Enhancing Critical Thinking Skills and Dispositions Through Reflective Writing Among Moroccan University Students

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Enhancing Critical Thinking Skills and Dispositions through Reflective Writing among Moroccan University Students

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To Me, Myself and I
Abstract

The present research investigated the progress/development of critical thinking skills and dispositions through a reflective writing intervention. It was hypothesized in the study that metacognitive processes underlying reflective writing and critical thinking interweave. In other words, when students think critically or write reflectively they tend to use the same cognitive skills as writing in general is a circuit of thinking. Hence, it has been empirically proven that Reflective writing is a pedagogical strategy, among others, that enhances Critical Thinking skills and dispositions of University students.

The research consists of two case studies in two different settings using reflective writing intervention. Progress on critical thinking skills and dispositions was measured using the ARC rubric, CCTDI and CCTST pre-test and post-test. The first experimental study was held at a Business College in Rabat (knowledge CBI). Reflective Writing productions of thirty Business College Juniors (N=30) were assessed, evaluated and scored over one academic term. The assessment was performed according to the Assessment Rubric for Critical thinking Skills which was originally designed within the Quality Enhancement plan (QEP) initiative, Georgia State University 2009. Current findings were significant as the six critical thinking skills defined in the rubric and proved major progress. It was hypothesized in the current study that Business college juniors’ critical thinking skills would improve following one academic term (8 weeks) reflective writing intervention. After assessing Students’ written productions using the ARC, a one way repeated measures ANOVA was conducted to evaluate change in critical thinking skills as a result of the reflective writing intervention. Results showed progress in the development of critical thinking skills (p<001.) in all critical thinking skills. The second study is a level III pretest –posttest experimental study held at the Faculty of Education, University Mohamed V, Rabat. Fifty one (N=51) third year (BA) students of which twenty seven (N=27) participated in Reflective Writing Intervention as an experimental group for 8 weeks and took the CCTDI and CCTST pre intervention and post intervention tests. Results of the experimental and comparison groups were statistically processed using a mixed design ANOVA. Results were significant at the level of both skills and dispositions. Critical thinking dispositions’ overall scores differed significantly between control and experimental groups from pre- test to post-test. Therefore, the interaction between reflective writing intervention and critical thinking dispositions was significant, F (1, 49) = 34, 59, p<001. Similarly, Critical thinking skills’ overall scores differed significantly between control and experimental groups from pre- test to post-test.
Therefore, the interaction between reflective writing intervention and critical thinking skills was significant, F (1, 49) = 14, 12 p<.001. This indicates that at least one CCTST subscale differed by group. It was also hypothesized that critical thinking dispositions are a predictor of academic achievement among faculty of education experimental group. A Pearson’s correlation was performed on overall change in CCTDI and semester 5 academic scores of the experimental group to investigate this relationship. A negative correlation was found r = - .43*, n = 27, p =0.024 between the two constructs suggesting that critical thinking dispositions do not predict higher academic scores. In the same vein, this entails that the reflective writing intervention in this study is not responsible for promoting academic achievement. Last, it was hypothesized that critical thinking dispositions are a predictor of critical thinking skills acquisition. A Pearson’s correlation was conducted on overall change in CCTDI and overall change of CCTST to investigate this relationship. A positive but marginal correlation exists between critical thinking skills and dispositions on the overall gains in both components r = 0.380, n = 51, p =0.006. This suggests that the variance in critical thinking skills test scores is potentially attributable to the differences in students’ critical thinking dispositions scores.
Abstract

La recherche présente examine le développement des compétences et dispositions de la réflexion critique à travers une intervention se basant sur la rédaction réflexive. L’hypothèse formulée pour cette étude se nourrit du fait que les processus métacognitifs sous-jacents la réflexion critique et la rédaction réflexive s’entrelacent. Autrement dit, quand les étudiants pensent d’une façon critique ou écrivent avec réflexion, ils ont tendance à utiliser les mêmes compétences cognitives. En effet, l’écriture forme un circuit de communication pour le raisonnement. D’où, il a été empiriquement prouvé que la rédaction réflexive est une stratégie pédagogique, parmi d’autres, qui développe les compétences et les dispositions du raisonnement critique des étudiants Universitaires.

La recherche consiste en deux études de cas dans deux établissements différents utilisant l’intervention de rédaction réflexive. Le progrès des compétences et des dispositions de la pensée critique a été mesuré en utilisant la rubrique ARC (Assessment Rubric for Critical Thinking Through Writing) et les deux tests CCTDI (California, Critical Thinking Dispositions Inventory), CCTST (California critical Thinking Skills Test) en pré-test et post-test. La première étude expérimentale a été tenue au sein d’une École de commerce à Rabat (Knowledge CBI). Les productions écrites de trente étudiants (N = 30) ont été évaluées et marquées pendant un semestre. L’évaluation a été effectuée selon la Rubrique d’Évaluation des Compétences du raisonnement critique (ARC) qui a été à l’origine conçue dans le cadre de l’initiative du Plan d’Amélioration de Qualité (QEP), au sein de l’Université d’État de la Géorgie 2009 (Etats Unis). Les résultats actuels étaient significants comme les six compétences critiques définies dans la rubrique ont été sujet de progrès majeur. L’hypothèse centrale de cette étude est que les compétences du raisonnement critique des étudiants de l’école de commerce s’amélioreraient après un semestre (8 semaines) comme résultat de l’intervention.

Après l’évaluation des productions écrites des Étudiants en utilisant l’ARC, une ANOVA à mesures répétée (analyse de variances) a été performé pour évaluer le changement de compétences critiques en conséquence de l’intervention. Les résultats ont montré un progrès dans le développement de compétences critiques (p= 0, 01) dans toutes les compétences définies dans l’étude. La deuxième étude est quasi expérimentale et a été tenue à la Faculté des sciences de l’éducation, Université Mohamed V, Rabat. Cinquante et un étudiants de troisième année (N=51) dont vingt-sept étudiants (N=27) ont participé dans
l'Intervention de rédaction réflexive comme un groupe expérimental pendant 8 semaines et ont passé les CCTDI et CCTST pré et post.

