier, C. L. (2002). Developing a performance-based assessment of students' critical thinking skills. *Assessing Writing*, *8*, 47-64.

Bogdan, R. C., & Biklen, S. K. (1992). Qualitative research for education: An introduction to theory and methods. Boston: Allyn and Bacon.

Bond, T. G., & Fox, C. M. (2001). Applying the Rasch model: Fundamental measurement in the human sciences. Mahwah, NJ: Lawrence Erlbaum Associates.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101.

Brookfield, S. (2003). Critical thinking in adulthood. In D. Fasko, Jr. (Ed.), *Critical Thinking and Reasoning* (pp. 143-163). Cresskill, NJ: Hampton Press.

Brown, A. L. (1997). Transforming schools into communities of thinking and learning about serious matters. *American Psychologist*, *52*(4), 399-413.

Bruner, J. (1960). *The process of education: A landmark in educational theory*. Cambridge, MA: Harvard University Press.

Bryan, S. (2002). The colonial times: A learning environment for the 21st century. *Virginia Society for Technology in Education Journal*, *16*(2), 4-10.

Çakir, H., & Bichelmeyer, B. A. (2016). *Effects of teacher professional characteristics on student achievement: An investigation in blended learning environment with standards-based curriculum. Interactive Learning Environments 24*(1), 20–32.

Case, R. (1978). Intellectual development from birth to adulthood: A neo-Piagetian interpretation. *Children's thinking: What develops*, 37-71.

Chatzigeorgiou, Y. (2001). Knowing the Curriculum. General and specific issues of curriculum and instruction. Athens: Atrapos. (in Greek).

Cohen, L., & Manion, L. (1994). *Research Methods in Education*. London: Routledge.

Cohen, L., Manion, L., & Morrison, K. (2007). Methodology of Educational Research. Athens: Metaixmio [in Greek]

Costa, A. L. (2003). Communities for developing minds. In D. Fasko, Jr. (Ed.), *Critical Thinking and Reasoning* (pp. 47-65). Cresskill, NJ: Hampton Press.

Creemers, B., Kyriakides, L., & Antoniou, P. (2013). *Teacher professional development for improving quality of teaching*. Dordrecht, the Netherlands: Springer Science + Business Media Dordrecht.

Creemers, B. P., & Kyriakides, L. (2006). Critical analysis to current approaches to modeling educational effectiveness: The importance of establishing a dynamic model. *School Effectiveness and School Improvement, 17*(3), 347-366.

Creemers, B. P. M., & Kyriakides, L. (2008). *The dynamics of educational effectiveness: A contribution to policy, practice and theory in contemporary schools.* London: Routledge.

Creemers, B. P., Kyriakides, L., & Sammons, P. (2010). *Methodological advances in educational effectiveness research.* Routledge.

Cuban, L. (1984). Policy and research dilemmas in the teaching of reasoning: Unplanned designs. *Review of Educational Research, 54*(4), 655-681.

Daniel, M. F., Lafortune, L., Pallascio, R., Splitter, L., Slade, C., & De la Garza, T. (2005). Modeling the development process of dialogical critical thinking in pupils aged 10 to 12 years. This research project was partially supported by a grant (410-98-1228) from the Social Sciences and Humanities Research Council of Canada (SSHRC). *Communication Education, 54*(4), 334-354.

Day, C. (1999). *Developing Teachers: The Challenges of Lifelong Learning*. London: Falmer Press.

Demetriou, D., & Kyriakides, L. (2012). The impact of school self-evaluation upon student achievement: A group randomisation study. *Oxford Review of Education, 38*(2), 149-170.

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher, 38*(3), 181-199.

Dewey, J., & Bento, J. (2009). Activating children's thinking skills (ACTS): The effects of an infusion approach to teaching thinking in primary schools. *British Journal of Educational Psychology, 79*(2), 329-351.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process.* Boston: D.C. Heath and Company.

Dillon, J. T. (2009). The questions of curriculum. *Journal of Curriculum Studies, 41*(3), 343-359.

Donovan, M. S., Bransford, J. D., & Pellegrino, J. W. (1999). *How people learn: Bridging research and practice.* Washington, DC: National Academy Press.

Dwyer C. P., Hogan, M. J., & Stewart, I. (2014). An integrated critical thinking framework for the 21st century. *Thinking Skills and Creativity, 12*, 43-52.

Eisner, E. W. (1967). Educational objectives: Help or Hindrance? *The School Review, 75*(3), 250-260.

Eisner, E. W. (2000). Those who ignore the past…: 12 'easy' lessons for the next millennium. *Journal of Curriculum Studies, 32*(2), 343-357.

El Hassan, K., & Madhum, G. (2007). Validating the Watson Glaser critical thinking appraisal. *Higher Education, 54*(3), 361-383.

Elder, L. (1997). Critical thinking: The key to emotional intelligence. *Journal of Developmental Education, 21*(1), 40-41.

Elder, L., & Paul R. (2010). *Critical thinking development: A stage theory*. At website www.criticalthinking.org

Ennis, R. H. (1987). Critical thinking and the curriculum. In M. Heiman, & J. Slomianko (Eds.), *Thinking Skills Instruction: Concepts and Techniques. Building Students' Thinking Skills Series* (pp. 40-48). Washington, D.C.: National Education Association.

Ennis, R. H. (1989). Critical thinking and subject specificity: Clarification and needed research. *Educational Researcher, 18*(3), 4-10.

Ennis, R. H. (1991). Critical thinking: A streamlined conception. *Teaching Philosophy, 14*(1), 5-24.

Ennis, R. H. (1993). Critical thinking assessment. *Theory into Practice, 32*(3), 179-186.

Ennis, R. H. (1997). Incorporating critical thinking in the curriculum: An introduction to some basic issues. *Inquiry, 16*(3), 1-9.

Ennis, R. H. (2011). *Strategies and tactics for teaching critical thinking* (access online via http://faculty.education.illinois.edu/rhennis/documents/StrategiesandTacticsforTeachingCriticalThinking.pdf)

Ennis, R. H., & Weir, E. (1985). *The Ennis-Weir critical thinking essay test: Test, manual, criteria, scoring sheet. An instrument for teaching and testing*. Pacific Grove, CA: Midwest Publications.

Ericsson, K. A., & Charness, N. (1994). Expert performance: Its structure and acquisition. *American Psychologist, 49*(8), 725-747.

Facione, N. C., & Facione, P. A. (1994). The "California Critical Thinking Skills Test" and the national league for nursing accreditation requirement in critical thinking. The California Academic Press.

Facione, N. C., & Facione, P. A. (1996). Externalizing the critical thinking in knowledge development and clinical judgment. *Nursing Outlook, 44*, 129-136.

Facione, P. A. (1990a). Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. Research findings and recommendations. ERIC.

Facione, P. A. (1990b). *The California Critical Thinking Skills Test--College level. Technical Report# 1. Experimental validation and content validity*. Millbrae, CA: California Academic Press.

Facione, P. A. (1990c). *The California Critical Thinking Skills Test--College Level. Technical Report# 2. Factors predictive of CT skills*. Millbrae, CA: California Academic Press.

Facione, P. A. (2011). *Critical thinking: What it is and why it counts.* Millbrae, CA: California Academic Press.

Facione, P. A. (2000). The disposition toward critical thinking: Its character, measurement, and relationship to critical thinking skill. *lnformal Logic*, *20*(1), 61-84.

Facione, P. A., Facione, N., & Giancarlo, C. A. F. (1997). *Professional judgment and the disposition toward critical thinking*. Millbrae, CA: The California Academic Press.

Fasko, D. (2003). Critical thinking: Origins, historical development, future directions. In D. Fasko, Jr. (Ed.), *Critical Thinking and Reasoning* (pp. 3-18). Cresskill, NJ: Hampton Press.

Finken, M., & Ennis, R. H. (1993). *Illinois critical thinking essay test.* Illinois Critical Thinking Project.

Fischer, S. C., Spiker, V. A., & Riedel, S. L. (2009). *Critical thinking training for army officers. Volume Two: A model of critical thinking.* Research Report 1882. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Fisher, A. (2001). Critical thinking: An introduction. UK: Cambridge University Press.

Fisher, A., & Scriven, M. (1997). *Critical thinking: Its definition and assessment*. Point Reyes, CA: Edgepress

Flores, K. L., Matkin, G. S., Burbach, M. E., Quinn, C. E., & Harding, H. (2012). Deficient critical thinking skills among college graduates: Implications for leadership. *Educational Philosophy and Theory, 44*(2), 212-230.

Frijters, S., ten Dam, G., & Rijlaarsdam, G. (2008). Effects of dialogic learning on value-loaded critical thinking. *Learning and Instruction, 18*(1), 66-82.

Garnham, A., & Oakhill, J. (1994). *Thinking and reasoning*. Oxford, UK: Blackwell Publishers.

Garside, C. (1996). Look who's talking: A comparison of lecture and group discussion teaching strategies in developing critical-thinking skills. *Communication Education, 45*(3), 212-227.

Gatawa, B. S. (1990). *The politics of the school curriculum: An introduction*. College press.

Giancarlo, C. A., Blohm, S. W., & Urdan, T. (2004). Assessing secondary students' disposition toward critical thinking: Development of the California Measure of Mental Motivation. *Educational and Psychological Measurement, 64*(2), 347-364.

Groth-Marnat, G. (2009). Handbook of Psychological Assessment. John Wiley & Sons: New Jersey.

Gul, R. B., Khan, S., Ahmed, A., Cassum, S., Saeed, T., Parpio, Y., Profetto-McGrath, J., & Schopflocher, D. (2014). Enhancing educators' skills for promoting critical thinking in their classroom discourses: A randomized control trial. *International Journal of Teaching and Learning in Higher Education, 26*(1), 37-54.

Guskey, T. R. (2003). What makes professional development effective?. *Phi delta kappan, 84*(10), 748-750.

Halpern, D. (1989). *Thought and knowledge. An introduction to critical thinking.* Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Halpern, D. (1998). Teaching critical thinking for transfer across domains. Dispositions, skills, structure training and metacognitive monitoring. *American Psychologist, 53*(4), 449-455.

Halpern, D. F. (2001). Assessing the effectiveness of critical thinking instruction. *The Journal of General Education, 50*(4), 270-286.

Halpern, D. (2002). Teaching for critical thinking: A four-part model to enhance thinking skills. In S. F. Davis, & w. Buskist (Eds.), *The Teaching of Psychology: Essays in Honor of Wilbert J. McKeachie and Charles L. Brewer* (pp. 91-104). Mahwah, NJ: Lawrence Erlbaum.

Hansen, J. (1981). The effects of inference training and practice on young children's reading comprehension. *Reading Research Quarterly*, 391-417.

Hargreaves, D. H. (1991). Coherence and manageability: Reflections on the national curriculum and cross-curricular provision. *The Curriculum Journal, 2*(1), 33-41.

Heyman, G. D. (2008). Children's critical thinking when learning from others. *Current Directions in Psychological Science, 17*(5), 344-347.

Hiebert, J., & Grouws, D. A. (2007). The effects of classroom mathematics teaching on students' learning. *Second handbook of research on mathematics teaching and learning, 1*, 371-404.

Huang, F. L., & Moon, T. R. (2009). Is experience the best teacher? A multilevel analysis of teacher characteristics and student achievement in low performing schools. *Educational Assessment, Evaluation and Accountability, 21*(3), 209-234.

Hudgins, B. B., Riesenmy, M., Ebel, D., & Edelman, S. (1989). Children's critical thinking: A model for its analysis and two examples. *The Journal of Educational Research, 82*(6), 327-339.

Insight Assessment. (2015). *California critical thinking skills test M-Series user manual* (User manual Editor and Project Director: Dee August). San Jose, CA: California Academic Press.

Iordanou, K., & Constantinou, C. P. (2015). Supporting use of evidence in argumentation through practice in argumentation and reflection in the context of Socrates learning environment. *Science Education, 99*(2), 282-311.

Johnson, D. W., Johnson, R. T., & Smith K. (2007). The state of cooperative learning in postsecondary and professional settings. *Educational Psychology Review, 19*(1), 15-29.

Johnston, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher, 33*, 14–26.

Karagiorgi, Y., & Symeou, L. (2007). Teachers' in-service training needs in Cyprus. *European Journal of Teacher Education, 30*(2), 175-194.

Keeley, S. M., Browne, M. N., & Kreutzer, J. S. (1982). A comparison of freshmen and seniors on general and specific essay tests of critical thinking. *Research in Higher Education, 17*(2), 139-154.

Kember, D. (1997). A reconceptualisation of the research into university academics' conceptions of teaching. *Learning and instruction, 7*(3), 255-275.

Kennedy, M., Fisher, M. B., & Ennis, R. H. (1991). Critical thinking: Literature review and needed research. In L. Idol, & B. Fly Jones (Eds.), *Educational Values and Cognitive Instruction: Implications for Reform* (pp. 11-40). Hillsdale, NJ: Erlbaum.

King, A. (1995). Designing the instructional process to enhance critical thinking across curriculum. Inquiring minds really do want to know: Using questioning to teach critical thinking.

King, A. (1995). Designing the instructional process to enhance critical thinking across the curriculum. *Teaching of Psychology, 22*(1), 13-17.

Koutselini, M. (1997). Contemporary trends and perspectives of the curricula: Towards a metamodern paradigm for curriculum. *Curriculum Studies, 5*(1), 87–101.

Koutselini, M. (2006). Towards a Meta-modern Paradigm of Curriculum: Transcendence of a Mistaken Reliance on Theory. *Educational Practice and Theory, 28*(1), 55-68.

Koutselini, M. (2008a). Listening to students' voices for teaching in mixed ability classrooms: Presuppositions and considerations for differentiated instruction. *Learning and Teaching, 1*(1), 17-30.

Koutselini, M. (2008b). Participatory teacher development at schools: Processes and issues. *Action Research, 6*(1). 29-48.

Koutselini, M. (2009). Teacher Misconceptions and Understanding of Cooperative Learning: An Intervention Study. *Journal of Classroom Interaction, 43*(2), 34-44.

Koutselini, M. (2013). *Curriculum and Instruction*. Athens: Pedio (in Greek).

Koutselini, M. (2015). Empowering principals and teachers to develop participatory teacher leadership in Cyprus: Toward a meta-modern paradigm of teacher and preservice teacher development. *International Teacher Education: Promising Pedagogies (Part B), 22*, 71-87.

Ku, K. Y. (2009). Assessing students' critical thinking performance: Urging for measurements using multi-response format. *Thinking Skills and Creativity, 4*(1), 70-76.

Ku, K. Y., & Ho, I. T. (2010). Metacognitive strategies that enhance critical thinking. *Metacognition and Learning, 5*(3), 251-267.

Kuhn, D. (1991). *The skills of argument*. Cambridge University Press.