Après le traitement statistique des résultats du groupe expérimental et du groupe contrôle en utilisant une analyse de variance à deux facteurs, il s’avère qu’il y a un progrès au niveau des compétences et des dispositions. Par conséquent, l'interaction entre l'intervention de rédaction réflexive et les dispositions de pensée critique était significative, $F (1, 49) = 34, 59, p <.001$. De même, les résultats des compétences de réflexion critique diffèrent considérablement entre le groupe contrôle et le groupe expérimentale, entre le pré-test et le post-test. De ce fait, l'interaction entre l'intervention et les capacités de pensée critique était significative, $F (1, 49) = 14, 12 p <0.001$. On a également émis l'hypothèse que les dispositions relatives à la pensée critique sont un prédicteur de la réussite académique au sein du groupe expérimental de la faculté des sciences de l'éducation. Une corrélation de Pearson a été effectuée sur le changement global dans le CCTDI et les résultats scolaires du groupe expérimental du semestre 5 pour examiner cette relation. Une corrélation négative a été trouvée $r = -43 \ast, n = 27, p = 024$ entre les deux variables suggérant que les dispositions de pensée critique ne prévoient pas la réussite académiques des étudiants. Dans le même ordre d'idées, cela implique que l'intervention de rédaction réflexive dans cette étude n'est pas responsable de la promotion des résultats scolaires. Enfin, on a émis l'hypothèse que les dispositions de pensée critique sont un prédicteur de l'acquisition de compétences en réflexion critique. Une corrélation de Pearson a été menée sur le changement global dans CCTDI et le changement global de CCTST pour examiner cette relation. Une corrélation positive mais marginale existe entre les compétences de réflexion critique et les dispositions sur les gains globaux dans les deux composantes $r = 0,380, n = 51, p = 0,006$. Cela suggère que la variance des résultats des tests de compétences en pensée critique est attribuable aux différences dans les scores des dispositions de pensée critique des étudiants.
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<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ARC</td>
<td>Assessment Rubric for Critical Thinking</td>
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<tr>
<td>CTD</td>
<td>Critical Thinking Dispositions</td>
</tr>
<tr>
<td>CTS</td>
<td>Critical Thinking Skills</td>
</tr>
<tr>
<td>CCTDI</td>
<td>California Critical Thinking Dispositions Inventory</td>
</tr>
<tr>
<td>CCTST</td>
<td>California Critical Thinking Skills Test</td>
</tr>
<tr>
<td>QEP</td>
<td>Quality Enhancement Plan</td>
</tr>
<tr>
<td>WAC</td>
<td>Writing Across the Curriculum</td>
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1.0 Introduction

The current national and international benchmarks of the job market are being more selective than ever, with all the new technologies and job requirements, one should cope with the dynamics of change. Hence, graduate students should be prepared to fit the various exigencies of the new global order. For that, they are expected to be critical thinkers who solve problems creatively, and responsible citizens who make ethical choices and know how to apply and integrate knowledge from different contexts. Students are also expected to be able to present their thoughts cogently both in oral and written communication and at the same time analyse and evaluate important trends in a given discipline and understand the interconnectedness of knowledge. Not only Educational programs should be designed in a way as to meet these requirements, but also educators must commit to sharpening students’ cognitive skills. The association of American College and Universities in its 2007 report, College Learning for the New Global Century, identified intellectual and practical skills including critical and creative thinking, inquiry and analysis, and written and oral communication as elements of the essential learning outcomes that students should gain across their college experience. Therefore, one of the primary aims of undergraduate education is to develop citizens who are able to engage in critical thinking and clear writing as mentioned before. According to Abdellaoui (2011), there is enough evidence to suggest that Moroccan University graduates are not perceived as possessing these standards. The aforementioned is regarded as the result of a range of educational programs which do not serve the development of high order skills and dispositions in terms of textbooks or materials used for they pay scant attention to big ideas but offer no room for analysis.
1.1 Statement of the problem

A prominent goal of higher education is to develop critical thinking ability in students and produce members of society able to engage consistently in higher-order thinking (Higbee, 2005; Kuhn & Dean, 2004). In the Moroccan context, higher education has been subject to important reforms to cope with the new economic and social needs of the country (Abdellaoui, 2011). According to the law 01-00 (the platform of higher education reforms in Morocco since 2004), the missions of higher education are

- Competencies’ formation, development and dissemination of knowledge in all domains.
- The contribution to scientific, technical, professional, economic and cultural development of the nation, taking into account development needs, economic and social progress.
- The mastery and development of science, technology and know-how, through research and innovation.

The reform, though seemingly in line with the requirements of the new global system, neglects aspects of critical thinking. Moreover, tertiary education finds difficulty to foster the above mentioned goals stated in the reform (Abdellaoui, 2011, p: 7). In the same vein, learning to manage change requires critical thinking at the personal and organizational levels (Mintzberg, 2004, p: 238; Smith, Kruschwitz, Laur, & Schely, 2008, p: 4-5). The worldwide concern with improving critical thinking is not driven simply by the desire to advance knowledge for its own sake. The need to improve critical thinking is driven by the requirements of a knowledge-based economy: innovation, efficiency, sustainability, and accountability (Chapnick, 2010). It is not much of a leap to suggest that university graduates should be capable of critically examining assumptions about how and why things are done in contemporary organizations. Just the complexity and the pace of change within many workplaces require graduates to be life-long learners capable of adapting to new circumstances (Canadian Council on Learning, 2007).

In the Moroccan context, limited attention is attributed to cognitive and psychological issues impacting the learning process in tertiary education. The focus is
drawn more towards degree completion, development and dissemination of knowledge rather than endowing learners with the “the ability to reason informally; to monitor one’s own thinking, analyse arguments, distinguish between correlation and causality; identify stereotypes and bias; and to make decision based on evidence” (Burkhart, 2003, p. 3). Moreover, because of current educational assessment approaches, crucial skills required to ensure the above mentioned are usually not assessed in standardized tests and, therefore, are rarely included in the educational programs (Neill, 2003).

The necessity to find effective pedagogical ways to incorporate critical thinking requires a deep understanding of the concept itself and how it relates to other educational components. There have been various efforts to define the construct (Facione, 1990; Vanderstoep & Pintrich, 2003). Although slightly different, most of the definitions of critical thinking corroborate that critical thinking is composed of both critical thinking skills and critical thinking disposition (Lee, 2009). The consensus definition of critical thinking provided by the Delphi report (1990) serves as a broad definition of critical thinking for this research. It defines critical thinking as a cognitive feature enabling ordered, systematic and well-reasoned thinking which comprises 1) a skills dimension that is a set of tools allowing the manipulation and processing of knowledge, 2) a set of characterological attributes thought to be associated with developing success in critical thinking (Facione, 1990, 1995, 1998).

Since the beginning of Critical thinking movement, the construct has triggered a large number of studies (Burkhart, 2006; 2001; Halpern, 1989; Ennis, 1996; Lee, 2004; McDade, 1995; Moon, 2008; Shin, 2002; Thayer, 2006; Wyre, 2007) aiming at its inclusion in curriculum (Pellegrino, 2007). Among the instructional methods given credit to improve reflective thinking is reflective practice and more specifically reflective writing which strongly relates to critical thinking. In fact, a great deal of research (Sable, 2012; Moon, 2008, Facione, 2007,1990) support the idea that reflective practice creates the conditions to establish and strengthen the development of well-reasoned, evaluative judgements and respect of others response (Sable, 2012; Belnky et al., 1986).
Because of the close relationships among critical thinking and reflective writing, and because of the void in the existing literature to investigate them interactively in the same study, this study also analysed relationships among them in order to create a model delineating their relationships to each other.

1.2 Rationale

This research project derived the need for investigation from suggestions reported in previous literature to investigate design and effects of reflective writing instructional strategies to develop critical thinking skills and dispositions in higher education. Above and beyond, the desire to conduct this study is nourished by the researcher’s longing to enhance the critical thinking ability in her first and be aware of her own critical thinking. In the same vein, the researcher’s teaching experience created an urge in her to develop students’ critical thinking abilities. The belief that a professor’s duty is not only lecturing or teaching content but trespasses this to instilling tools and competencies that would allow learners to operate effectively in the long term, was the motive that orchestrated the present study.

1.3 Objectives of the study

The present study intends to examine impact of reflective writing intervention on critical thinking skills and dispositions of university students. It therefore aims at highlighting mechanisms by which the two components of critical thinking operate and if there is interplay linking them to reflective writing. In addition, the research has as a goal to investigate the relationship between critical thinking dispositions and critical thinking skills and explore how the dispositional attributes could predict acquisition of skills. Last, the study looks at the role of critical thinking skills and dispositions in predicting academic achievement.

1.4 Research questions

The present research sets out to answer the following set of questions:
Question 1. To what extent does a Reflective writing intervention impact College students’ performance in Critical thinking skills and dispositions?

Question 2. To what extent do critical thinking dispositions predict the academic achievement of Moroccan faculty of education students?

Question 3. To what extent do critical thinking dispositions predict the acquisition of critical thinking skills of Moroccan Faculty of Education students?

1.5 Hypotheses

H1: Students who receive supplemental instruction on reflective writing develop better critical thinking skills and dispositions.

H2: Critical thinking dispositions are a predictor of academic achievement

H3: Critical thinking dispositions are a predictor of critical thinking skills acquisition

1.5 Organization of the study

The first section 0.1 is a General Introduction to this dissertation including the Background, the Rationale for this research, the Objectives, research questions and hypotheses, and the Organization of the Dissertation.

Chapter 1.0 comprises a Literature Review of relevant concepts highlighting critical thinking enhancement and reflective writing. This chapter presents a critical review of research in each area, aimed at situating this thesis in these areas and creating the bridge for interdisciplinary research.

Chapter 2.0 describes the Methodology. It describes first the Common Ground necessary for an interdisciplinary study and the rationale for the methods used in the study.

Chapter 3.0 encompasses the Presentation and Discussion of the results in the light of the research questions that guide the study.
The General Conclusion includes a summary, limitations of the study, pedagogical implications and suggestion for future research
Literature Review
CHAPTER 1: REVIEW OF THE LITERATURE

1. 0. Introduction

Educationalists have always been aware of the inherence of critical thinking skills and dispositions as an academic outcome. Critical thinking has been identified as a major learning and a cross-disciplinary skill indispensible to prepare students for graduate studies and professional development. Hence, the purpose of this study is to come up with a way to promote critical thinking using reflective writing. In more practical terms, the current study is going to investigate the effect of Reflective Writing intervention on the development of Critical Thinking skills and dispositions of undergraduate students. The literature for this study is reviewed in the context of the conceptual and empirical literature related to four major concepts: critical thinking, reflection, metacognition and reflective writing.

Consequently, it is important to explore as well as expose critical thinking from different perspectives, as a general concept and as a fundamental educational outcome since it prowls primarily about higher education and professional development. The term critical thinking will be defined in a manner that is appropriate to educational concerns. First, there will be an exploration of the theory of critical thinking from Cognitive, psychological and pedagogical perspectives and then the study will consider the practical implications and applications of critical thinking and reflective writing for learners and the learning processes. Then the chapter will clarify the interconnectedness of critical thinking and reflective writing as a pedagogical strategy to promote skills and dispositions. In order to work with the complexities of critical thinking, it should be defined according to perspectives. The purpose of this chapter is to operationalize the term based on review, synthesis, and critique of the literature regarding critical thinking development of college students, so that the use of the term is clear with regard to this study. Despite widespread recognition of its importance, there is a notable lack of consensus regarding the definition of critical thinking.
1.1 Critical thinking

Descartes (1637) said ‘I think, therefore I am’ and challenged the human pride by saying that “it is not enough to have a good mind. The main issue is to use it well” (Les Discours, Vol. 1, p: 7). All human beings can think, however, can all of them use their thoughts critically and engage in critical reasoning. This ability exists in all humans but in different degrees and is thought of as critical thinking dispositions, which mean the abilities, attitudes and habits of the mind of the critical thinker.

Thinking is what differentiates the human being from all types of living creatures. Blaise Pascal (1904) claimed, “We are but thinking reeds, but because we know, we are superior to the universe. Thoughts constitute our greatness” (p: 347). This means that Man is a very feeble creature. Thinking is what makes his power and greatness and his ability to think critically, solve problems, reflect on issues, make decisions is even greater. It is that very process that pushes Men to progress and to become civilized to be able to fit in the very competitive society they live in. H. L. Mencken (1945) explains the latter by saying that ‘Men become civilized, not in proportion to their willingness to believe, but in their readiness to doubt’ (p: 54). Doubt is at the heart of critical thinking. This implies that thinking is the cognitive activity of moving from one state of thinking to another one and it is only the need to know more and the imperfection of the human thoughts that pushes them to question what they see, think about it, analyze it, scrutinize it, evaluate it and it is that very process which stimulates learning. The word ‘critical’ is derived from the Greek word ‘critic’(kritikos), meaning to question, to make sense of, the ability to analyze (Chaffee 2000, p.45, see also Emilia 2005) or decide on judgment or (kriterion) which means standards (Paul and Elder, 2009). Chaffee (2009) proffers that it is through questioning, attempting to make sense of situations, analyzing matters that personal thinking and the thinking of the others is examined.
The intellectual origins of critical thinking could be traced back to the vision and teachings of Socrates 2500 years ago. Through a method of inquisitive questioning, he discovered that people were not able to justify their claims to knowledge rationally. He found out that unclear meaning, poor evidence and contradictory beliefs lied behind an even rhetoric. Socrates set up the assumption that the person cannot rely upon authority as a source of established and tangible knowledge. He stressed the importance of asking insightful and purposeful questions that query deeply into thinking before taking ideas for granted. He also established the vitality of requesting evidence, profoundly examine and scrutinize reasons and assumptions, analyzing concepts, and mapping out inferences for both what is said and done. The method he came up with about questioning is known as "Socratic Questioning" and is considered one of the best strategies to teach critical thinking. In his method of questioning, Socrates stressed the need, while thinking, for ‘clarity’ and ‘logical consistency’. He also highlighted the need to question the commonly set beliefs and explanations reflectively to distinguish the ones that are reasonable and logical from those which are lacking rationality and tangible evidence to support them. Other giants of the discipline were Plato, Aristotle and the Greek skeptics who followed Socrates’ line of thought. They all accentuated the fact that things are most of the time different from what they appear to be on the surface and that only an open and trained mind is ready to read between the lines to trespass the delusive appearances of things and reach a deeper level, namely realities of life. It is from the ancient Greek traditions that emerged the need for those who seek an overall understanding of those deep realities of life to think in a systematic way, to map out implications and inferences deeply. Only a comprehensive, well structured, well-reasoned and objective thinking can intrude the walls of the surface.

Although critical thinking has been studied for decades, and has been variably defined over the past 80 years in particular; the concept is difficult to limit to a single definition as there is no consensus on a single one and it is difficult to agree about what is exactly that constitutes it (Reed & Kromrey, 2001), (Cromwell, 1992; Ennis, 1985; Facione, Sanchez, & Facione, 1994, Paul, 1990).
In the early 1980, the critical thinking movement gained an impetus with research and theories from psychology, philosophy and education. The movement was a result of the dissatisfaction of educators with the back to basics trend in education (Martin, 1994, cited in Fasco. 2006). Therefore, the information processing model took the lead in the study of thinking (Ericsson; Hastie, 1994).