Kurfiss, J. G. (1988). *Critical thinking: Theory, research, practice, and possibilities*. ASHE-ERIC Higher Education Report No. 2. Washington, D.C: Association for the Study of Higher Education.

Kyriakides, L., Campbell, R. J., & Christofidou, E. (2002). Generating criteria for measuring teacher effectiveness through a self-evaluation approach: A complementary way of measuring teacher effectiveness. *School Effectiveness and School Improvement, 13*(3), 291-325.

Kyriakides, L., & Charalambous, C. (2004). Extending the scope of analyzing data of IEA studies: Applying multilevel modeling techniques to analyse TIMSS data. *In Proceedings of the IRC-2004 TIMSS, Vol. 1*, 69-86.

Kyriakides, L., Christoforidou, M., Panayiotou, A., & Creemers, B. P. M. (2017a). The impact of a three-year teacher professional development course on quality of teaching:

strengths and limitations of the dynamic approach. *European Journal of Teacher Education, 40*(4), 465-486.

Kyriakides, L., Creemers, B. P., & Antoniou, P. (2009). Teacher behaviour and student outcomes: Suggestions for research on teacher training and professional development. *Teaching and Teacher Education, 25*(1), 12-23.

Kyriakides, L., Georgiou, M., Creemers, B. P. M., Panayiotou, A., & Reynolds, D. (2017b). The impact of national educational policies on student achievement: A European study. *School Effectiveness and School Improvement,* 1-33

Lai, E. R. (2011). Critical thinking: A literature review. *Pearson's Research Reports, 6*, 1-49.

Lambert, L. (2003). *Leadership capacity for lasting school improvement.* Alexandra, VA: Association for Supervision and Curriculum Development (ASCD).

Lee, M., Kim H., & Kim, M. (2014): The effects of Socratic questioning on critical thinking in web-based collaborative learning. *Education as Change,* (ahead-of-print), 1-18.

Lewis, A., & Smith, D. (1993). Defining higher order thinking. *Theory into Practice, 32*(3), 131-137.

Lewis, C., Perry, R., & Murata, A. (2006). How should research contribute to instructional improvement? The case of lesson study. *Educational Researcher, 35*(3), 3-14.

Linder, S. (2011). The facilitator’s role in elementary mathematics professional development. *Mathematics Teacher Education and Development, 13*(2), 44–66.

Lipman, M. (1988). Critical thinking – What can it be? *Educational Leadership, 46*(1), 38-43.

Logan, C. (1976). Do Sociologists teach students to think more critically? *Teaching Sociology, 4*(1), 29-48.

Lomask, M. S., & Baron, J. B. (2003). What can performance-based assessment tell us about students’ reasoning? In D. Fasko, Jr. (Ed.), *Critical Thinking and Reasoning* (pp. 331-354). Cresskill, NJ: Hampton Press.

Loo, R., & Thorpe, K. (1999). A psychometric investigation of scores on the Watson-Glaser critical thinking appraisal new form S. *Educational and Psychological Measurement, 59*(6), 995-1003.

Luckey, G. M. (2003). Critical thinking in colleges and universities: A model. In D. Fasko, Jr. (Ed.), *Critical Thinking and Reasoning* (pp. 253-271). Cresskill, NJ: Hampton Press.

Magnussen, L., Ishida, D., & Itano, J. (2000). The impact of the use of inquiry-based learning as a teaching methodology on the development of critical thinking. *Journal of Nursing Education, 39*(8), 360-364.

Malamitsa, K., Kasoutas, M., & Kokkotas, P. (2009). Developing Greek primary school students' critical thinking through an approach of teaching science which incorporates aspects of history of science. *Science & Education*, *18*(3-4), 457-468.

Marin, L. M., & Halpern, D. F. (2011). Pedagogy for developing critical thinking in adolescents: Explicit instruction produces greatest gains. *Thinking Skills and Creativity*, *6*(1), 1-13.

Markovits, H. (2003). The development of thinking: Commentary. In D. Fasko, Jr. (Ed.), *Critical Thinking and Reasoning* (pp. 165-184). Cresskill, NJ: Hampton Press.

McBride, R. E., Xiang, P., & Wittenburg, D. (2002). Dispositions toward critical thinking: The preservice teachers' perspective. *Teachers and Teaching*, *8*, 29-40.

McGuinness, C. (1999). *From thinking skills to thinking classrooms*. DfEE Publications.

McKendree, J., Small, C., Stenning, K., & Conlon, T. (2002). The role of representation in teaching and learning critical thinking. *Educational Review*, *54*(1), 57-67.

McKinstery, J., & Topping, K. J. (2003). Cross-age peer tutoring of thinking skills in the high school. *Educational Psychology in Practice*, *19*(3), 199-217.

McMillan, J. H. (1987). Enhancing college students' critical thinking: A review of studies. *Research in Higher Education*, *26*(1), 3–29.

McLaughlin, M. W., & Talbert, J. E. (2006). *Building school-based teacher learning communities: Professional strategies to improve student achievement* (Vol. 45). Teachers College Press.

McPeck, J. E. (1990). Critical thinking and subject specificity: A reply to Ennis. *Educational Researcher, 19*(4), 10-12.

McTighe, J. J. (1987). Teaching for thinking, of thinking, and about thinking. In M. Heiman, & J. Slomianko (Eds.), *Thinking Skills Instruction: Concepts and Techniques* (pp. 24-30). Washington, D.C.: National Education Association.

Means, M. L., & Voss, J. F. (1996). Who reasons well? Two studies of informal reasoning among children of different grade, ability, and knowledge levels. *Cognition and Instruction*, *14*(2), 139-178.

Milner, M., & Wolfer, T. (2014). The use of decision cases to foster critical thinking in social work students. *Journal of Teaching in Social Work, 34*(3), 269–284.

Munro, J. (1999). Learning more about learning improves teacher effectiveness. *School Effectiveness and School Improvement*, *10*(2), 151–171.

New Curricula of Cyprus. (2010). Introduction. Ministry of Education and Culture. Cyprus.

New Language Arts Curriculum of Cyprus (2016). Ministry of Education and Culture. Cyprus.

Newmann, F. M. (1991). Promoting higher-order thinking in social studies: Overview of a study of sixteen high school departments. *Theory and Research in Social Education, 19*(4), 324-340.

Nickerson, R. S. (1984). Kinds of thinking taught in current programs. *Educational Leadership, 42*(1), 26-36.

Nickerson, R. S. (1988). On improving thinking through instruction. *Review of Research in Education, 15*, 3-57.

Niu, L., Behar-Horenstein, L. S., & Garvan, C. W. (2013). Do instructional interventions influence college students' critical thinking skills? A meta-analysis. *Educational Research Review, 9*, 114-128.

Noffke, S., & Somekh, B. (2005). Action Research. In B. Somekh, & C. Lewin (Eds.), *Research Methods in the Social Sciences* (pp. 89-96). London: Sage.

Onosko, J. J. (1991). Barriers to the promotion of higher-order thinking in social studies. *Theory and Research in Social Education, 19*(4), 341-366.

Papastephanou, M., & Koutselini, M. (2006) Reason, language and education: Philosophical assumptions for new curricular orientations. *Pedagogy, Culture & Society, 14*(2), 149-169.

Papastephanou, M., & Angeli, C. (2007). Critical thinking beyond skill. *Educational Philosophy and Theory, 39*(6), 604-621.

Paul, R. (1981). Teaching critical thinking in the "strong" sense: A focus on self-deception, world views, and a dialectical mode of analysis. ERIC.

Paul, R. (1992). Critical thinking: What, why and how. *New Directions for Community Colleges, 77*, 2-24.

Paul, R. (1995). *Critical thinking: How to prepare students for a rapidly changing world*. Santa Rosa, CA: Foundation for Critical Thinking.

Paul, R. (2005). The state of critical thinking today. *New directions for community colleges, 130*, 27-38.

Paul, R., Binker, A. J. A., & Weil, D. (1990). *Critical Thinking Handbook: K-3rd Grades. A Guide for Remodelling Lesson Plans in Language Arts, Social Studies & Science*. ERIC.

Paul, R., Elder, L., & Bartell, T. (1997). *California teacher preparation for instruction in critical thinking: Research findings and policy recommendations.* Sacramento, California: California Commission on Teacher Credentialing.

Phillips, C. R., Chesnut, R. J., & Rospond, R. M. (2004). The California critical thinking instruments for benchmarking, program assessment, and directing curricular change. *American Journal of Pharmaceutical Education 2004, 68*(4), 1-8.

Philips, M. L. (1988). *The design and development of the Phillips-Patterson test of inference ability in reading comprehension.* Ottawa, Ontario: Social Sciences and Humanities Research Council of Canada.

Pike, G. R., & Rocconi, L. M. (2012). Multilevel modeling: Presenting and publishing the results for internal and external constituents. *New Directions for Institutional Research, 2012*(154), 111-124.

Pithers, R. T., & Soden, R. (2000). Critical thinking in education: A review. *Educational Research, 42*(3), 237-249.

Plath, D., English, B., Connors, L., & Beveridge, A. (1999). Evaluating the outcomes of intensive critical thinking instruction for social work students. *Social Work Education, 18*(2), 207-217.

Prawat, R. S. (1991). The value of ideas: The Immersion approach to the development of thinking. *Educational Researcher*, *20*(2), 3-10.

Presseisen, B. Z. (1986). *Critical thinking and thinking skills: State of the art definitions and practice in public schools.* Philadelphia, Pennsylvania: Research for Better Schools, Inc.

Ruggiero, V. R. (2003). Neglected issues in the field of critical thinking. In D. Fasko, Jr. (Ed.), *Critical Thinking and Reasoning* (pp. 369-380). Cresskill, NJ: Hampton Press.

Sadler, T. D., & Zeidler, D. L. (2004). The significance of content knowledge for informal reasoning regarding socioscientific issues: Applying genetics knowledge to genetic engineering issues. Science *Education, 89*(1), 71-93.

Savage, L. B. (1998). Eliciting critical thinking skills through questioning. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 71*(5), 291-293.

Scriven, M., & Paul, R. (1987). *Critical thinking as defined by the National Council for Excellence in Critical Thinking*. Retrieved from http://www.criticalthinking.org/pages/defining-critical-thinking/766

Seligman, M. E. (2002). Positive psychology, positive prevention, and positive therapy. *Handbook of positive psychology, 2*(2002), 3-12.

Shim, W. J., & Walczak, K. (2012). The impact of faculty teaching practices on the development of students' critical thinking skills. *International Journal of Teaching and Learning in Higher Education, 24*(1), 16-30.

Siegel, H. (1985). Educating reason: Critical thinking, informal logic, and the philosophy of education. Part two: Philosophical questions underlying education for critical thinking. *Informal Logic, 2*(2-3), 69-81.

Simpson, R. E, & Courtney, R. M. (2002). Critical thinking in nursing education: Literature review. *International journal of nursing practice, 8*(2), 89-98.

Staib, S. (2003). Teaching and measuring critical thinking. *Journal of Nursing Education, 42*(11), 498–508.

Stapleton, P. (2011). A survey of attitudes towards critical thinking among Hong Kong secondary school teachers: Implications for policy change. *Thinking Skills and Creativity, 6*(1), 14-23.

Sternberg, R. J. (1986). Critical thinking: Its nature, measurement, and improvement. ERIC.

Sternberg, R. J. (1987). Teaching critical thinking: Eight easy ways to fail before you begin. *Phi Delta Kappan, 68*(6), 456-459.

Sternberg, R. J., & Bhana, K. (1986). Synthesis of research on the effectiveness of intellectual skills programs: Snake-oil remedies or miracle cures? *Educational Leadership, 44*(2), 60-67.

Supovitz, J., & Turner, H. (2000).The effects of professional development on science teaching practices and classroom culture. *Journal of Research in Science Teaching, 37*(9), 963-980.

Swartz, R. (2003). Infusing critical and creative thinking into instruction in high school classrooms. In D. Fasko, Jr. (Ed.), *Critical Thinking and Reasoning* (pp. 207-251). Cresskill, NJ: Hampton Press.

Swartz, R. J., & Parks, S. (1994). *Infusing the teaching of critical and creative thinking into content instruction: A lesson design handbook for the elementary grades.* California: Critical Thinking Press and Software.

Taube, T. K. (1995). *Critical thinking ability and disposition as factors of performance on a written critical thinking test.* Paper presented at the Annual Meeting of the American Educational Research Association San Francisco, CA.

ten Dam, G., & Volman, M. (2004). Critical thinking as a citizenship competence: Teaching strategies. *Learning and Instruction, 14*, 359-379.

Tiruneh, D. T., Verburgh, A., & Elen, J. (2014). Effectiveness of critical thinking instruction in higher education: A systematic review of intervention studies. *Higher Education Studies, 4*(1), 1-17.

Todd, G., & Freshwater, D. (1999). Reflective practice and guided discovery: Clinical supervision. *British Journal of Nursing, 8*(20), 1383-1389.

Torff, B. (2003). Developmental changes in teachers' use of higher order thinking and content knowledge. *Journal of Educational Psychology, 95*(3), 563.

Torff, B. (2005). Developmental changes in teachers’ beliefs about critical-thinking activities. *Journal of Educational Psychology, 97*(1), 13–22.

Torff, B. (2006). Expert teachers' beliefs about use of critical-thinking activities with high- and low-advantage learners. *Teacher Education Quarterly*, 37-52.

Torff, B., & Warburton, E. C. (2005). Assessment of teachers' beliefs about classroom use of critical-thinking activities. *Educational and Psychological Measurement, 65*(1), 155-179.

Tsui, L. (2001). Faculty attitudes and the development of students' critical thinking. *The Journal of General Education, 50*(1), 1-28.

Tsui, L. (2002). Fostering critical thinking through effective pedagogy: Evidence from four institutional case studies. *The Journal of Higher Education, 73*(6), 740-763.

Tyler, R. W. (1949). Basic principles of curriculum design. *The University of Chicago Press, Chicago, 150*, 6.

Valanides, N., & Angeli, C. (2005). Effects of instruction on changes in epistemological beliefs. *Contemporary Educational Psychology, 30*(3), 314-330.

Van Gelder, T. (2005). Teaching critical thinking: Some lessons from cognitive science. *College Teaching, 53*(1), 41-46.

Vassiliades, Y., & Koutselini, M. (2014). Development of students’ reasoning and critical thinking skills through argument mapping using Rationale™ software. *Computers in the Schools*.

Venville, G. J., & Dawson, V. M. (2010). The impact of a classroom intervention on grade 10 students’ argumentation skills, informal reasoning, and conceptual understanding of science. *Journal of Research in Science Teaching, 47*(8), 952-977.

von Aufschnaiter, C., Erduran, S., Osborne, J., & Simon S. (2008). Arguing to learn and learning to argue: Case studies of how students’ argumentation relates to their scientific knowledge. *Journal of Research in Science Teaching, 45*(1), 101–131.