Critical thinking is perceived as both skills and dispositions. It is also perceived as being both a stage in the student’s epistemic development, a trait of character and a learning outcome of the academic career. It includes the component skills of analyzing arguments, making inferences using inductive or deductive reasoning, judging or evaluating, and making decisions or solving problems. The concept is defined in terms of skills and dispositions that could be acquired through instruction and as an outcome of higher education. In 1991, Pascarella and Terenzini compiled several definitions, stating that critical thinking “typically involves the individual’s ability to do some or all of the following: identify central issues and assumptions in an argument, recognize important relationships, make correct inferences from data, deduce conclusions from information or data provided, interpret whether conclusions are warranted on the basis of the data given, and evaluate evidence or authority” (p. 118).

When thinking critically, cognitive processes and affective dispositions are integrated (Bandman & Bandman, 1995; Ennis, 1985; Facione, 1990; Halpern, 1996; Paul, 1993; Scheffer & Rubenfeld, 2000; Watson & Glaser, 1980). In addition to dispositions, there are cognitive skills which go hand in glove with those dispositions to allow the process of critical thinking. The cognitive skills are: interpretation, analysis, evaluation, inference, explanation, self-regulation (Facione, 1990) and reflection (Ennis, 1985; Facione, Facione & Sanchez, 1994; McPeck, 1981; Paul, 1993) and are used in a recursive and dynamic manner which enables the evaluation of own interpretation, explanation of one’s analysis and interpretation of own analysis (Facione, 1990).

In his definition of critical thinking, Fisher (2001) linked the concept to creativity and defined it from a perspective emphasizing the quality of reasoning that revolves around logic. He argued that “Critical thinking is a kind of evaluative thinking which involves both criticism and creative thinking and which is particularly concerned with
the quality of reasoning or argument which is presented in support of a belief or a course of action (p.13).”

Critical thinking was thought to be strongly related to logic. The logical approach dates back to the days of Plato and even earlier. For the thinking elite of that time logic and philosophy were highly regarded, and logic was considered the major method associated with critical thinking. Applying logic was perceived as maximizing the objectivity of critique and argumentation. In general, logic is concerned with the quality of reasoning and the way arguments are constructed and takes a hard line on ‘objective truth’ (Moon, 2007). The aforementioned is reached through the appropriate techniques of logical analysis, when the subject matter is represented by problems with a kind of expected ‘correct answer’ (Moon, 2007). Adding to the fact that critical thinking is a problem solving process, it is also an assessment process in which all types of assumptions are subject to question and divergent views are sought and analyzed in a way that is unbiased and undirected by predetermined notions (Halpern, 1988).

Chaffee (2002) defines critical thinking as an educational philosophy, a field of academic study, and as a method of epistemological inquiry. Chaffee contends that critical thinking is “an ideal, with its own theoretical framework, used to organize experience, construct knowledge, and develop a philosophy of life” (Chaffee, 2002, p. 4). Ennis (1985) approached critical thinking in a slightly different but not divergent manner, in terms of belief and decision making, and defined it as “reflective and reasonable thinking that is focused on deciding what to believe or do” (p. 45).

On the basis of his deep research in the field of critical thinking, Ennis correlated four sets of abilities of critical thinking: sets related to making inferences, establishing a basis for inference, decision-making, and problem solving. The aforementioned abilities set the ground for individuals to make decisions about what to believe or do. A definition considering the same perspective is that of Cottrell (2005). She claims that “critical thinking involves working out whether we believe what we see or hear; taking steps to find out whether something is likely to be true; arguing our own case if someone doesn’t believe us”(P: 5).

Another similar categorization was made by Brookfield (1987) who identifies four constituents of critical thinking: ‘identifying and challenging assumptions,
challenging the importance of context, identifying and exploring alternatives, and reflective skepticism’. Similarly, Paul (1990) differentiates between sophistic or weak critical thinking (or uncritical thinking), in which the occurring thinking process is directed towards self-interest, and fair-mindedness or strong critical thinking, in which thinking is open to diversity. The latter helps students to take their time and feel free to adjust their thinking to the different contexts and situations they are confronted with.

Dewey, 1933 defined critical thinking as including three major characteristics necessary to process any belief or form of knowledge. He says that critical thinking is “The active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds that support it and the further conclusions to which it tends” (p: 118). It is important to stress that critical thinking is first a process that requires several stages to reflect on information using high order skills. Information processing is performed on the basis of a given background namely that of the critical thinker. It is a demanding process in terms of cognitive energy as it pushes the person to think and rethink any given piece of information by asking questions, analyzing and evaluating it, which is an active and persistent attempt to have answers. Critical thinking is a mental activity that revolves around the assessment of knowledge and the evidence that would lead to conclusions to foster judgments about that knowledge. The existing literature about critical thinking insists on the fact that it is also a self-regulatory, problem solving process to better the quality of thinking.

Paul, Binker, Adamson, and Martin (1989) contend that critical thinking is ‘thinking about your thinking while you are thinking in order to make your thinking better: clearer, more accurate, or more defensible” (Paul, as cited in Long, 2003, p. 2). They even go further to define it as being a mode of thinking that develops the reflection through the skillful analysis, assessment and reconstruction of evidence within a framework of self-regulation and monitoring. According to Paul, "Thinking about own thinking" is reflection that engages the critical thinker in “disciplined, self-directed thinking...” (p. 137), an "intellectual training for the mind" (Paul, 1993, p. 22)

Facione (2006) highlighted this aspect in his definition of critical thinking. He argues that critical thinking is a ‘purposeful, self-regulatory judgment which results in
interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual consideration upon which that judgment is based” (Facione, 2006, p. 21). The tremendous range of definitions that emerged over the time concerning critical thinking and which tackled the issue from different perspectives and approaches, stresses the fact that critical thinking is an active process that trespasses simple acquisition and memorization of information or knowledge to the complex ability of recognizing and rationally reflecting on different concepts and components that constitute a ground for thought (Jones, Hoffman, Ratcliff, Tibbetts, & Click, 1995, in Halpern 2013).

As mentioned earlier, critical thinking is an aspect of the activity of thinking and a form of learning in the sense that it is a means of generating new ideas by processing the existing knowledge using what Jennifer Moon (2008) calls “tools of manipulation of knowledge” that she summarizes in “analysis, understanding, synthesis” (P: 93), which are strategies of processing information. Throughout the review of the existing conceptual and empirical literature, there has been a strong emphasis on the “criticality” or the evaluative side of critical thinking. The use of the word ‘critical’ represents the notion of critique or evaluation of the processes used in thinking and the anticipated outcomes of the thinking process in which there is a sense of precision and skill. However, the mechanical aspect of critical thinking is not enough to define it fully. Other components such as the learner’s epistemic development and the learner as a critical thinker should be highlighted to have a complete perception of the concept.