Voss, J. F., Perkins, D. N., & Segal, J. W. (Eds.). (2009). *Informal reasoning and education*. Routledge.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

Waghid, Y., & Davids, N. (2013). Rethinking citizenship education as a pedagogical encounter. On becoming an equal, intelligible, amateur citizen. In Y. Waghid, & N. Davids (Eds.), *Citizenship, Education and Violence. On Disrupted Potentialities and Becoming* (pp. 9-19). Rotterdam: Sense Publishers.

Wang, W. C., & Cheng, Y. Y. (2001). Measurement issues in screening outstanding teachers. *Journal of Applied Measurement, 2*(2), 171–186.

Watson, G., & Glaser, E. (1980). *Critical thinking appraisal manual.* New York: Harcourt Brace Jovanovich.

Willingham, D. T. (2007). Critical thinking: Why is it so hard to teach? *American Educator*, 8-19.

Wolcott, S. K., Baril, C. P., Cunningham, B. M., Fordham, D. R., & Pierre, K. S. (2002). Critical thought on critical thinking research. *Journal of Accounting Education, 20*(2), 85-103.

Wood, D., & Wood, H. (1996). Vygotsky, tutoring and learning. *Oxford Review of Education, 22*(1), 5-16.

Yang, Y. T. C. (2008). A catalyst for teaching critical thinking in a large university class in Taiwan: Asynchronous online discussions with the facilitation of teaching assistants. *Educational Technology Research and Development*, *56*(3), 241-264.

Yeh, S. S. (2001). Tests worth teaching to: Constructing state-mandated tests that emphasize critical thinking. *Educational Researcher, 30*(9), 12-17.

Zohar, A., & Nemet, Fl. (2002). Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *Journal of Research in Science Teaching, 39*(1), 35-62.

Zohar, A., Weinberger, Y., & Tamir, P. (1994). The effect of the Biology critical thinking project on the development of critical thinking. *Journal of Research in Science Teaching, 31*(2), 183-196.

Zoller, U. (1999). Teaching tomorrow's college science courses – Are we getting it right? *Journal of College Science Teaching, 29*(6), 409–414.

Zygmont, D. M., & Schaefer, K. M. (2006). Assessing the critical thinking skills of faculty: what do the findings mean for nursing education? *Nursing Education Perspectives, 27*(5), 260-268.

APPENDICES

Appendix A

The Student Critical-Thinking Instrument

– Δοκίμιο Αξιολόγησης Δεξιοτήτων Κριτικής Σκέψης –

Για τον/τη Μαθητή/Μαθήτρια

Πανεπιστήμιο Κύπρου
Τμήμα Επιστημών της Αγωγής

Κωδικός:

Αγαπητέ/ή μαθητή/τρια,

Το δοκίμιο αυτό δεν είναι διαγώνισμα γνώσεων. Πρόκειται για ένα δοκίμιο που μελετά τον τρόπο σκέψης σου αλλά και την ικανότητά σου να κατανοήσεις, να αναλύσεις και να αξιολογήσεις κριτικά αυτό που διαβάζεις, ώστε να βγάλεις κάποια συμπεράσματα.

ΟΔΗΓΙΕΣ ΣΥΜΠΛΗΡΩΣΗΣ

1. Θα διαβάσεις το κείμενο και θα απαντήσεις σε ΟΛΕΣ τις ερωτήσεις.
2. Διάβασε προσεκτικά κάθε ερώτηση και βεβαιώσου ότι κατάλαβες τι χρειάζεται να κάνεις πριν αρχίσεις να γράφεις. Αν έχεις απορία, ρώτα πριν ξεκινήσεις.
3. Στο Μέρος Α θα χρησιμοποιήσεις πληροφορίες από το κείμενο για να απαντήσεις τις ερωτήσεις. Στο Μέρος Β μπορείς να χρησιμοποιήσεις πληροφορίες που μπορεί να γνωρίζεις για το θέμα αφού το κείμενο δεν δίνει άμεσα απαντήσεις σε όλες τις ερωτήσεις.
4. **Γράψε ό,τι νομίζεις έστω κι αν δεν είσαι σίγουρος/η ότι είναι σωστό**. Εκείνο που έχει σημασία είναι να εκφράσεις τη σκέψη σου, αφού δεν υπάρχουν σωστές ή λανθασμένες απαντήσεις. Επειδή όλοι μας σκεφτόμαστε διαφορετικά, ο καθένας θα επιλέξει ή θα γράψει την καλύτερη δυνατή απάντηση.

Πολύτιμοι φίλοι του ανθρώπου

Σκύλος, ένας αληθινός φίλος

Αναμφίβολα, ο σκύλος αποτελούσε πάντα έναν πολύ πιστό φίλο για τον άνθρωπο. Πολλές φορές μπορεί να άκουσες πως ο σκύλος είναι ο καλύτερός φίλος ενός παιδιού αλλά και ενός μεγάλου. Είναι πάντα κοντά σου, δεν ζητά αντάλλαγμα και του αρκεί να του δίνεις σημασία.

Υπάρχουν πολλά παραδείγματα που αποδεικνύουν την αφοσίωση του σκύλου στον άνθρωπο. Είναι γνωστός από την ελληνική μυθολογία ο Άργος, ο πιστός σκύλος του Οδυσσέα. Ο Οδυσσέας έλειπε δέκα ολόκληρα χρόνια από την πατρίδα του, την Ιθάκη. Για χρόνια πολεμούσε στην Τροία και περιπλανιόταν σε θάλασσες και νησιά μέχρι να επιστρέψει. Και επέστρεψε μεταμφιεσμένος σε ζητιάνο. Παρ' όλα αυτά ο Άργος αναγνώρισε τον κύριό του. Τι κι αν πέρασαν τόσα πολλά χρόνια; Αμέσως μετά, ο Άργος πέθανε, αφού αξιώθηκε να ξαναδεί τον αφέντη του!

Δεν είναι τυχαίο που όσοι έχουμε σκύλο λέμε πως είναι ο καλύτερος μας φίλος, ο πιο πιστός. Και γιατί παρακαλώ; Η απάντηση είναι πολύ απλή! Από τη μέρα που γεννιέσαι οι σκύλοι είναι εκεί για σένα είτε είσαι πλούσιος είτε είσαι φτωχός. Και σου δίνουν ένα χεράκι αν το χρειάζεσαι … Και μένουν δίπλα σου στις δύσκολες στιγμές … Επίσης, θα σε τραβήξουν σε ασφαλές σημείο, αν χρειαστεί … Και θα είναι τα μάτια σου, όταν δεν μπορείς να δεις … Επιπλέον, σου φτιάχνουν τη διάθεση και σε κάνουν να νιώθεις καλύτερα … Μπορούν να σε κάνουν ευτυχισμένο! Με το παιχνίδι και τις σκανταλιές τους δεν σε κάνουν ποτέ να βαριέσαι και σου χαρίζουν απλόχερα την αγάπη τους. Και το μόνο που ζητούν είναι να φροντίζεις για τις ανάγκες τους (φαγητό, βόλτα, εκπαίδευση) και να μην τους παραμελείς. Χρειάζονται αγάπη και φροντίδα, όπως όλοι μας.

Παρ' όλα αυτά, δεν μπορούν όλοι οι άνθρωποι να συνδεθούν φιλικά με τα ζώα. Υπάρχουν άτομα που θεωρούν ότι ένας σκύλος δεν μπορεί να σου προσφέρει την αγάπη, την πίστη και την αφοσίωση που θα μπορούσε να σου προσφέρει ένας πολύ καλός φίλος. Έρευνες που έχουν γίνει επιβεβαιώνουν τον ισχυρισμό σημειώνοντας κιόλας ότι δεν μπορούν όλοι οι άνθρωποι να πάρουν έναν σκύλο στο σπίτι και να συνδεθούν μαζί του, ιδιαίτερα εκείνοι που δουλεύουν όλη μέρα.

Αν, όμως, αναζητάς πραγματική αγάπη και στοργή από τη συντροφιά ενός σκύλου, να ξέρεις ότι η αφοσίωση ενός σκύλου κρατάει για πάντα. Οι σκύλοι θα σου είναι για πάντα πιστοί, οι καλύτεροι φίλοι!

(Πηγή: Μηνιαίο παιδικό περιοδικό Παιδική Χαρά, τόμος 52, τεύχος 6(409), Μάρτιος 2013, Επιμέλεια: Γιώργος Γεωργίου, Διασκευή)

<u>ΜΕΡΟΣ Α</u>

1) Ποιο είναι το <u>βασικό συμπέρασμα</u> του συγγραφέα στο άρθρο;

....

....

....

2) Ο συγγραφέας αναφέρει διάφορους λόγους για να μας πείσει ότι ο σκύλος είναι ένας πολύ πιστός φίλος για τον άνθρωπο. <u>Βρες και γράψε 2 λόγους από το άρθρο</u>.

....

....

....

....

3) <u>Ποια πληροφορία</u> που αναφέρει ο συγγραφέας στο άρθρο του <u>σε έπεισε πιο πολύ</u>; <u>Δικαιολόγησε την απάντησή σου</u>.

....

....

....

....

4) <u>Ποιο παράδειγμα</u> αναφέρεται στο άρθρο για να μας πείσει ότι ο σκύλος είναι ένας πολύ πιστός φίλος του ανθρώπου;

....

....

....

....

....

5) Ο συγγραφέας λέει το εξής για τους σκύλους: «Σου δίνουν ένα χεράκι αν το χρειάζεσαι…». Να δώσεις ένα <u>δικό σου παράδειγμα</u> για να εξηγήσεις τι εννοεί.

....

....

....

....

6) <u>Κάποιοι διαφωνούν</u> ότι ο σκύλος είναι ένας πιστός φίλος για τον άνθρωπο και χρησιμοποιούν διάφορα επιχειρήματα για να μας πείσουν. <u>Εντόπισε και γράψε 1 δικό τους επιχείρημα</u> από το άρθρο.

………

………

………

………

7) Ο συγγραφέας λέει για τον σκύλο «Είναι πάντα κοντά σου, δεν ζητά αντάλλαγμα και του αρκεί να του δίνεις σημασία». <u>Τι εννοεί</u>;

α) Ότι ο σκύλος δεν χρειάζεται φαγητό και βόλτα.

β) Ότι ο σκύλος χρειάζεται να παίζεις μαζί του πού και πού για να νιώθει ότι τον αγαπάς.

γ) Ότι ο σκύλος χρειάζεται σημασία ως αντάλλαγμα.

δ) Ότι ο σκύλος δεν χρειάζεται δώρα και παιχνίδια για να σε αγαπά.

8) Ο συγγραφέας λέει για τους σκύλους: «Μένουν δίπλα σου στις δύσκολες στιγμές…..». Πώς θα συνέχιζες την πρόταση <u>για να εξηγήσεις τι εννοεί</u>;

α) όπως, όταν, για παράδειγμα, βλέπεις τηλεόραση.

β) όπως, όταν, για παράδειγμα, είσαι άρρωστος στο σπίτι και θέλεις συντροφιά.

γ) όπως, όταν, για παράδειγμα, έχεις διάφορες δυσκολίες στη ζωή σου.

δ) όπως, όταν, για παράδειγμα, είσαι μόνος, βαριέσαι και δεν ξέρεις τι να κάνεις.

9) Με βάση το άρθρο, σε <u>ποιο συμπέρασμα καταλήγεις</u> για τη σχέση του συγγραφέα με τους σκύλους;

α) Ο συγγραφέας αγαπά πολύ τους σκύλους και τους θεωρεί καλούς φίλους.

β) Στον συγγραφέα αρέσουν τα παραδείγματα πιστών σκύλων από την ελληνική μυθολογία.

γ) Δεν μπορώ να ξέρω τι σχέση μπορεί να έχει ο συγγραφέας με τους σκύλους.

δ) Ο συγγραφέας έχει σκύλο που αγαπά πολύ και θεωρεί ότι είναι ο καλύτερος του φίλος.

10) <u>Πώς αξιολογείς</u> τη σκέψη του συγγραφέα στο άρθρο;

α) Πλούσια. Ο συγγραφέας εξηγεί πολύ ξεκάθαρα γιατί ο σκύλος είναι ένας πιστός φίλος για τον άνθρωπο, δίνει αρκετά παραδείγματα και δείχνει ότι τα επιχειρήματα κάποιων με διαφορετική άποψη δεν είναι πειστικά.

β) Πολύ καλή. Ο συγγραφέας εξηγεί γιατί ο σκύλος είναι ένας καλός και πιστός φίλος του ανθρώπου δίνοντας και παράδειγμα ενώ αναφέρει και επιχειρήματα ατόμων με διαφορετική άποψη.

γ) Αρκετά καλή. Ο συγγραφέας λέει με ξεκάθαρο τρόπο ότι ο σκύλος είναι ο πιο καλός και πιστός φίλος του ανθρώπου και αναφέρει διάφορους λόγους.
δ) Φτωχή. Ο συγγραφέας δεν αναφέρει αρκετά παραδείγματα για να εξηγήσει τους λόγους που ο σκύλος είναι ένας καλός και πιστός φίλος του ανθρώπου.

11) Βάλε σε κύκλο ένα επιχείρημα που ΔΕΝ ανέφερε ο συγγραφέας στο άρθρο και θεωρείς ότι είναι <u>το ΠΙΟ ΠΕΙΣΤΙΚΟ</u> από τα ακόλουθα.

α) Ένας σκύλος μπορεί να αποδειχτεί απαραίτητος και πολύτιμος και να είναι ο πιο πιστός και καλός φίλος του ανθρώπου, αφού έρευνες δείχνουν ότι τα σκυλιά μπορούν να γίνουν πολύ καλοί προστάτες.
β) Με έναν σκύλο ο άνθρωπος είναι πάντα χαρούμενος και χαμογελά, γι' αυτό κι ο σκύλος μπορεί να είναι ένας πιστός και καλός φίλος.
γ) Ένας σκύλος μπορεί να γίνει ο καλός και πιστός σου φίλος, γιατί όταν αγαπάς τα σκυλιά και τα ζώα και δεν τα φοβάσαι, κι αυτά σε αγαπούν.
δ) Ένας σκύλος μπορεί να ρισκάρει τη ζωή του για την ασφάλειά σου, όπως όταν χρειαστεί να κυνηγήσει κάποιον που προσπαθεί να σε κλέψει, γι' αυτό και είναι ένας πιστός και καλός φίλος.

12) Διαβάζεις στο άρθρο τον ακόλουθο ισχυρισμό: «Τα σκυλιά μπορούν να σε κάνουν ευτυχισμένο». <u>Συμφωνείς ή διαφωνείς</u>; Γράψε <u>2 λόγους</u> που να δικαιολογούν την απάντησή σου.

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13) <u>Πόσο καλά</u> νομίζεις ότι μπόρεσες να αναπτύξεις τη σκέψη σου στην προηγούμενη ερώτηση;

α) Η σκέψη μου δεν είναι ολοκληρωμένη. Έγραψα μόνο τη γνώμη μου και δεν χρησιμοποίησα καθόλου λόγους και επιχειρήματα για να εξηγήσω αν συμφωνώ ή διαφωνώ με τον ισχυρισμό.
β) Η σκέψη μου δεν είναι πολύ ολοκληρωμένη. Έγραψα τη γνώμη μου και για να τη δικαιολογήσω χρησιμοποίησα έναν ή δύο λόγους, όχι πολύ πειστικούς.
γ) Η σκέψη μου είναι αρκετά ολοκληρωμένη. Έγραψα τη γνώμη μου χρησιμοποιώντας δύο αρκετά πειστικούς λόγους για να εξηγήσω αν συμφωνώ ή διαφωνώ με τον ισχυρισμό.

δ) Η σκέψη μου είναι πολύ ολοκληρωμένη. Έγραψα τη γνώμη μου χρησιμοποιώντας δύο πειστικούς λόγους για να εξηγήσω αν συμφωνώ ή διαφωνώ με τον ισχυρισμό. Έδωσα και παράδειγμα και κατέληξα σε συμπέρασμα.

ΜΕΡΟΣ Β

14) Πρόσφατα έγινε έρευνα για τους σκύλους και τα ηλικιωμένα άτομα σε ένα γηροκομείο. Στην έρευνα 40 ηλικιωμένοι απάντησαν σε ένα Ερωτηματολόγιο που μετρούσε το πόσο ευτυχισμένοι νιώθουν. Η έρευνα έδωσε τις εξής πληροφορίες: α) 25 από τους 40 ηλικιωμένους έκαναν παρέα με τον σκύλο του γηροκομείου μέσα στην εβδομάδα, και β) 25 από τους 40 ηλικιωμένους είχαν καλύτερα αποτελέσματα στο Ερωτηματολόγιο.
Αν υποθέσουμε ότι οι 25 ηλικιωμένοι που έκαναν παρέα με τον σκύλο του γηροκομείου ήταν αυτοί που είχαν καλύτερα αποτελέσματα στο Ερωτηματολόγιο, σε ποιο συμπέρασμα καταλήγεις;

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15) Μετά από εξέταση της φίλης σου από γιατρό, οι γονείς της αποφασίζουν να δώσουν τον σκύλο τους σε άλλη οικογένεια. Η φίλη σου κλαίει και δεν θέλει να τον αποχωριστεί. Μετά από συζήτηση αποφασίζουν να κρατήσουν τον σκύλο αλλά με ΟΡΟΥΣ: α) η φίλη σου να μην κοιμάται με τον σκύλο στο δωμάτιό της και β) ο σκύλος να κοιμάται σε ένα σπιτάκι στην αυλή. Κατά τη γνώμη σου, τι είναι πιο πιθανό να έχει συμβεί και έχουν βάλει αυτούς τους όρους; Εξήγησε.

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16) Σου δίνουν τέσσερα κείμενα και διαβάζεις μόνο τους ΤΙΤΛΟΥΣ. Βάλε σε κύκλο τον τίτλο του κειμένου που νομίζεις ότι θα βρεις <u>τις πιο σχετικές πληροφορίες για να πείσεις τους γονείς σου να σου πάρουν σκύλο</u>.

α) «4 Λόγοι για να είμαστε φιλόζωοι»

β) «Πόσο συχνά μιλάς στον σκύλο σου;»

γ) «Διαλέγοντας κατοικίδιο: Γάτα, σκύλο ή ενυδρείο;»

δ) «Μαξ (1994-2006): Ένας διάσημος σκύλος»

17) <u>Τι είδους πληροφορίες νομίζεις ότι θα βρεις στο κείμενο που διάλεξες;</u> <u>Εξήγησε γιατί υποθέτεις</u> ότι θα βρεις αυτές τις πληροφορίες.

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18) Όλοι μας, όταν είμαστε λυπημένοι, χρειαζόμαστε κάτι ή κάποιον για να μας κάνει να νιώσουμε καλύτερα. Στο κείμενο λέει ότι ένας σκύλος σε κάνει να νιώθεις καλύτερα. *Επομένως, όταν κάποιος είναι λυπημένος, ένας σκύλος πάντα τον κάνει να νιώθει καλύτερα*. <u>ΠΟΣΟ ΛΟΓΙΚΟ κρίνεις ότι είναι αυτό το συμπέρασμα;</u>

α) Απόλυτα λογικό. Ισχύει πάντα, σε κάθε περίπτωση. Όποτε είμαστε λυπημένοι, ένας σκύλος μας κάνει να νιώθουμε καλύτερα.

β) Αρκετά λογικό. Ισχύει ιδιαίτερα για τα άτομα που έχουν σκύλο για κατοικίδιο.

γ) Όχι πολύ λογικό. Μπορεί να ισχύει για κάποιους ανθρώπους, μερικές φορές. Αλλά, εξαρτάται και από τη σχέση που έχεις με τον σκύλο και από το πόσο λυπημένος είσαι.

δ) Λίγο λογικό. Δεν ισχύει για όλους. Εξαρτάται από το πόσο λυπημένος είσαι.

19) Ένας φίλος σου ζητά από τους γονείς του να του πάρουν σκύλο για να παίζει στον ελεύθερό του χρόνο. Οι γονείς του βρίσκουν συνεχώς δικαιολογίες για να τον πείσουν ότι ο σκύλος είναι μπελάς κι έχει πολλές ευθύνες. <u>Ανάπτυξε τη σκέψη σου πιο κάτω χρησιμοποιώντας τουλάχιστον τρία (3) πειστικά επιχειρήματα, για να πείσεις τους γονείς του φίλου σου να του πάρουν σκύλο</u>.

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<u>ΟΙ 2 ΠΙΟ ΚΑΤΩ ΕΡΩΤΗΣΕΙΣ ΑΦΟΡΟΥΝ ΤΗΝ ΑΠΑΝΤΗΣΗ ΣΟΥ ΣΤΗΝ ΕΡΩΤΗΣΗ 19 ΜΟΝΟ</u>

20) <u>Πόσο καλά</u> νομίζεις ότι μπόρεσες να αναπτύξεις τη σκέψη σου στην προηγούμενη ερώτηση για να πείσεις τους γονείς του φίλου σου να του πάρουν σκύλο;

α) Η σκέψη μου δεν είναι ολοκληρωμένη. Έγραψα μόνο τη γνώμη μου και δεν χρησιμοποίησα καθόλου λόγους και επιχειρήματα για να πείσω τους γονείς του φίλου μου να του πάρουν σκύλο.

β) Η σκέψη μου δεν είναι πολύ ολοκληρωμένη. Έγραψα τη γνώμη μου και για να τη δικαιολογήσω χρησιμοποίησα έναν ή δύο λόγους, όχι πολύ πειστικούς, ή αντέγραψα λόγους από το άρθρο.

γ) Η σκέψη μου είναι αρκετά ολοκληρωμένη. Έγραψα τη γνώμη μου χρησιμοποιώντας δύο ή τρεις αρκετά πειστικούς λόγους για να πείσω τους γονείς του φίλου μου να του πάρουν σκύλο.

δ) Η σκέψη μου είναι πολύ ολοκληρωμένη. Έγραψα τη γνώμη μου χρησιμοποιώντας τρεις ή τέσσερις πειστικούς λόγους για να πείσω τους γονείς του φίλου μου να του πάρουν σκύλο. Έδωσα και παράδειγμα και κατέληξα σε συμπέρασμα.

21) Τι θα ήθελες να διορθώσεις στο αποτέλεσμα της σκέψης σου <u>στην ερώτηση 17</u>;

<u>ΓΙΑ ΤΗ ΔΙΟΡΘΩΣΗ ΤΗΣ ΑΠΑΝΤΗΣΗΣ ΣΟΥ, ΣΚΕΨΟΥ ΤΑ ΑΚΟΛΟΥΘΑ:</u>

Α) Ποιος ήταν ο σκοπός σου;

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Β) Πέτυχες τον σκοπό σου; ΝΑΙ ………… ΟΧΙ ………. (σημείωσε με √)

Γ) Τι σου άρεσε περισσότερο απ' όσα έγραψες; (υπογράμμισε με πράσινο)

Δ) Τι θα μπορούσες να είχες γράψει καλύτερα; (υπογράμμισε με κόκκινο)

Ε) Πώς θα μπορούσες να το διορθώσεις τώρα; (συμπλήρωσε ή διόρθωσε από πάνω με στυλό)

Στ) Τι θα μπορούσες να είχες γράψει ακόμα; (συμπλήρωσε ανάλογα)

<u>Σημείωση</u>: Αν δεν θες να διορθώσεις κάτι ή να συμπληρώσεις κάτι (Ε και Στ σημεία), εξήγησε πιο κάτω γιατί δεν θες.

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Appendix B

The Student Reasoning Essay

ΠΑΙΡΝΟΝΤΑΣ ΜΙΑ ΣΩΣΤΗ ΑΠΟΦΑΣΗ

Πανεπιστήμιο Κύπρου
Τμήμα Επιστημών της Αγωγής

Κωδικός:

Ο αγώνας μπάσκετ μεταξύ δύο τάξεων του σχολείου διακόπηκε, γιατί μια ομάδα μαθητών/μαθητριών έκανε φασαρία κι έριξε πέτρες στο γήπεδο. Αυτό είχε ως αποτέλεσμα να τραυματιστούν πέντε μαθητές. Οι δάσκαλοι των δύο τάξεων έπρεπε να αποφασίσουν με ποιον τρόπο θα παραδειγμάτιζαν τους μαθητές για να καταλάβουν το λάθος τους.

1. Ο ένας δάσκαλος πρότεινε να απαγορεύσουν τα παιχνίδια με μπάλες σε όλους τους μαθητές των δύο τάξεων για έναν μήνα. Υποστήριξε την άποψη του λέγοντας ότι μόνο όταν στερήσουμε από τους μαθητές κάτι που αγαπούν, θα μάθουν να είναι υπεύθυνοι για τις πράξεις τους και να μην το ξανακάνουν. Τόνισε ότι πρέπει να είναι σταθεροί στην απόφασή τους και να μην υποχωρήσουν αν οι μαθητές είναι φρόνιμοι τις επόμενες μέρες.

2. Ο άλλος δάσκαλος εισηγήθηκε να κάνουν έρευνα, ώστε να βρουν ποιοι ήταν οι υπεύθυνοι της διακοπής του αγώνα και να μάθουν γιατί προκάλεσαν τη φασαρία. Υποστήριξε ότι πρέπει να στερήσουν μόνο σε αυτούς τα παιχνίδια με μπάλες για έναν μήνα. Αν δεν τους βρουν, θα πρέπει να σκεφτούν άλλη λύση.

3. Ένας τρίτος δάσκαλος είχε διαφορετική άποψη για το θέμα λέγοντας ότι το θέμα της τιμωρίας δεν «πιάνει» πάντα. Έδωσε, μάλιστα, στους δασκάλους των δύο τάξεων να διαβάσουν το πιο κάτω άρθρο για να σκεφτούν άλλες λύσεις που θα μπορούσαν να εφαρμόσουν για να καταλάβουν οι μαθητές το λάθος τους.

Σχολείο αντί για «τιμωρία» βάζει τα παιδιά να κάνουν «διαλογισμό»

Φανταστείτε να είστε σε ένα σχολείο και κάποια παιδιά κάνουν φασαρία στο μάθημα ή στην αυλή όταν παίζουν! Τι γίνεται συνήθως; Παραδοσιακά η απάντηση είναι η τιμωρία.

Οι περισσότεροι όταν ακούμε τη λέξη «τιμωρία» σκεφτόμαστε το γραφείο του διευθυντή, έναν κενό τοίχο ή ένα άδειο θρανίο μακριά από τους συμμαθητές μας. Ο στόχος της «τιμωρίας» είναι να μας κάνει να σκεφτούμε το λάθος μας, αλλά τις περισσότερες φορές αυτή η τακτική δεν «πιάνει». Το μόνο που σκεφτόμαστε είναι το πότε θα περάσει η ώρα του σχολείου ή ότι είναι άδικη η τιμωρία.

Αλλά το δημοτικό σχολείο Robert W. Coleman στη Βαλτιμόρη της Αμερικής έχει κάνει κάτι διαφορετικό όταν οι μαθητές κάνουν φασαρία ή ενοχλούν. Αντί να τιμωρούνται τα ατίθασα παιδιά με το να τα στέλνουν στο γραφείο του διευθυντή ή να τους στερούν διάφορα πράγματα, τα στέλνουν στο δωμάτιο του Διαλογισμού. Τα παιδιά που δεν συμπεριφέρονται σωστά, ενθαρρύνονται να καθίσουν στο δωμάτιο και να κάνουν ασκήσεις αναπνοής και διαλογισμού, για να ηρεμήσουν. Επίσης, οι δάσκαλοι τους ζητούν να μιλήσουν για αυτό που συνέβη και για τον λόγο που βρίσκονται εκεί, ώστε να καταλάβουν το λάθος τους.

(Από το Mother's blog, 3/10/2016, διασκευή)

ΕΡΩΤΗΜΑΤΑ

Α) Εσύ ποια από τις τρεις εισηγήσεις επιλέγεις και γιατί;
Β) Γιατί ΔΕΝ επιλέγεις τις άλλες δύο εισηγήσεις;
Γ) Υπάρχει κάποια άλλη λύση που μπορείς να προτείνεις; Εξήγησε γιατί τη θεωρείς καλύτερη.

Appendix C

The Student Demographics' Questionnaire

– Ερωτηματολόγιο για τον/τη Μαθητή/Μαθήτρια –

Πανεπιστήμιο Κύπρου
Τμήμα Επιστημών της Αγωγής

Κωδικός: ☐

Αγαπητέ/ή μαθητή/τρια,

Αρχικά, σε ευχαριστούμε για τη συμμετοχή σου στην έρευνα. Στα πλαίσια της έρευνας, θα θέλαμε κάποιες πληροφορίες που θα μας βοηθούσαν να έχουμε πιο ξεκάθαρα αποτελέσματα. Οι πληροφορίες αυτές είναι ανώνυμες και δεν έχουν καμία σχέση με την απόδοσή σου στο σχολείο. Γι' αυτό, σε παρακαλούμε, να απαντήσεις ελεύθερα.

ΟΔΗΓΙΕΣ ΣΥΜΠΛΗΡΩΣΗΣ

1. Πρώτα συμπλήρωσε τα στοιχεία σου.
2. Σε κάθε ερώτηση βάλε σε κύκλο έναν αριθμό που να ισχύει για εσένα και τους γονείς σου.
3. Απάντησε σε ΟΛΕΣ τις ερωτήσεις.