1. Critical Thinking and Epistemological Beliefs

At a given stage of higher education, learners are expected to be critical thinkers who solve problems creatively, and responsible citizens who make ethical choices and know how to apply and integrate knowledge from different contexts and perspectives. Students are also expected to be able to present their thoughts cogently both in oral and written communication and at the same time analyze and evaluate important trends in a given discipline and understand the interconnectedness of knowledge. Understanding the way learners view knowledge (epistemology) and the way they construct it has implications for critical thinking abilities and ways of enhancing it. One of the most
important things to critical thinking is to understand the learners’ beliefs about what constitutes knowledge and the process of knowing. This constitutes a condition to finding answers to the question of how some individuals at the same level, the same age could face the same situation and perceive it differently, all claiming knowledge of the genuineness of a given conclusion drawn from that perception. This conundrum is perceived as being the impetus for studying epistemological belief.

When dealing with the term beliefs, a wide spectrum of definitions is denoted. However, the one definition concerned with critical thinking and its developmental nature is that designated personal epistemologies. They represent the set of personal beliefs relevant to knowledge and knowing. They are also defined as “socially shared intuitions about the nature of knowledge and the nature of learning and involve knowledge about the limits of knowing, the certainty of knowing, and criteria of knowing” (Jehng, Johnson, and Anderson, 1993, p. 24). The abovementioned personal epistemologies or epistemological beliefs have a developmental nature in the sense that they progress over time. This sequential nature goes hand in glove with the progressive nature of critical thinking skills and dispositions and explains to some extent why university students lack the critical thinking skills intrinsic to such a level.

Epistemological development has been the subject of considerable research over the last decades. These studies point out that there is a developmental sequence in the epistemological beliefs of the learner which influences the way he/she functions. Consequently, the learner’s capacity to think critically is significantly affected.

The way we think is determined by the structure and functioning of the brain. Thinking involves an electrical and chemical transmission of information via and between neurons in the brain (Sprenger, 1999). In a research that she conducted, Sprenger (2005) found that the release of “Myelin” in the brain (the chemical substance previously mentioned) boosts the individual’s capacity to think at a higher level and enables messages to travel quickly without any loss of information. Moreover, the “prefrontal lobe”, the section of the brain responsible for higher order thinking is the last area to receive “Myelin”. The sufficient myelination of the neurons in this area of the brain is reached at the approximate age of eleven. The aforementioned is an
electrochemical process which begins at birth and is in continuous development until the individual reaches what Piaget (1972, 1990) calls the “Formal Operational stage” of cognitive development matching with the Myelination process. According to him, children begin to think in an abstract way and have the ability to analyze and rationalize in an adult like level at the age of eleven. Skills such as logical thought, deductive reasoning, and systematic planning emerge during this stage. Instead of relying solely on previous experiences, children begin to consider possible outcomes and consequences of actions. This type of thinking is important in long-term planning. This explains the progressive nature of higher order thinking skills like critical thinking.

In another attempt to explain the interplay between learning and high order thinking, Gazzaniga, Ivry, &Mangun, 2002; Handley, Capon, Beveridge, Dennis, & Evans, 2004 (in Oaksford & Chater, 2010) claim that the learning process and outcomes build and alter the learner’s memories. These memories then shape the beliefs held either implicitly or explicitly by the learner. Accordingly, beliefs serve as filters through which received information is processed, stored and used to either modify and strengthen currently held beliefs, or are rejected being considered as incongruous to the already existing knowledge and beliefs (Schreiber & Shinn, 2003). Notwithstanding the nature of the subject, a learner’s prior beliefs determine the ability of that learner to acquire new knowledge. Hence, understanding the process through which beliefs are altered is intrinsic for understanding how learning occurs (Kuhn, 2000, 2001). Having a handle on ways in which to adjust beliefs is vital for developing painstakingly careful and accurate theory of learning. To clarify more the sequential nature of personal epistemologies, we devote the following section to some of the most prominent studies on epistemological development.

1. 1. 2 Developmental Epistemology: Description of Some of the Main Studies

William Perry’s scheme of intellectual and ethical development (1970) is one of the best known studies done about epistemic development and a major reference in this area of research. He proffers that college students ”journey” through nine progressive positions from least to most sophisticate in terms of their attitudes towards knowledge.
He divided the nine positions into four major dimensions. The first stage is Dualism or Received Knowledge and spoon feeding. At this stage learners in higher education interpret the world in an absolutist way of thinking and knowledge is perceived as largely indisputable as it is provided by the teachers: the experts. It is a matter of absorption of knowledge in a dualistic way that is to say either right or wrong, them and us, black or white. Dualism includes two dimensions. The first is basic dualism position where there is a right or a wrong answer to questions or problems and the teacher is an authority figure who holds the knowledge and knows the right and the wrong answer and the students learn the right answer. The second position is full dualism where disagreement of views and facts takes place and learners start to realize that the expert’s views and answers are obscure; hence, they learn the right solution or answer and discard the others. The second stage is Multiplicity or Subjective Knowledge. At this stage there are several conflicting answers, and multiplicity of opinions is accepted and recognized as legitimate. Therefore, students start to have some self confidence and trust their "inner voices" and not the external Authority. Earlier in this stage comes a position where students start to trust self and progress to a stage where they learn how to find right answers and solutions. Later on students discard the teacher’s answers as being right and start understanding that everyone has a right to their own opinion and that they are expected to have more personal and independent thinking. The third stage is relativism or Procedural Knowledge where knowledge is seen as being relative to a frame of reference and it is derived from coherent sources, evidence, logic, systems, and patterns allowing for comparison. Students learn to evaluate answers and solutions and then start to make decisions. The last stage is Commitment or Constructed Knowledge where the learner progress to a state in which they integrate knowledge learned from others with personal experience and reflection. They express their stance towards any given issue. They also discover responsibility of choice, commitment towards it, believe in their own values, and at the same time are open to consider other views and reconsider their own. Correspondingly, the role of the teacher at this stage is seen as that of a facilitator within the process of knowledge development. Perry’s study was conducted on male students. Belenky, Clinchy, Goldberger and Tarule (1996), however, advocate that females might enroll in a different process of developing their conceptions
of knowledge. According to them, the way women think about education and learning shapes their self-perception. Belenky et al identified five epistemological perspectives. These are related to a larger breadth of epistemological development. The first of these stages is the silent stage in which one blindly follows authority, sticks to stereotypes and finds it difficult to define oneself and have a voice of one’s own. Received knowledge, a stage where one listens to voices of others subjectively, then comes a stage where one listens to oneself in a way that serves their senses of obligation to follow others’ view. Knowledge is conceived of in a subjective manner. Procedural knowledge, an epistemological phase where the process of connecting knowledge starts to take place as the notion of truth, becomes personal, particular and grounded in first-hand experience. Women tend to seek truth through listening, empathizing, and taking impersonal stances towards information. Subsequently, they progress to a stage which Belenky called separate knowing in which feelings are completely excluded while making meaning and this process relies strictly on reason. The final stage is constructed knowledge a more sophisticated position where knowledge is perceived as being constructed and related to a context. There is more integration to own opinion and a strong emergence of sense of self. Similarly, Baxter Magolda (1992) was originally interested in gender issues. She argues the possibility of making a distinction between the types of thinking of men and women. Her study included a mixed population of college students. She highlights four main perspectives of knowledge and reasoning, similar to the previously discussed studies, in which she displays a similar sequential growth. Baxter Magolda’s study is well placed to illustrate the developmental nature of conception of knowledge relevant to higher education. Magolda’s first stage is absolutist knowledge corresponding to Perry’s dualist stage in which knowledge is seen as “absolute” and the process of learning mainly about absorbing the knowledge of the expert: the teacher. Another stage is transitional knowing, in which learners start to doubt the certainty of knowledge and progress to a position where they avow that there exists certainty and partial uncertainty which is subjective. The third phase is independent knowing where learners start to be aware of the fact that knowledge is uncertain and that there is acceptance of different opinions and beliefs. In a more developed stage _ that of contextual knowing_
knowledge is perceived as constructed and comprehended within the framework of effective evidence and context fitting.

We have, therefore, three studies described in this section which provide evidence that epistemological development is occurring in stages that follow a given continuum.

1. 1.3. The Intersection of two Dimensions: Critical Thinking and Epistemological Development

Significant changes on the quality of the thinking process and thoughts produced occur during the period of higher education. As mentioned in previous sections, a learner’s prior beliefs determine the ability of that learner to acquire new knowledge. This is well illustrated in some researchers’ attempts to investigate the relationship between epistemological development and learning as an initial step to uncover some of the odds enveloping critical thinking and epistemological development. In his study, Rayan (1994), and based on Perry’s findings, suggests that one’s epistemological beliefs shape the psychological context in which the learner builds up standards to assess and analyze the extent to which knowledge has been extracted from a given text. He assumes that the degree of knowledge extracted from a text is closely dependent on this learner’s stage of epistemological beliefs. The latter answers a range of questions concerned with the perception of knowledge in the classroom. Perry’s publication, “Different worlds in the same classroom” (1985) advocates that the same teaching materials and the same teaching methods could be perceived differently by individuals in the same classroom but who are at different stages of epistemological development. It has been demonstrated that analysis of an individual’s personal epistemology and its developmental sequence predicts the ability of that individual to employ high order thinking in both personal and academic situations. In other words, the more mature or complex the beliefs are the more likely it is for higher order thinking to be employed or to occur. If we go back to the question of why most of our University students do not display the necessary critical thinking skills and dispositions, we would merely say that it is in part due to the fact that they are not yet able to conceive of knowledge in a way that allows them to fully engage in the critical thinking process. Still, I have concerns
about the way learners deal with material of teaching which assumes they are at a more sophisticated stage of epistemological development than is their case. The teaching material might be a lecture which presents various theories or even a modeling of critical thinking. Learners who are still absolutists will be disturbed and their beliefs will be shaken by the wide span of alternatives presented. One way to manage this situation is for them to believe that they are being trained by the teacher to think by generating alternatives. However, the question to be asked at this point is: does the teacher know which is the right theory? Another way might be to learn the content of the material in an absolutist way, that is to say, memorizing for the sake of examination or dissertations, but then, would it be appropriate for the claims of enhancing critical thinking?

A better understanding of how one’s personal epistemology matures can help educators develop more effective methods to facilitate learning and lead to a more full understanding of epistemologically states of minds.

1. 1.4. Pedagogical Practices Supporting the Enhancement of Critical Thinking and Epistemological Development

The enhancement of epistemological development and critical thinking occupies a major place in pedagogical practices within curriculum design. Baxter Magolda investigated further development of both concepts in some of the students’ sample she assisted through university years. She was able to point out some of the factors contributing to further development. Magolda (1994) found that due to its nature, postgraduate education puts students in contextual conceptions of knowledge and so did professional life situations in the sense that it confronts them with real life situations which held them responsible for self-decision making. Still, fostering critical thinking and enhancing epistemological development in a group of students requires careful management. They should also be provided with examples of critical thinking to be able to have a handle on the concept. Reflective approaches should be fostered in either oral or written communication to promote reflection. Teachers should select material that displays ambiguity and the possibility of multiple perspectives in order to stimulate the thinking of students like fiction and poetry (Kloss, 1994) but still within the framework of epistemological stages.
According to the above mentioned studies, the conclusion to be drawn at this point is that there is a qualitative change that occurs in learners’ conception of knowledge and this is essential for the process of learning at the higher education stage. Fully developed critical thinking involves analyzing arguments, making inferences using inductive or deductive reasoning, judging or evaluating, and making decisions or solving problems. It also involves the recognition that knowledge is constructed. Hence, fully developed critical thinking cannot logically be possible until the learner has reached the developmental stage where he/she recognizes that knowledge has a constructed nature and that he/she can take a relativist stance of it. This developmental stage could also be seen from a neurocognitive perspective as it is related to the full myelination of the prefrontal lobe/cortex responsible for high order thinking skills and hence determining the level of cognitive maturity. There is a strong link between the prefrontal lobe functioning and the person’s personality. This brain area is implicated in planning complex cognitive behavior, personality expression, decision making and moderating social behavior. It orchestrates thoughts and actions in accordance with internal goals and supports concrete rule learning (Shimamura, 2000). He proposed dynamic Filtering theory to clarify the role of prefrontal cortex in executive functioning or cognitive control and supervisory attention system as a general term for regulation of cognitive processes including working memory, reasoning, task flexibility and problem solving. The studies of executive functioning yielded to a developmental sequence as these abilities mature at different rates over time. In a study conducted about Adolescent maturity and the brain by Johnson and Bloomberg (2009), longitudinal neuroimaging demonstrated that the adolescent brain continues to mature well into the twenties. These results show that there is a strong link between neuromaturation and maturity of judgment. Hence, the prefrontal lobe/cortex is among the last brain parts to mature and may not be fully developed until halfway through the third decade of life. The talk about the full myelination of prefrontal lobes and cognitive maturity leads us to talk about the relationship between critical thinking metacognition and self-regulation more clearly in the following section.
1. 1.2. The Person as a Critical Thinker

Critical thinking is not only about processes, procedures, practices, skills or dispositions. It revolves in great part around the person as a critical thinker who is the circuit of all the above mentioned. The critical thinker has some traits that allow him to interact with his world objectively, rationally and remain in constant progress. According to Brookfield (1987), “Being a critical thinker involves more than cognitive activities such as logical reasoning or scrutinizing arguments for assertions unsupported by logical evidence. Thinking critically involves recognizing the assumptions underlying our beliefs and behaviors. It means we can give justifications for our ideas and actions. More importantly, perhaps, it means we try to judge the rationality of these justifications. We can do this by comparing them to a range of varying interpretations and perspectives . . . we can test the accuracy and rationality of these justifications against some kind of objective analysis of the ‘real’ world as we understand it.”(p. 13–14).

The critical thinker is predisposed with the following set of traits: inquisitiveness, self-confidence in one's ability to reason, open-mindedness regarding divergent world views, flexibility, fair-mindedness, honesty about personal biases, understanding of the opinions of others, reasonableness, commitment to remain well-informed (Facione, 1990), and reflection (Ennis, 1985; Kataoka-Yahiro & Saylor, 1994; McPeck, 1981; Meyers, 1986; Paul, 1993; Scheffer & Rubenfeld, 2000). The dispositions, or habits of the mind, represent personal attributes as well as the tendency to use them. To engage in critical thinking, one uses the dispositions in ‘conjunction’ with the cognitive skills (Bandman & Bandman, 1995; Ennis, 1985; Facione, 1990; Paul, 1993; Scheffer & Rubenfeld, 2000; Watson & Glaser, 1980).