Φύλο: Αγόρι ☐ Κορίτσι ☐ Τάξη: ………… Σχολείο: ………………………………………

Χρόνια διαμονής στην Κύπρο: ………….. *(αν γεννήθηκες στην Κύπρο, βάλε την ηλικία σου)*

Μητρική Γλώσσα Μητέρας: ……………… *(ποια γλώσσα μιλούν στη χώρα που γεννήθηκε η μητέρα σου)*

Μητρική Γλώσσα Πατέρα: ……………… *(ποια γλώσσα μιλούν στη χώρα που γεννήθηκε ο πατέρας σου)*

1	Ο πατέρας μου έχει πάρει Απολυτήριο Δημοτικού	1
	Ο πατέρας μου έχει πάρει Απολυτήριο Μέσης Εκπαίδευσης (Λύκειο – Τεχνική Σχολή)	2
	Ο πατέρας μου έχει πάρει πτυχίο Πανεπιστημίου	3
	Ο πατέρας μου έχει πάρει πτυχίο Μεταπτυχιακό Δίπλωμα	4
	Ο πατέρας μου έχει πάρει Διδακτορικό Δίπλωμα	5
2	Η μητέρα μου έχει πάρει Απολυτήριο Δημοτικού	1
	Η μητέρα μου έχει πάρει Απολυτήριο Μέσης Εκπαίδευσης (Λύκειο – Τεχνική Σχολή)	2
	Η μητέρα μου έχει πάρει πτυχίο Πανεπιστημίου	3
	Η μητέρα μου έχει πάρει πτυχίο Μεταπτυχιακό Δίπλωμα	4
	Η μητέρα μου έχει πάρει Διδακτορικό Δίπλωμα	5

3	**Εργάζεται ο πατέρας σου;**	
	ΝΑΙ	1
	ΟΧΙ	2
4	**Ποιο είναι το επάγγελμα του πατέρα σου;** ______________________________	
5	**Εργάζεται η μητέρα σου;**	
	ΝΑΙ	1
	ΟΧΙ	2
6	**Ποιο είναι το επάγγελμα της μητέρας σου;** ________________________________	

7	**Ο πατέρας σου διαβάζει εφημερίδες;**		**Η μητέρα σου διαβάζει εφημερίδες;**	
	Ποτέ	1	Ποτέ	1
	Κάποτε	2	Κάποτε	2
	Αρκετά συχνά	3	Αρκετά συχνά	3
	Πολύ συχνά	4	Πολύ συχνά	4
8	**Ο πατέρας σου διαβάζει βιβλία;**		**Η μητέρα σου διαβάζει βιβλία;**	
	Ποτέ	1	Ποτέ	1
	Κάποτε	2	Κάποτε	2
	Αρκετά συχνά	3	Αρκετά συχνά	3
	Πολύ συχνά	4	Πολύ συχνά	4

9	**Εσύ διαβάζεις εφημερίδες;**	
	Ποτέ	1
	Κάποτε	2
	Αρκετά συχνά	3
	Πολύ συχνά	4
10	**Αν ναι, ποια/ες εφημερίδα/ες διαβάζεις; ________________________________**	
11	**Εσύ διαβάζεις βιβλία;**	
	Ποτέ	1
	Κάποτε	2
	Αρκετά συχνά	3
	Πολύ συχνά	4

12	**Πόσο συχνά κάνεις τα ακόλουθα στον ελεύθερό σου χρόνο το απόγευμα;**	**ΠΟΤΕ**	**ΚΑΠΟΤΕ**	**ΑΡΚΕΤΑ ΣΥΧΝΑ**	**ΠΟΛΥ ΣΥΧΝΑ**
	Παίζω ηλεκτρονικά παιχνίδια	1	2	3	4
	Βλέπω τηλεόραση ή/και ταινίες στον ηλεκτρονικό υπολογιστή	1	2	3	4
	Ψάχνω και διαβάζω διάφορες πληροφορίες στον ηλεκτρ. υπολογιστή	1	2	3	4
	Διαβάζω βιβλία (π.χ. παιδική λογοτεχνία, εγκυκλοπαίδειες)	1	2	3	4
	Διαβάζω τα μαθήματά μου με τους γονείς μου	1	2	3	4
	Διαβάζω τα μαθήματά μου με δάσκαλο/α στο σπίτι ή στο φροντιστήριο	1	2	3	4
	Διαβάζω και μελετώ με τους γονείς μου διάφορα, όπως, ντοκιμαντέρ, επιτραπέζια παιχνίδια και βιβλία (εκτός από τα μαθήματά μου).	1	2	3	4
	Παίζω με τους φίλους/φίλες μου (στο σπίτι, πάρκο, στον παιδότοπο)	1	2	3	4
	Κάνω άλλες δραστηριότητες (χορό, αθλητισμό, μουσική, ζωγραφική)	1	2	3	4

Appendix D

The Critical-Thinking Observation Tool

ΚΛΕΙΔΑ ΠΑΡΑΤΗΡΗΣΗΣ ΜΑΘΗΜΑΤΟΣ ΕΛΛΗΝΙΚΩΝ
ΓΙΑ ΑΞΙΟΛΟΓΗΣΗ ΤΗΣ ΔΙΔΑΣΚΑΛΙΑΣ ΓΙΑ ΤΗΝ ΚΡΙΤΙΚΗ ΣΚΕΨΗ - Η ΕΝΣΩΜΑΤΩΣΗ ΚΑΙ ΠΡΟΩΘΗΣΗ ΤΗΣ ΣΤΟ ΜΑΘΗΜΑ

Παρακολούθηση: Πρώτη / Δεύτερη / Τρίτη Ημερομηνία: ______________ Διάρκεια Μαθήματος: __________
Όνομα Παρατηρητή/τριας: _________________________________

Στοιχεία Εκπαιδευτικού: Πειραματική Ομάδα / Ομάδα Ελέγχου
Κωδικός Εκπαιδευτικού: _______________________________________ Σχολείο: __________________________________ Τμήμα: ___________
Στοιχεία Μαθήματος: Ενότητα: ____ Θέμα/Περιεχόμενο: __________________________________

Οδηγίες Χρήσης Κλείδας Παρατήρησης

- Σημείωσε με √ ό,τι αντιστοιχεί/ανταποκρίνεται στον βαθμό που παρατηρείς τη διδακτική συμπεριφορά που περιγράφεται στη δήλωση.
- Σημείωσε, επίσης, τη συχνότητα ή διάρκειά της καθεμίας ανάλογα με το πόσες φορές ή για πόσο την παρατηρείς, χρησιμοποιώντας ανάλογη κλίμακα από τις ακόλουθες: α) 0=Καθόλου, 1=1 φορά, 2=2 φορές, 3=3 φορές κοκ., β) 0=Καθόλου 1=μέχρι 5 λεπτά, 2=μέχρι 10 λεπτά, 3=μέχρι 15 λεπτά, 4=16 λεπτά και άνω.

Προϋποθέσεις – Κριτήρια Διδασκαλίας Κριτικής Σκέψης (ΚΣ) στο Μάθημα

Παράμετροι	Ο/η εκπαιδευτικός …		Δεν το κάνει	Το κάνει	Συχνότητα Ή Διάρκεια
Πλαισίωση Προσανατο-λισμός	**1**	Ορίζει πλαίσιο που απαιτεί σκόπιμο είδος σκέψης *(π.χ. λήψη απόφασης, επίλυση προβλήματος, διερεύνηση υλικού, ανάλυση επιχειρημάτων)*, το οποίο στοχευμένα επαναφέρει κατά τη διάρκεια (για εξασφάλιση συνοχής και συνέχειας στο μάθημα).			
	2	Προσανατολίζει τους μαθητές σε σχέση με τις δεξιότητες ΚΣ που θα χρησιμοποιηθούν *(π.χ. «…χρειάζεται να αναπτύξουμε λογικά και πειστικά επιχειρήματα …»)* τονίζοντας τη χρησιμότητά τους στο μάθημα (απαντώντας στο γιατί κάνουμε το μάθημα).			
Γενική Διδακτική Μεθοδολογία	**3**	Χρησιμοποιεί στοχευμένες ερωτήσεις κριτικής σκέψης με τρόπο τέτοιο που να δημιουργεί προβληματισμό/ούς.			
		Α) Χρησιμοποιεί ερωτήσεις ερμηνείας (κατηγοριοποίησης, αποκωδικοποίησης σημασίας, παράφρασης νοήματος).			
		Β) Χρησιμοποιεί ερωτήσεις ανάλυσης (εξέτασης ιδεών, σύγκρισης, αναγνώρισης & ανάλυσης επιχειρημάτων).			

Γενική Διδακτική Μεθοδολογία		*Γ) Χρησιμοποιεί ερωτήσεις αξιολόγησης (αξιολόγησης ισχυρισμών/θέσεων και επιχειρημάτων).*			
		Δ) Χρησιμοποιεί ερωτήσεις συνεπαγωγής (αναζήτησης ενδείξεων, αιτιολογημένων προβλέψεων και συμπερασμάτων).			
		Ε) Χρησιμοποιεί ερωτήσεις επεξήγησης (παράθεσης κι επεξήγησης τρόπου σκέψης, επιχειρηματολογίας).			
		Στ) Χρησιμοποιεί ερωτήσεις αυτορρύθμισης (αυτό-αξιολόγησης και αυτό-διόρθωσης/βελτίωσης του τρόπου σκέψης τους).			
	4	Ενθαρρύνει ανοικτού τύπου σύντομες συζητήσεις, ώστε οι μαθητές να εκφράσουν τις απόψεις τους, να διαφωνήσουν ή να συμφωνήσουν με συνομιλητές τους αναπτύσσοντας επιχειρήματα.			
	5	Εμπλέκει τους μαθητές σε δραστηριότητες (γραπτής) παραγωγικής εργασίας/εξάσκησης εύστοχα πλαισιωμένης γύρω από ΚΣ με σαφείς οδηγίες ως προς τη δεξιότητα ή τον συνδυασμό δεξιοτήτων ΚΣ που θα εφαρμόσουν			
		Α) Εμπλέκει τους μαθητές σε δραστηριότητες ερμηνείας (π.χ. να τονίσουν το νόημα προτάσεων με δικά τους παραδείγματα).			
		Β) Εμπλέκει τους μαθητές σε δραστηριότητες ανάλυσης (π.χ. εντοπισμού λέξεων-κλειδιών & καταγραφή πλαγιότιτλων)			
		Γ) Εμπλέκει τους μαθητές σε δραστηριότητες αξιολόγησης (π.χ. αξιολόγηση τίτλου του κειμένου στη βάση κριτηρίων).			
		Δ) Εμπλέκει τους μαθητές σε δραστηριότητες συνεπαγωγής (π.χ. διερεύνηση, εντοπισμός πληροφοριών, τεκμηρίων για συμπεράσματα).			
		Ε) Εμπλέκει τους μαθητές σε δραστηριότητες επεξήγησης (π. χ. αιτιολόγηση του τρόπου σκέψης, συζήτησης απόψεων-debate).			
		Στ) Εμπλέκει τους μαθητές σε δραστηριότητες αυτό-αξιολόγησης &αυτό-διόρθωσης του γραπτού αποτελέσματος της σκέψης τους.			
	6	Αλληλεπιδρά με τους μαθητές και δίνει ανατροφοδότηση στο αποτέλεσμα της σκέψης τους με στοχευμένα, διευκρινιστικά ή/και επεξηγηματικά σχόλια που αφορούν τις υπό έμφαση δεξιότητες ΚΣ που χρησιμοποιούν (συντρέχουσα αξιολόγηση).			
Διδακτικές Στρατηγικές	**7**	Μοντελοποιεί δεξιότητες ΚΣ με <u>αξιοποίηση διοργανωτών σκέψης/νοητικών στηριγμάτων</u> *(π.χ. βέννειο διάγραμμα)* και διδάσκει τους μαθητές πώς να τα χρησιμοποιούν για σκοπούς κατανόησης ή/και παραγωγής γραπτού λόγου *(π.χ. πριν από γραπτή εργασία).*			
	8	Σκέφτεται δυνατά (‘think aloud’ technique) τονίζοντας την κατάλληλη ορολογία σε σχέση με τις δεξιότητες ΚΣ (π.χ. πώς αναλύω) και τα αποτελέσματά της (π.χ. συμπέρασμα) για να βοηθήσει τους μαθητές να εφαρμόσουν τη διαδικασία σκέψης (<u>μοντέλο σκέψης ο ίδιος ο εκπαιδευτικός</u>).			
Κλίμα/ Περιβάλλον Μάθησης	**9**	Δημιουργεί κίνητρα για σκόπιμο είδος σκέψης *(π.χ. πρέπει να εντοπίσω τεκμήρια/ενδείξεις για να αποδείξω το συμπέρασμά μου)* δίνοντας χρόνο και ενθαρρύνοντας τους μαθητές να σκεφτούν – και να εργαστούν – κριτικά.			
	10	Ενθαρρύνει λεκτικά τους μαθητές να έχουν κριτική διάθεση *(π.χ. να είναι ανοικτοί σε διαφορετικές οπτικές, να διερευνούν, να ψάχνουν, να αναστοχάζονται, να μην φοβούνται να εκφράσουν άποψη).*			

Appendix E

The Teacher Demographics' Questionnaire

Πανεπιστήμιο Κύπρου
Τμήμα Επιστημών της Αγωγής

Ερευνητικό Πρόγραμμα Επαγγελματικής Ανάπτυξης Εκπαιδευτικών «Κριτική σκέψη και Διδακτικές Προεκτάσεις: Η φύση, η Προώθηση και η Διδασκαλία για την Κριτική Σκέψη»

Οδηγίες

Σημειώστε με √ ό,τι αντιστοιχεί στην περίπτωσή σας και συμπληρώστε ανάλογα.