An important element of the list of personal attributes of the critical thinker is interest or intellectual curiosity (Moon, 2008). According to Moon, it is the driving force behind critical thinking activity and the whole reason behind questioning an issue. She goes further to claim that some people are intellectually curious and are able to think critically while others tend to accept ideas and assumptions (Kneale, 2003, cited in...
Moon, 2008, P. 75). Meyers (1986) sets the ground of his pedagogy of critical thinking in part on the basis of curiosity, stimulation and interest. He argues that “curiosity is fed by disequilibrium in thoughts”. (P. 80). Hence, intellectual curiosity is a form of motivation (Moon 2008).

The talk about intellectual curiosity and the other traits characterizing the critical thinker directs the discussion to more detailed areas related to the person as part of the critical thinking process. In addition to the components mentioned earlier, there are other premises that impact both the person as a critical thinker and the critical thinking process. In fact, all definitions about critical thinking tend to keep the concept within the hallow of logic, objectivity, rationality and systematicness, excluding all type of emotion and subjectivity while personal premises like personality, ‘emotion’ and ‘academic assertiveness’ are central to critical thinking (Moon 2008). These are elements inherent in the process of enhancing critical thinking in a person. Meyers (1986) and Brookfield are examples of numerous other writers who are in support of the centrality of concern with the person. Concerning the personality and cultural background of the critical thinker, Brookfield claims that ‘Information about these two factors is the most important one can obtain before trying to make a person think critically about some aspects of life’ (1987). (Cited in Moon, 2008, p. 231).

Personal emotion is inherent to critical thinking; however, it is still a ‘neglected issue’ (Blom Kendal and Montgomery, 1997, p. 74). Hastie and Davies (2001) argue that “everyone knows that emotions play a significant role in decision making and choice”. At this point, determining the role emotion plays remains difficult as there is no consensus on what constitutes it. Moon (2008) suggests that in dealing with emotion one might be dealing with more than one role. De Bono (1982) contends a similar claim. He says that “in the end all thinking is emotional. In the end our decisions, choices and courses of action are all determined by emotions, feelings and values. The purpose of thinking is to serve us as human beings and feelings are the best judge of the effectiveness of that service”. (p. 76) He goes further to ask a pertinent question “Do we use our emotions first and allow these to determine our perception and our thinking? Or
According to Moon (2008), “emotion is involved in critical thinking where emotions or topics with emotional associations are the subject matter of the critical thinking or where relevant emotion is a conscious influence on the nature of the knowledge” (p. 70). She gives an example of a situation concerning critical thinking activities when the activity is about a personal issue like reflecting on one’s behavior or experience (p. 70). Brookfield (1987) says “challenging unquestioned assumptions, looking skeptically at givens we have lived by, and trying to shake off habitual ideas and behaviors so that we can try out alternatives, are emotionally potent activities” (p. 70 cited in Moon 2008).

Accordingly, emotion can have an influence on the process of critical thinking in the sense that it can interweave the process by influencing the manner in which we make use of the ideas and material of learning (Moon 2008, P. 72). She illustrates this idea by referring to the pedagogical literature which indicates the urge to create a ‘safe’ and risk-free atmospheres where learners in particular terms can voice the outcome of their critical thinking process freely. Read, Francis and Robson (2001) conducted a research on ‘the student voice’ in writing and found that learners were inhibited by the lack of self-confidence to express themselves. It is both due to the power relationship between them and the teachers who are regarded as the source of knowledge and because of their position in the classroom.

Another assumption is that emotions are not clearly relevant to a given situation, they may inhibit, facilitate or modify cognitive processes such as Critical Thinking (Moon 2008, Claxton 2000). The way in which emotion can distort critical thinking is vital. De Bono (1983) suggests that there is a need for a person to feel that he is right, which the author claims could be translated into ‘winning the argument’. It is always directly linked to the ‘preservation’ of ‘self-esteem’. Following the same line of thought, he proffers that “In practice, being right has nothing to do with reality. Being right means believing that you are right at the time of thinking” (p: 12). Moon (2008) adds that this need to be right is crucially reflected in the way in which arguments and
evidence are selected and considered for a given situation or the way in which the process of reasoning is manipulated and hence distorted.

Based on the abovementioned framework, it is suggested that there are different manners in which emotion impacts critical thinking and learning. Critical thinking is definitely related to emotion but not in a simple way.

As mentioned earlier in the discussion about the person as a critical thinker, ‘academic assertiveness’ is an important element that the person engaging in the process of critical thinking should have. Being academically assertive as a thinker is ‘being self-confident, having a voice in academia, and having the ability to process, work with and express critical ideas and action’ (Moon 2008. P. 77). Similarly, she proposes a general definition of the term by saying that “academic assertiveness is a set of emotional and psychological orientations and behaviors that enables the learner to manage the challenges to the self in progressing in learning and critical thinking” (Moon 2008.p. 79). The word ‘assertiveness’ has a positive connotation in that it is used to talk about ‘positive behavior characterizing successful people in their self-presentation’ (Moon 2008. P. 77). The idea of ‘voice’ expressed by Moon is similar to that expressed by Barnet and Coate (2005) in a section entitled ‘Student voice’ in which they merge ‘self-critique’ and ‘self-drive’. They argue that in academic assertiveness ‘there is a sense of personal independence, of determination not to be tangled up by dogma or fashion but rather find a way that keeps one’s truthfulness’. They conclude the section about Students voice by questioning ‘the way in which fashioned curricula nurture the student voice, give students the powers of expression in different contexts with different listeners’.

Meyers (1986) related the aforementioned ideas to critical thinking. He contends that the process of critical thinking “is not a dispassionate learning process in which students need only to be shown new ways of perceiving things in order to follow it, but a threatening encounter that challenges one’s very selfhood”(p.96 cited in Moon 2008).

Moon (2008) suggested that the process of being academically assertive includes a set of behaviors which could be observable in the academic work and in the learning
experience. She summarizes these behaviors in the following. 1) ‘finding a suitable ‘voice’ through which to engage in critical thinking or debate 2) the ability and willingness to challenge, to disagree and to seek or accept a challenge 3) the ability to cope with the reality or the likelihood of not being ‘right’ sometimes, making an error or failing, effective recovery from these situations, the willingness to change one’s mind if necessary; the openness to feedback on one’s performance 4) willingness to listen and account of the viewpoint of others, awareness that others can make mistakes and reasonable tolerance of their failings 5) autonomy _a willingness to be proactive; to make and justify independent judgments and to act on them; 6) an appropriate level of academic self-esteem’ (p.79). For a more elaborate understanding of the above behaviors, it is required to expand on each of them. First is the talk about finding an appropriate voice to engage in critical thinking, it is worth noting that voice at this stage means “the sense that a person possesses to express a point of view”(Belenky, Clinchy, Coldberger and Tarule, 1986, p. 67). It is the ability to feel recognized and comfortable as a person with opinions and the ability and will to express them (Moon 2008, Gilligan, 1998). Based on the study Belenky et al. conducted about ‘voice’ and gender issues, it is of paramount importance to highlight the role of gender in academic assertiveness and the absence of it as well. However, it is only one partition. According to Moon (2005), learners from non _dominant backgrounds or cultures can develop similar difficulties concerning the element of voice in academic contexts. To narrow down the scope of the notion of voice, it should be explored in some narrower contexts specific to learning and critical thinking. In this context, voice has implications in ‘self-confidence to express oneself in the academic environment’ in which most learners have the feeling of being totally novice while they are at final year in a Bachelor’s degree in the majority of the times (Moon 2008). As an explanation to this situation, Read et al.(2001) suggest that this holding back stemming from a situation of lack of self-confidence is due to the power relationship between the instructors and students through a belief that lecturers will penalize views with which they do not agree.