1. Φύλο: Άρρεν _____ Θήλυ _____

2. Σχολείο που δουλεύετε φέτος: ____

3. Οργανική Θέση: ____ Δάσκαλος/α ____ Βοηθός Διευθυντής/ρια

4. Χρόνια Υπηρεσίας (συμπεριλαμβανομένου του φετινού): _______________________

5. Χρόνια Υπηρεσίας σε Ε' ή Στ' τάξη (τάξη που διδάσκετε φέτος): _________________

6. Ανώτατο Μορφωτικό Επίπεδο:

____ Κάτοχος Μεταπτυχιακού τίτλου Σε _____________________________________

____ Κάτοχος Διδακτορικού τίτλου Σε _____________________________________

____ Κάτοχος Δεύτερου πτυχίου Σε _____________________________________

7. Επιμόρφωση σχετικά με το θέμα της Ανάπτυξης και Διδασκαλίας Κριτικής Σκέψης:

_____ Παρακολούθηση επιμορφωτικών σεμιναρίων/ημερίδων

_____ Παρακολούθηση επιστημονικών συνεδρίων (στην Κύπρο ή/και στο εξωτερικό)

_____ Ενασχόληση με έρευνα / ερευνητικό πρόγραμμα για την κριτική σκέψη

_____ Μεταπτυχιακές σπουδές

_____ Προσωπική ενασχόληση με σχετική βιβλιογραφία

_____ Άλλο (Παρακαλώ καθορίστε: …………………………………………………………………………)

8. Ανάμειξη στην Αναδόμηση των ΝΑΠ της Κύπρου: ___ ΟΧΙ ____ ΝΑΙ

Αν ΝΑΙ, Ρόλος: _________________

9. Κίνητρο για Συμμετοχή στο Πρόγραμμα Επαγγελματικής Ανάπτυξης: _____________

____

____

Appendix F

The Teacher Reflections' Questionnaire

Πρόγραμμα Επαγγελματικής Ανάπτυξης Εκπαιδευτικών
«Κριτική σκέψη και Διδακτικές Προεκτάσεις: Η φύση, η Προώθηση και η Διδασκαλία για την Κριτική Σκέψη»
(2016-2017)

Πανεπιστήμιο Κύπρου
Τμήμα Επιστημών της Αγωγής

Υπεύθυνη προγράμματος: Φλώρια Ν. Βαλανίδου

1. ΤΟ ΠΡΟΓΡΑΜΜΑ

Το Πρόγραμμα Επαγγελματικής Ανάπτυξης Εκπαιδευτικών για τη διδασκαλία της Κριτικής Σκέψης (ΚΣ) προσφέρθηκε κατά τη Σχολική Χρονιά 2016-2017 από το Τμήμα Επιστημών της Αγωγής του Πανεπιστημίου Κύπρου στα πλαίσια έρευνας σε Δημοτικά Σχολεία με τίτλο *«Διδασκαλία για την Κριτική Σκέψη: Ανάπτυξη και Βελτίωση της Κριτικής Σκέψης των Μαθητών μέσω Ενδυνάμωσης κι Επαγγελματικής Ανάπτυξης Εκπαιδευτικών.* Σκοπός του προγράμματος η ενημέρωση και ενδυνάμωση εκπαιδευτικών Ε' & Στ' Δημοτικού για τη φύση της ΚΣ και για διδακτικές πρακτικές για ανάπτυξη της ΚΣ των μαθητών στο μάθημα των Ελληνικών αλλά και η ανάπτυξη δεξιοτήτων σχεδιασμού ή/και αναδόμησης διδασκαλίας με έμφαση στην προώθηση της ΚΣ.

2. ΑΞΙΟΛΟΓΗΣΗ ΤΟΥ ΠΡΟΓΡΑΜΜΑΤΟΣ

Στα πλαίσια της συμμετοχής σας στο πρόγραμμα, η συμβολή σας στην αξιολόγηση του προγράμματος κρίνεται πολύ σημαντική. Θα το εκτιμούσα ιδιαίτερα αν αφιερώνατε λίγα λεπτά για να παρουσιάσετε και να αξιολογήσετε την εμπειρία σας από το πρόγραμμα, συμπληρώνοντας το παρόν ερωτηματολόγιο. Διευκρινίζεται ότι οι πληροφορίες που θα συλλεγούν από το ερωτηματολόγιο θα παραμείνουν άκρως εμπιστευτικές και θα χρησιμοποιηθούν αποκλειστικά και μόνο για σκοπούς αναστοχασμού και αξιολόγησης του ίδιου του προγράμματος.

Μέρος Α

Βάλτε σε κύκλο τον αριθμό που περιγράφει καλύτερα την αντίδρασή σας σε κάθε δήλωση.

	Καθόλου	Λίγο	Αρκετά	Πολύ
1. Το πρόγραμμα ανταποκρίθηκε στις προσδοκίες μου.	1	2	3	4
2. Οι συναντήσεις στα πλαίσια του προγράμματος με βοήθησαν να ξεκαθαρίσω τι είναι η κριτική σκέψη και πώς διδάσκεται.	1	2	3	4
3. Το πρόγραμμα ανέπτυξε/εμπλούτισε τις διδακτικές μου δεξιότητες σε σχέση με την προώθηση της κριτικής σκέψης στην τάξη.	1	2	3	4
4. Το υλικό του προγράμματος ήταν βοηθητικό τόσο σε θεωρητικό όσο και σε πρακτικό επίπεδο.	1	2	3	4
5. Αξιοποίησα το υλικό ή μέρος του υλικού του προγράμματος στη διδασκαλία μου.	1	2	3	4
6. Το πρόγραμμα με βοήθησε να αναστοχάζομαι περισσότερο σε σχέση με την προώθηση της κριτικής σκέψης στη διδασκαλία μου.	1	2	3	4

Μέρος Β

Απαντήστε με συντομία τις ερωτήσεις που ακολουθούν

1. Πώς το πρόγραμμα συνείσφερε στην επαγγελματική σας ανάπτυξη; *(π.χ. οφέλη που έχουν να κάνουν με σχεδιασμό διδασκαλίας, πραγμάτωση διδασκαλίας, αξιολόγηση και αναστοχασμό).*

2. Αναφέρετε τις 2 πιο σημαντικές <u>για εσάς</u> έννοιες (key-ideas) που αφορούν την κριτική σκέψη και τη διδασκαλία της και εξηγήστε. (ποιες είναι αυτές που εσείς επιλέγετε να κρατήσετε από το πρόγραμμα).

3. Εισηγηθείτε ένα στοιχείο που θεωρείτε ότι θα βελτίωνε την υλοποίηση του προγράμματος επαγγελματικής ανάπτυξης που συμμετείχατε.

Μέρος Γ

Παρατηρήσεις και Σχόλια

Καταγράψτε παρατηρήσεις ή σχόλια, αν υπάρχουν σχετικά με την εμπειρία σας στο πρόγραμμα.

Appendix G

The Critical-Thinking Curriculum used in the Teacher Professional Development Programme

ΑΝΑΛΥΤΙΚΟ ΠΡΟΓΡΑΜΜΑ ΔΕΞΙΟΤΗΤΩΝ ΚΡΙΤΙΚΗΣ ΣΚΕΨΗΣ
(ΠΛΑΙΣΙΟ ΜΑΘΗΜΑΤΟΣ ΕΛΛΗΝΙΚΩΝ)

Δεξιότητες Κριτικής Σκέψης (Facione, 1990)

Ερμηνεία
- -Κατηγοριοποίηση
- -Αποκωδικοποίηση
- -Παράφραση νοήματος

Ανάλυση
- -Εξέταση Ιδεών
- -Σύγκριση Ιδεών
- -Αναγνώριση & Ανάλυση Επιχειρημάτων

Αξιολόγηση
- -Αξιολόγηση Ισχυρισμών
- -Αξιολόγηση Επιχειρημάτων

Συνεπαγωγή
- -Διερεύνηση Δεδομένων
- -Διατύπωση Αιτιολογημένων Υποθέσεων/Προβλέψεων
- - Συμπεράσματα

Επεξήγηση
- -Παρουσίαση Αποτελεσμάτων Σκέψης
- -Επεξήγηση Τρόπου Σκέψης
- -Ανάπτυξη Επιχειρημάτων

Αυτορρύθμιση
- - Αυτοαξιολόγηση
- - Αυτοδιόρθωση

Σημαντικές Λέξεις-Κλειδιά για κάθε Δεξιότητα Κριτικής Σκέψης

Ερμηνεία
- - Κατηγοριοποιώ (Κατηγορία, κριτήριο)
- -Τονίζω το νόημα, Βρίσκω τη σημασία με βάση τα συμφραζόμενα
- -Δίνω παράδειγμα, Εξηγώ με δικά μου λόγια - Παραφράζω

Ανάλυση
- -Εντοπίζω βασική ιδέα (π.χ. συμπέρασμα, εξέλιξη ιστορίας)
- -Σύγκρίνω - Εντοπίζω ομοιότητες & διαφορές
- - Αναγνωρίζω και αναλύω επιχειρήματα (βασική θέση/άποψη, λόγους, αποδείξεις ή τεκμήρια, παράδειγμα)

Αξιολόγηση
- -Αξιολογώ ισχυρισμούς (π.χ. τίτλο κειμένου)
- - Κριτήρια αξιολόγησης (λογική, ακρίβεια, σαφήνεια, συνάφεια)
- -Αξιολογώ επιχειρήματα
- Κριτήρια αξιολόγησης (έγκυρα, λογικά, αληθή)

Συνεπαγωγή
- -Διερευνώ πηγές, αναζητώ δεδομένα, πληροφορίες
- - Εντοπίζω ενδείξεις που να τεκμηριώνουν συμπεράσματα
- - Διατυπώνω Αιτιολογημένες Υποθέσεις και Προβλέψεις
- - Καταλήγω σε συμπεράσματα

Επεξήγηση
- - Καταγράφω παρατηρήσεις, Παρουσιάζω αποτελέσματα
- - Συμφωνώ, Διαφωνώ, Δικαιολογώ τη γνώμη μου
- -Εξηγώ τον τρόπο σκέψης μου, Εξηγώ πώς το έκανα
- -Επιχειρηματολογώ, Υποστηρίζω θέση/άποψη με λόγους και επιχειρήματα

Αυτορρύθμιση
- - Κάνω αυτοαξιολόγηση
- - Ελέγχω αν η σκέψη μου είναι ολοκληρωμένη με βάση κριτήρια
- - Διορθώνω τη σκέψη μου
- - Προσθέτω, διαγράφω ή αναδιατυπώνω πληροφορίες

ΑΝΑΛΥΤΙΚΟ ΠΡΟΓΡΑΜΜΑ ΔΕΞΙΟΤΗΤΩΝ ΚΡΙΤΙΚΗΣ ΣΚΕΨΗΣ
(ΠΛΑΙΣΙΟ ΜΑΘΗΜΑΤΟΣ ΕΛΛΗΝΙΚΩΝ)

Παραδοχές

1. Οι δεξιότητες κριτικής σκέψης (ΚΣ) διδάσκονται στοχευμένα, ξεκάθαρα μέσα από κατάλληλο περιεχόμενο/πλαίσιο, όπως η επίλυση προβλήματος, η λήψη απόφασης, η κατανόηση νέου υλικού, η ανάπτυξη αξιολογικής κρίσης και η ανάλυση επιχειρημάτων *(π.χ. Ennis, 1989, 1991; Facione, 2011; Fischer et al., 2009; McGuinness, 1999; McTighe, 1985; Plath et al., 1999; Swartz, 2003; Zohar et al., 1994)*.
2. Ο βαθμός στον οποίο οι μαθητές είναι γνώστες του θέματος (γνώση, κατανόηση, εμπειρία) επηρεάζει τον βαθμό στον οποίο οι μαθητές θα σκεφτούν κριτικά αξιοποιώντας συνδυασμό δεξιοτήτων κριτικής σκέψης *(Bailin et al., 1999a; Ennis, 1987, 1991; Hudgins et al., 1989)*.
3. Δεν υπάρχει ιεραρχία βάσει της οποίας διδάσκονται, επαναφέρονται ή/και χρησιμοποιούνται οι δεξιότητες ΚΣ. Λειτουργούν συμπληρωματικά και συνδυαστικά κατά περίπτωση σε κάθε μάθημα *(π.χ. Ennis et al. 2004, 1985; Facione, 2000; Facione & Facione, 1996)*.
4. Οι δεξιότητες κριτικής σκέψης βελτιώνονται μέσω εξάσκησης (learning by doing) κατά τη διάρκεια της οποίας χρειάζεται οι μαθητές να αναγνωρίζουν τις δεξιότητες ή/και στρατηγικές που χρησιμοποιούν *(π.χ Plath et al., 1999; Swartz, 2003; van Gelder, 2005)*.

Αναμενόμενα Μαθησιακά Αποτελέσματα (Δείκτες Επιτυχίας – Attainment Targets)		**Διδακτέα – ΤΙ ΔΙΔΑΣΚΕΙ Ο/Η ΕΚΠΑΙΔΕΥΤΙΚΟΣ; (Δείκτες Επάρκειας – Teaching Targets)**
Δεξιότητες ΚΣ	**Οι μαθητές…**	**Ο/η εκπαιδευτικός …**
1. Ε Ρ Μ	1.1. Κατηγοριοποιούν/ οργανώνουν πληροφορίες σε κατηγορίες βάσει ενός (κοινού) χαρακτηριστικού/ κριτηρίου **(Categorizing)**	1.1.1. Κατηγορία = Ομάδα/ Σύνολο όμοιων πληροφοριών/ιδεών (λέξεων / προτάσεων / κειμένων). 1.1.2. Υποκατηγορία = Ομάδα/ Σύνολο όμοιων πληροφοριών/ιδεών (π.χ. λέξεων) που αποτελεί μέλος μιας ευρύτερης κατηγορίας/ομάδας. 1.1.3. Κριτήρια, προκαθορισμένα ή μη, για ομαδοποίηση/ οργάνωση ιδεών/πληροφοριών (λέξεων/ προτάσεων / κειμένων) που αφορούν σε διαφορετικά σημεία έμφασης *(π.χ. ομαδοποίηση λέξεων με βάση τη σημασία τους, κατηγοριοποίηση τίτλων από άρθρα με βάση το είδος της φράσης – ονοματική ή ρηματική φράση, διαχωρισμός κειμένων με βάση τον τίτλο/ επικεφαλίδα ή περιεχόμενο)*
	1.2. Αποκωδικοποιούν το νόημα/σημασία μιας πληροφορίας	1.2.1. Αποκωδικοποίηση σημασίας/νοήματος μιας πληροφορίας (λέξης/ πρότασης/παραγράφου/κειμένου/ συμβόλου κοκ.) με βάση το είδος πληροφορίας *(π.χ. τίτλος)*, τις βασικές έννοιες/λέξεις (που πιθανόν επαναλαμβάνονται) και τα συμφραζόμενα.

Η Ν Ε Ι Α	**(Decoding significance)**	1.2.2. Συμφραζόμενα = Πλαίσιο/συγκείμενο / νοήματα κειμένου
	1.3. Ερμηνεύουν / παραφράζουν / περιγράφουν με άλλα λόγια το νόημα **(Clarifying meaning)**	1.3.1. Παράφραση = α) Περιγραφή του νοήματος/ περιεχομένου μιας πληροφορίας (πρότασης/ παραγράφου / κειμένου / συμβόλου κοκ.) με άλλα λόγια/άλλες λέξεις και β) Περιγραφή του νοήματος/ περιεχομένου μιας πληροφορίας (πρότασης/ παραγράφου/ κειμένου/ συμβόλου κοκ.) μέσω παραδείγματος ή παραδειγμάτων που να εξηγούν τη σημασία.
2. Α Ν Α Λ Υ Σ Η	2.1. Εξετάζουν ιδέες αναγνωρίζοντας και εντοπίζοντας βασικές ή/και επιμέρους ιδέες που δηλώνονται ρητά ή υπόρρητα **(Examining ideas – Identifying component parts)**	2.1.1. Βασική/κεντρική ιδέα = Το πιο σημαντικό στοιχείο/ μήνυμα κειμένου (γενική εντύπωση) που αφορά στο για τι ή για ποιον μιλά το κείμενο. Παίρνει πολλαπλές μορφές ανάλογα με το είδος του κειμένου *(π.χ. εξέλιξη/πλοκή στην αφήγηση, βασικό αντικείμενο/χαρακτηριστικό περιγραφής, συμπέρασμα επιχειρηματολογικού κειμένου)* - Μηνύματα που δηλώνονται ρητά και άμεσα - Μηνύματα που δεν δηλώνονται ρητά και άμεσα (υπόρρητα μηνύματα, π.χ. σκοπός, κίνητρα συγγραφέα) 2.1.2. Στρατηγικές εντοπισμού λέξεων-κλειδιών που επαναλαμβάνονται, εντοπισμού πρώτης ή τελευταίας πρότασης κειμένου και επεξήγηση *(π.χ. με σημειώσεις στο περιθώριο, με πλαγιότιτλους)* της σημαντικότητας/ρόλου της *(π.χ. συμπέρασμα).*
	2.2. Συγκρίνουν δεδομένα/ πληροφορίες με εντοπισμό ομοιοτήτων /διαφορών **(Examining ideas – Compare/Contrast)**	2.2.1. Εντοπισμός ομοιοτήτων και διαφορών μεταξύ δηλώσεων/ προτάσεων/παραγράφων/κειμένων ίδιου ή/και διαφορετικού τύπου, που εντάσσονται σε ίδια ή και διαφορετικά επικοινωνιακά και κοινωνικοπολιτισμικά πλαίσια *(π.χ. σύγκριση έντυπων διαφημίσεων ή έντυπης διαφήμισης και τηλεοπτικής διαφήμισης ως πολυτροπικού κειμένου)* μέσω αντιπαραβολής επισημαίνοντας αρχικά το μέτρο σύγκρισης (π.χ. περιεχόμενο, σκοπός, νοήματα)
	2.3. Αναγνωρίζουν επιχειρήματα μεταξύ άλλων ειδών δηλώσεων **(Detecting arguments)**	2.3.1. Επιχείρημα (Argument): Συλλογισμός με τον οποίο υποστηρίζουμε ή καταπολεμούμε μια θέση που αποτελείται από 2 τουλάχιστον προτάσεις/ ισχυρισμούς που συνδέονται με αιτιολογικούς συνδέσμους: i) βασικό συμπέρασμα/θέση, ii) Λόγος (ή λόγοι) που υποστηρίζουν το βασικό συμπέρασμα και iii) πληροφορίες/τεκμήρια ή/και παραδείγματα που υποστηρίζουν/ενδυναμώνουν τους λόγους. <u>Παράδειγμα</u>: *Ένας σκύλος μπορεί να σε κάνει ευτυχισμένο, γιατί με το παιχνίδι και τις σκανταλιές του δεν σε κάνει ποτέ να βαριέσαι. Έρευνες φαίνεται να αποδεικνύουν ότι ένας σκύλος μπορεί να σου χαρίσει*

	2.4. Αναλύουν επιχειρήματα **(Analyzing arguments)**	*απλόχερα την αγάπη του χωρίς να περιμένει αντάλλαγμα.* 2.3.2. Αντεπιχείρημα ή αντίθετο επιχείρημα = Επιχείρημα με το οποίο αντικρούουμε ένα άλλο επιχείρημα 2.3.3. Λόγος = Δευτερεύουσα αιτιολογική πρόταση που εισάγεται με αιτιολογικούς συνδέσμους (π.χ. γιατί, επειδή, διότι, καθώς, αφού…). Απαντά στο γιατί. 2.3.4. Μορφές επιχειρημάτων: Σύντομα (π.χ. δύο προτάσεις που συνδέονται) και πιο μακροσκελή (π.χ. παράγραφος, κείμενο)
3. ΑΞΙΟΛΟΓΗΣΗ	3.1. Αξιολογούν ισχυρισμούς **(Assessing claims)**	3.1.1. Ισχυρισμός = Δήλωση/πρόταση (λ.χ. συμπέρασμα κειμένου) 3.1.2. Δυνατός/Ισχυρός ισχυρισμός = (α) Συμπέρασμα που τεκμηριώνεται/ ενδυναμώνεται από τα δεδομένα (π.χ. λόγους) 3.1.3. Αδύνατος ισχυρισμός = Συμπέρασμα που δεν τεκμηριώνεται/ αποδυναμώνεται από τα δεδομένα (π.χ. *"Το γερμανικό φαγητό είναι απαίσιο"*) 3.1.4. Ρητά και υπόρρητα νοήματα = Πολλαπλές φωνές / μηνύματα που εμφανίζονται ή δεν εμφανίζονται ρητά και ξεκάθαρα στο ίδιο κείμενο *(π.χ. σκοπός συγγραφέα, κίνητρα)*
	3.2. Αξιολογούν επιχειρήματα (παραδείγματα σκέψης/ συλλογισμούς) **(Assessing arguments)**	3.2.1. Αντικειμενικά κριτήρια αξιολόγησης πειστικών επιχειρημάτων = εγκυρότητα, αλήθεια/λογική, ορθότητα. 3.2.2. Αξιολόγηση/ιεράρχηση πειστικών επιχειρημάτων βάσει αντικειμενικών κριτηρίων, δηλαδή κρίνοντας κατά πόσο: α) το συμπέρασμα προκύπτει από τους λόγους που δίνονται (εγκυρότητα), β) το συμπέρασμα και οι λόγοι που δίνονται αληθεύουν (αλήθεια), και γ) το επιχείρημα είναι λογικά ορθό αν είναι έγκυρο και αληθές (ορθότητα).
4. ΣΥΝ	4.1. Διερευνούν και αναζητούν σχετικές και αξιόπιστες με συγκεκριμένο θέμα/ισχυρισμό/ιδέα πληροφορίες/τεκμήρια **(Querying evidence)**	4.1.1. Στρατηγικές διερεύνησης πληροφοριών = Τρόπος αναζήτησης πληροφοριών για ένα θέμα ή/και εργασία σε βήματα: α) ανάλυση θέματος - ποιες πληροφορίες έχουμε/ποιες χρειαζόμαστε, β) προβλέψεις σε σχέση με τις πληροφορίες που χρειαζόμαστε, γ) αναζήτηση των πληροφοριών σε συγκεκριμένη - δοσμένη ή μη- πηγή (λ.χ. κείμενο) βάσει κριτηρίων (να είναι σχετικές και αξιόπιστες) και επαλήθευση/απόρριψη προβλέψεων, και δ) περαιτέρω συστηματοποιημένη αναζήτηση σε άλλες πηγές (αν χρειάζεται).
	4.2. Διατυπώνουν αιτιολογημένες υποθέσεις / προβλέψεις /εναλλακτικές επιλογές/λύσεις	4.2.1. Υποθέσεις και αιτιολογημένες προβλέψεις για το είδος, το περιεχόμενο και την οπτική/σκοπό του συγγραφέα σε ένα κείμενο μέσα από σύνθεση πληροφοριών, με βάση στοιχεία όπως εικόνα, τίτλος, είδος κειμένου, συγγραφέας, σκοπός, επικοινωνιακό και κοινωνιοπολιτισμικό πλαίσιο.

ΕΠΑΓΩΓΗ	**(Conjecturing alternatives)**	
	4.3. Καταλήγουν σε συμπεράσματα μέσα από σύνθεση δεδομένων/ πληροφοριών **(Drawing conclusions)**	4.3.1. Συμπέρασμα = Το αποτέλεσμα ενός συλλογισμού / μιας συλλογιστικής πορείας σκέψης. 4.3.2. Επαγωγικός συλλογισμός (informal logic) = Εξαγωγή συμπερασμάτων μεταβαίνοντας από το ειδικό στο γενικό λαμβάνοντας υπόψη όλες τις επιμέρους πληροφορίες/ δεδομένα/ στοιχεία που δίνονται σε ένα πλαίσιο (κείμενο, εικόνα, χαρακτήρας). Τα συμπεράσματα είναι αληθή/σωστά όταν δικαιολογούνται με λόγους ή/και τεκμήρια/αποδείξεις/ενδείξεις. Παράδειγμα: *Π1 = 25 από τα 40 ηλικιωμένα άτομα κάνουν παρέα με σκύλο. Π2= Οι 25 από τα 40 άτομα που έκαναν παρέα με τον σκύλο δήλωσαν πιο ευτυχισμένα. Σ = Επομένως ένας σκύλος κάνει έναν ηλικιωμένο ευτυχισμένο.* 4.3.3. Παραγωγικός συλλογισμός (formal logic) = Εξαγωγή συμπερασμάτων μεταβαίνοντας από το γενικό στο ειδικό. Τα συμπεράσματα είναι πάντα αληθή. Παράδειγμα: *Π1 = Όλοι οι άνθρωποι είναι θνητοί. Π2 = Ο Νικόλας είναι άνθρωπος. Σ = Ο Νικόλας είναι θνητός.*
5. ΕΠΕΞΗΓΗΣΗ	5.1. Παραθέτουν το αποτέλεσμα της σκέψης τους **(Stating results)**	5.1.1. Αποτέλεσμα = Αυτό που προκύπτει από την ολοκλήρωση ή κατάληξη κάποιας εργασίας *(π.χ. διερεύνησης, πειράματος, επίλυσης προβλήματος, επιλογής/ απόφασης)* Παράδειγμα: *Ποια πηγή επέλεξες/ σε έπεισε πιο πολύ; Γιατί;* 5.1.2. Αξιοποίηση δευτερευουσών αιτιολογικών προτάσεων που εισάγονται με αιτιολογικούς συνδέσμους *(π.χ. γιατί, επειδή, διότι, καθώς, αφού…)* για παρουσίαση + τεκμηρίωση του αποτελέσματος της σκέψης (απαντούν στο γιατί).
	5.2. Εξηγούν τον τρόπο σκέψης τους (π.χ. πώς καταλήγουν σε ερμηνεία, ανάλυση, αξιολόγηση και συμπέρασμα) **(Justifying procedures)**	5.2.1. Επεξήγηση του τρόπου με τον οποίο εφαρμόζουν δεξιότητες κριτικής σκέψης κάθε φορά (π.χ. πώς ερμηνεύουν, πώς αναλύουν, πώς αξιολογούν δεδομένα και πώς καταλήγουν σε συμπεράσματα).
	5.3. Επιχειρηματολογούν / παρουσιάζουν την κρίση τους για ένα θέμα χρησιμοποιώντας κατάλληλα επιχειρήματα **(Presenting arguments)**	5.3.1. Επιχείρημα (Argument): Συλλογισμός με τον οποίο υποστηρίζουμε ή καταπολεμούμε μια θέση που αποτελείται από 2 τουλάχιστον προτάσεις/ ισχυρισμούς που συνδέονται με αιτιολογικούς συνδέσμους: i) βασικό συμπέρασμα/θέση, ii) Λόγος (ή λόγοι) που υποστηρίζουν το βασικό συμπέρασμα και iii) πληροφορίες/τεκμήρια ή/και παραδείγματα που υποστηρίζουν τους λόγους. 5.3.2. Αντεπιχείρημα ή αντίθετο επιχείρημα = Επιχείρημα με το οποίο αντικρούουμε ένα άλλο επιχείρημα 5.3.3. Λόγος = Δευτερεύουσα αιτιολογική πρόταση που εισάγεται με αιτιολογικούς συνδέσμους (π.χ. γιατί,

		επειδή, διότι). Απαντά στο γιατί. 5.3.4. Μορφές επιχειρημάτων: Σύντομα (π.χ. δύο προτάσεις που συνδέονται) και πιο μακροσκελή (παράγραφος, κείμενο) 5.3.5. Δομή επιχειρηματολογικού κειμένου = (α) Αναπτυγμένη επαγωγική επιχειρηματολογία από το ειδικό (λόγος/οι) στο γενικό (συμπέρασμα) ή (β) παραγωγική επιχειρηματολογία από το γενικό (συμπέρασμα) στο ειδικό (λόγος/οι) και τεκμηρίωση με αναφορά σε εξωτερικές πηγές πληροφόρησης (π.χ. εγκυροποίηση επιχειρημάτων με αναφορές σε επίσημες έρευνες, δεδομένα ή/και παραδείγματα) ▪ Φράσεις για να εισάγουμε θέση/ άποψη *(π.χ. «Η γνώμη μου είναι…», «Νομίζω πως…», «Θεωρώ πως…», «Κατά την άποψη μου», «Υποστηρίζω»)* ▪ Συνδετικές φράσεις και επιρρήματα *(π.χ. Αρχικά, καταρχήν, Πρώτα απ' όλα, επίσης, ακόμα, επιπλέον, τέλος)* και συμπερασματικοί σύνδεσμοι *(π.χ., «άρα», «συνεπώς»).* 5.3.6. Οργάνωση κειμένου με σαφή εισαγωγή, σώμα βασικών ιδεών και πληροφοριών και υποστηρικτικές λεπτομέρειες σε λογική σειρά και σαφές συμπέρασμα με ξεκάθαρη παραγραφοποίηση (δόμηση παραγράφου: θεματική πρόταση, λεπτομέρειες, κατακλείδα).
6. ΑΥΤΟΡΥΘΜΙΣΗ	6.1. Αναστοχάζονται και αξιολογούν το αποτέλεσμα της σκέψης τους βάσει κριτηρίων **(Self-examination)**	6.1.1. Αυτό-αξιολόγηση = Αξιολόγηση του αποτελέσματος της σκέψης τους βάσει κριτηρίων που δίνονται εκ των προτέρων ή αποφασίζονται επαγωγικά (π.χ. με βάση τη δομή ενός κειμενικού είδους). 6.1.2. Κριτήρια αξιολόγησης = Σημεία έμφασης που αξιοποιούνται για αξιολόγηση (π.χ. σκοπός, κειμενογλωσσικά χαρακτηριστικά) <u>Παράδειγμα:</u> *Πόσο καλά νομίζεις ότι μπόρεσες να αναπτύξεις τη σκέψη σου στο κείμενο που έγραψες; α) Η σκέψη μου δεν είναι ολοκληρωμένη. Έγραψα μόνο τη γνώμη μου και δεν χρησιμοποίησα καθόλου λόγους και επιχειρήματα για να εξηγήσω, β) Η σκέψη μου δεν είναι πολύ ολοκληρωμένη. Έγραψα τη γνώμη μου και για να τη δικαιολογήσω χρησιμοποίησα έναν ή δύο λόγους, όχι πολύ πειστικούς, γ) Η σκέψη μου είναι αρκετά ολοκληρωμένη. Έγραψα τη γνώμη μου χρησιμοποιώντας δύο αρκετά πειστικούς λόγους για να την εξηγήσω; δ) Η σκέψη μου είναι πολύ ολοκληρωμένη. Έγραψα τη γνώμη μου χρησιμοποιώντας δύο πειστικούς λόγους για να εξηγήσω αν συμφωνώ ή διαφωνώ με τον ισχυρισμό. Έδωσα και παράδειγμα ή παραδείγματα.*
	6.2. Διορθώνουν λάθη ή/και αδυναμίες στο αποτέλεσμα της σκέψης τους **(Self-correction)**	6.2.1. Αυτό-διόρθωση = Διόρθωση/βελτίωση του αποτελέσματος της σκέψης που μπορεί να γίνει με πολλαπλούς τρόπους στη βάση της αυτό-αξιολόγησης, που θα έχει προηγηθεί, μέσω: α) προσθήκης πληροφοριών, β) αφαίρεσης πληροφοριών, ή/και γ) τροποποιήσεων και αναδιατύπωσης μέρους (πρότασης, παραγράφου) ή όλου (κειμένου) *(π.χ. να προσθέσουν λόγους υπέρ της θέσης τους, να λάβουν υπόψη τους αντίθετα επιχειρήματα).*

Appendix H

A Part of the Booklet titled "Teaching for Critical Thinking"

Πανεπιστήμιο Κύπρου
Τμήμα Επιστημών της Αγωγής

Επαγγελματική Ανάπτυξη Εκπαιδευτικών
Ερευνητικό Πρόγραμμα
«Η Φύση, η Προώθηση και η Διδασκαλία της Κριτικής Σκέψης»
(2016-2017)

Υλικό που έχει παραχθεί στα πλαίσια Διδακτορικής Διατριβής με τίτλο
"Teaching for Critical Thinking: Enhancing Instructional Effects on
Students' Critical-Thinking Performance through Teacher Empowerment and Professional Development"

Τμήμα Επιστημών της Αγωγής
Πανεπιστήμιο Κύπρου

ΒΑΣΙΚΕΣ ΠΡΟΥΠΟΘΕΣΕΙΣ ΔΙΔΑΣΚΑΛΙΑΣ ΔΕΞΙΟΤΗΤΩΝ ΚΡΙΤΙΚΗΣ ΣΚΕΨΗΣ (ΠΛΑΙΣΙΟ ΜΑΘΗΜΑΤΟΣ ΕΛΛΗΝΙΚΩΝ)

1. Εύστοχο Πλαίσιο/Πλαισίωση Μαθήματος (π.χ. Επίλυση προβλήματος, Λήψη απόφασης/Δίλημμα, Κατανόηση υλικού, Ανάλυση Επιχειρημάτων)

2. Ξεκάθαρος Προσανατολισμός ως προς τις Δεξιότητες Κριτικής Σκέψης (ΚΣ) που θα χρησιμοποιηθούν

3. Στοχευμένη και Ξεκάθαρη Διδασκαλία ΚΣ

Στοχευμένη ενσωμάτωση και ξεκάθαρη διδασκαλία δεξιοτήτων ΚΣ εντός του περιεχομένου του μαθήματος είτε με άμεσο είτε με έμμεσο τρόπο, όποτε χρειάζεται.

4. Εύστοχη Διδακτική Μεθοδολογία και Ευκαιρίες για Παραγωγική Εργασία σε Δραστηριότητες που Αφορούν Δεξιότητες ΚΣ

(π.χ. Χρήση κατάλληλων ερωτήσεων ή/και δραστηριοτήτων, γραπτώς ή προφορικώς, που να αφορούν δεξιότητες ΚΣ, αξιοποίηση στοχευμένων ερωτήσεων ΚΣ και πλαισιωμένων συζητήσεων, στοχευμένη διαμορφωτική αξιολόγηση)

5. Ξεκάθαρες Διδακτικές Στρατηγικές (visible thinking strategies) για Διδασκαλία Δεξιοτήτων ΚΣ και Καθοδήγηση Μαθητών ΠΩΣ ΝΑ ΣΚΕΦΤΟΝΤΑΙ και Χρήση Κατάλληλης Γλώσσας και Ορολογίας Σχετικής με Δεξιότητες ΚΣ και τα Αποτελέσματά της

(π.χ. Μοντελοποίηση: α) Μοντέλο σκέψης ο εκπαιδευτικός, β) Μοντέλο σκέψης ο μαθητής, γ) Εννοιολογικοί Χάρτες/Διοργανωτές Σκέψης)

6. Κατάλληλο Περιβάλλον μάθησης & Επικοινωνία

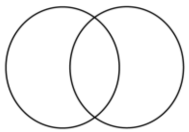
Κίνητρα για σκόπιμο είδος σκέψης / Ενθάρρυνση για κριτική διάθεση στο Μάθημα

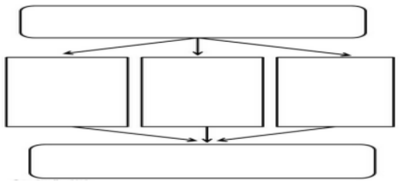
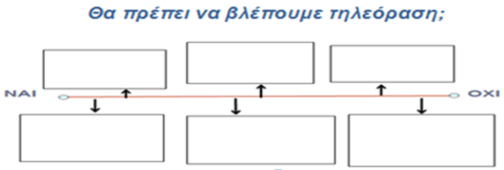
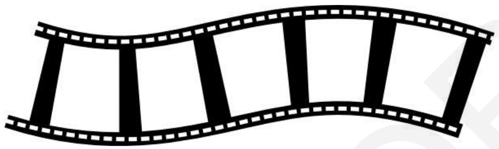
Στόχος Προώθησης Κριτικής Σκέψης (ΚΣ)

Η ξεκάθαρη και άμεση (explicit) διδασκαλία των δεξιοτήτων κριτικής σκέψης μέσω εύστοχα πλαισιωμένων δραστηριοτήτων που να ενθαρρύνουν ΣΚΟΠΙΜΟ ΕΙΔΟΣ ΣΚΕΨΗΣ, <u>ΟΤΑΝ ΧΡΕΙΑΖΕΤΑΙ ΚΑΙ ΟΤΑΝ ΤΟ ΠΛΑΙΣΙΟ ΠΡΟΣΦΕΡΕΤΑΙ</u>.

<u>Είναι σημαντικό οι μαθητές να αναγνωρίζουν τις διαδικασίες ή τις δεξιότητες που εμπλέκονται στη μάθησή τους και να τις περιγράφουν.</u>

ΠΑΡΑΔΕΙΓΜΑΤΑ ΑΞΙΟΠΟΙΗΣΗΣ ΔΙΔΑΚΤΙΚΩΝ ΣΤΡΑΤΗΓΙΚΩΝ (VISIBLE - EXPLICIT – DIRECT THINKING STRATEGIES)
(ΠΛΑΙΣΙΟ ΜΑΘΗΜΑΤΟΣ ΕΛΛΗΝΙΚΩΝ)

Διδακτικές Στρατηγικές	Πραγμάτωση Διδακτικών Στρατηγικών (παραδείγματα)	Δεξιότητες ΚΣ που επιστρατεύονται
Στρατηγική Zoom-in	Δίνω μια λέξη ή φράση για ερμηνεία με βάση πρότερη γνώση και εμπειρία για την οποία οι μαθητές κάνουν αιτιολογημένες υποθέσεις (τύπου ιδεοθύελλα). Συνθέτουν ιδέες για να καταλήξουν σε συμπεράσματα. Έπειτα, τοποθετώ τη λέξη ή φράση σε ένα άλλο πλαίσιο (π.χ. κείμενο, εικόνα) για να αποκτήσει διαφορετικό νόημα το οποίο οι μαθητές προσπαθούν να ερμηνεύσουν. Ταυτόχρονα εξηγούν τον τρόπο που σκέφτονται και δρουν κάθε φορά.	✓ Ερμηνεία – Αποκωδικοποίηση ✓ Συνεπαγωγή – Διατύπωση αιτιολογημένων υποθέσεων ✓ Επεξήγηση τρόπου σκέψης
Βέννειο Διάγραμμα 	Δίνω δύο εικόνες/δηλώσεις/κείμενα και καλώ τους μαθητές να τα συγκρίνουν σε ό,τι αφορά σε περιεχόμενο, τη δομή ή τα γλωσσικά και μη γλωσσικά στοιχεία. Επιλέγουμε κριτήρια κάθε φορά με τους μαθητές.	✓ Ανάλυση – Σύγκριση
Αλυσίδα Ιστορίας	Δίνω πίνακα με 2 στήλες. Στη μία έχω συμπληρώσει λέξεις, φράσεις ή προτάσεις από το αφηγηματικό κείμενο (ιστορία) με τη σειρά που εμφανίζονται σε αυτό. Στη $2^{η}$ στήλη οι μαθητές βάσει των ενδείξεων μαντεύουν την ιστορία και προβλέπουν το περιεχόμενο αιτιολογώντας τις προβλέψεις τους.	✓ Συνεπαγωγή – Διατύπωση Αιτιολογημένων Προβλέψεων
Πίνακας για συμπλήρωση γνωστών και νέων πληροφοριών	Αξιοποιώ πληροφοριακό ή άλλο είδος κειμένου και καλώ τους μαθητές να εντοπίσουν & να καταγράψουν πληροφορίες για συγκεκριμένες θεματικές κατηγορίες και να καταλήξουν στο ποιες επιπρόσθετες πληροφορίες δεν συμπεριλαμβάνονται στο κείμενο και χρειάζεται να τις αναζητήσουν. Μπορώ να δώσω επιπρόσθετες πηγές ή/και υλικό.	✓ Συνεπαγωγή – Διερεύνηση δεδομένων

Εννοιολογικός χάρτης επιχειρημάτων 	Μπορεί να χρησιμοποιηθούν πολλαπλές μορφές χάρτη επιχειρημάτων. Για παράδειγμα, μπορεί να χρησιμοποιηθεί το διαγραμματικό στήριγμα που παρατίθεται, ώστε οι μαθητές να αναλύσουν επιχειρηματολογικό κείμενο ή/και να οργανώσουν δικό τους κείμενο με την οπτική και τα επιχειρήματά τους, καταγράφοντας εισαγωγή, σώμα επιχειρημάτων και συμπέρασμα/συμπεράσματα. Μπορεί, όμως, να χρησιμοποιηθεί και απλός πίνακας («Claim – Support Draw») όπου στην $1^{η}$ στήλη καταγράφεται η θέση (Claim), στη $2^{η}$ στήλη καταγράφονται οι λόγοι (Support with a Reason) και στην $3^{η}$ στήλη τα τεκμήρια/αποδείξεις/ παραδείγματα (Proof).	✓ Ανάλυση επιχειρημάτων ✓ Επεξήγηση – Ανάπτυξη επιχειρημάτων
Γραμμή προβληματισμού ή Γραμμή Σκέψης (Exit Slip Question Statement)  (ΝΑΠ Ε’ τάξης, σελ. 17)	Οι μαθητές καλούνται να τοποθετήσουν σε διάφορες θέσεις στη γραμμή προβληματισμού sticker notes με την απάντησή τους στον αρχικό προβληματισμό του μαθήματος. Η γραμμή προβληματισμού επαναφέρεται κατά τη διάρκεια του μαθήματος ως πλαίσιο. Στο τέλος του μαθήματος οι μαθητές καλούνται να επανατοποθετηθούν στη γραμμή προβληματισμού αναπτύσσοντας επιχειρήματα.	✓ Επεξήγηση – Ανάπτυξη επιχειρημάτων
(Χρονική) Γραμμή της αφήγησης 	Η συγκεκριμένη στρατηγική μπορεί να χρησιμοποιηθεί ποικιλοτρόπως. Για παράδειγμα, μπορώ να διαβάζω αποσπασματικά το κείμενο και σε σημεία-επεισόδια να σταματώ, ώστε οι μαθητές να καταγράφουν σε φιλμ τίτλους σκηνών/επεισοδίων. Εναλλακτικά, μπορεί να διαβαστεί το κείμενο μεγαλόφωνα ή/και σιωπηλά και έπειτα από αρχική ανάλυση/κατανόηση μέσω εύστοχων ερωτήσεων, οι μαθητές να αναλύσουν την αφήγηση σε σκηνές σε ζευγάρια ή ομάδες.	✓ Ανάλυση – Εντοπισμός βασικής ιδέας και επιμέρους ιδεών

Σημασιολογικός χάρτης περιγραφής	Καλώ τους μαθητές να παρουσιάσουν οργανωμένα σχέσεις που συνδέουν τις γενικές και τις ειδικές και επιμέρους πληροφορίες ενός περιγραφικού κειμένου με ιεραρχικό τρόπο	✓ Ανάλυση – Εντοπισμός βασικής ιδέας και επιμέρους ιδεών ✓ Συνεπαγωγή – Εξαγωγή συμπερασμάτων
Λίστα Ελέγχου με Κριτήρια ή/και ερωτήσεις	Αφού προηγηθεί προσυγγραφικό και συγγραφικό στάδιο με παραγωγή γραπτού λόγου, καλώ τους μαθητές σε αυτό-αξιολόγηση στη βάση κριτηρίων. Τους καλώ να αναστοχαστούν σε σχέση με τον σκοπό αλλά και τα κειμενογλωσσικά χαρακτηριστικά του κειμένου τους. Έπειτα καλούνται σε αυτοδιόρθωση – διόρθωση μέρους ή όλου του κειμένου τους (μέσω προσθήκης, αφαίρεσης ή/και αναδιατύπωσης στοιχείων και πληροφοριών). Σημαντικό να δώσουμε έμφαση στο να κατανοήσουν οι μαθητές τι διορθώνουν και γιατί.	✓ Αυτορρύθμιση – Αυτοαξιολόγηση και Αυτοδιόρθωση

Σημαντικές Σημειώσεις / Παρατηρήσεις

- Η ενδεικτική αντιστοίχιση των διδακτικών στρατηγικών που προτείνονται πιο πάνω με δεξιότητες κριτικής σκέψης δεν εξαντλεί τις στρατηγικές (ή/και τις δραστηριότητες), αλλά και την αντιστοιχία τους με συγκεκριμένες δεξιότητες ή/και συνδυασμό δεξιοτήτων ΚΣ, που είναι δυνατόν να αξιοποιηθούν για την άμεση διδασκαλία της ΚΣ.
- Αρκετές από τις διδακτικές στρατηγικές που προτείνονται πιο πάνω προτείνονται και στο Νέο Αναλυτικό Πρόγραμμα (ΝΑΠ, Νοέμβρης 2016) του μαθήματος των Ελληνικών.