In addition, the notion of voice in the context of critical thinking involves a sense of sensitivity that the learner should either have or acquire (Moon, 2008). Voice could also find a meaning in the context of critical thinking and written expression. It is
strongly related to the expression of the writer in a given writing task. A comment on an essay involves the very meaning of voice in writing. According to Moon (2008), the notion of voice is concerned with the state of the writers as they engage in the process of expressing themselves in essay or other form. To sum up, academic assertiveness deals with ‘voice building’ (Gleaves and Walker 2007 cited in Moon 2008, p. 81).

The following section is about the willingness to challenge, to disagree and to seek or accept a challenge. It refers to the urge to enable students to move towards a more active state of thinking and therefore of being. The common tradition in educational settings is spoon feeding as opposed to the ability and willingness to challenge. To foster this ability, the creation of a challenging atmosphere is necessary. Meyers (1986) stresses the need of creating a challenge by creating ‘disequilibrium’ or ‘constructive disorder’ as mentioned by Yinger (1980). The latter goes further to contend that “Teaching critical thinking involves intentionally creating an atmosphere of disequilibrium, so that students can change, rework or construct their thinking” (p. 21). However he insists on the fact that this situation should be created in the most careful conditions by taking into account the amount of disequilibrium that will give positive and useful results. When connecting the idea of creating disequilibrium to challenge, it is worth mentioning that in any class, some students are challenged just by their being there while some others are ready to take responsibility and handle any kind of challenge (Peelo, 2002). At the same time, there are learners who are expected to interpret ideas differently depending on their level of epistemological development and cognitive maturity.

Moon (2008) proffers that “the challenge in critical thinking is a challenge to oneself” (p. 28). In the same line of thought, Paul and Elder (2004) raise the issue of ‘having intellectual courage’. They suggest that possessing intellectual courage in critical thinking is similar to having consciousness of the necessity and importance of fairly facing and addressing ideas, concepts, beliefs or points of view towards which there is a tendency to neglect due to the amount of challenge they present.
The third behavior is coping with reality or likelihood of not being ‘right’ sometimes; making an error or failing; effective recovery from these situations; the willingness to change one’s mind if necessary; the openness to feedback on one’s performance (Moon, 2008). Critical thinking is mainly about risk management and dealing with challenge as mentioned earlier. A specific area specialized in coping with risk in critical thinking is disagreement and having to admit the ‘not being right’ issue, or coping with failure which is most of the times not feasible to the majority of people and especially learners. These all involve emotion related to the self and the image of the person which could seriously impact the self-esteem and therefore inhibit any further critical thinking. At this point there should be a distinction between ‘being right’ and ‘evaluating a judgment’. De Bono (1983), for instance talks of similar ways of being right but these are modes of evaluating a judgment. He talks of the emotional, logical modes; a form of intuitive rightness and rightness based on evaluation. According to Moon (2008), these modes are not associated with the ability of generating the right or most appropriate response in a given situation. For her, ‘being right’ is related to the concept of ‘winning an argument’ or to be judged ‘right by others’. While receiving comments on their performance in class, many learners take it as being a punishment to their so called mistakes. Therefore, it is difficult for them to recognize that the whole matter is about the task or conduct of failure, and not about the person they are (Moon, 2008). A directly related issue to the notion of failure is ‘recovery from failure’ (Cannon 2002) which is accepting the fact that humans do fail and make mistakes and need constructive thinking to recover (Back, 1982; Gillen, 1992). Another fundamental action to critical thinking is the aptitude to change one’s mind about a given argument. This process raises negative comments on the part of others and involves emotional energy which is rarely recognized in discussing critical thinking (Moon, 2008).

The fourth point to be considered is the ‘willingness to listen and take account of the viewpoint of others, awareness that others can make mistakes and the need to have reasonable tolerance of their failings’ (Moon, 2008, p.92). Critical thinking is an activity that is performed in a social context, that is to say, it requires a social interaction and therefore intrudes the actions of the thinker. Accordingly, it involves active listening, objective reading of others work and consciousness of what lies between the lines,
awareness of the assumptions and consideration of the context of information (Moon, 2008).

Concerning the consideration of the others’ viewpoints, Paul and Elder (2004) came up with the term ‘intellectual fair mindedness’. They define it as ‘being aware of the need to deal with all viewpoints alike, without referring to one’s own feelings or vested interests, or feelings or vested interests of one’s friends, community or nation’. Similarly, Bailin, Case, Coombs and Daniels, (1999) make use of the term ‘fair mindedness’ claiming that respect for others in group inquiry is needed. This does not only involve attributing a ‘fair hearing’ to others but also the recognition of the role their feelings play and the role of authority when it comes to those who could be considered as experts in a given matter. The fifth factor is the ability to be autonomous; a willingness to be proactive; to make and justify independent judgments and to act on them. When talking about autonomy in this section, it is referred to as being a central characteristic to the development of critical thinking. Autonomy here implies the ability “to stand up for one’s firmly grounded beliefs” (Moon, 2008, p.146). Bailin et al. (1999) refer to it using the term ‘independent mindedness’ which involves the process of independent judgment. It is worth mentioning, at this stage, Ronald Barnett’s standpoint about the necessity for higher education to produce citizens who have the ability to engage and interact ‘actively’ within their societies, instead of “just being good at thinking and reflecting”(p: 287). According to Barnett and Coate (2005) curricula should be designed in a way that requires ‘critical engagement’ which in turn demands ‘daring to take a stand, to declare oneself, to be clear about one’s opinion, argument, and position (p.148 in Moon 2008). Following the same idea, Baxter Magolda (2004) made a study about the learner’s ability to make independent judgments vis a vis other abilities to process knowledge and found out that both of them are related to the level of epistemological development required by higher education.

The last factor is an appropriate level of academic self-esteem. According to Moon, 2008, self-esteem is inserted in the majority of the abovementioned factors as all of them are interrelated. Relating to the way in which learners consider or approach a given learning task, it has been shown that students with more self-esteem tend to take a
deeper stance (Abousire, 1995). However, the situation is not the same when it comes to critical thinking. Learners with high academic self-esteem may feel that they have easy access to the ‘right’ answer in critical thinking. Another situation that requires self-esteem is the one in which there is ‘an encounter of multiple issues and in which the learner cannot find an acceptable outcome to the thinking process’ (Moon, 2008, p. 150).

There exists different features of self-esteem, and most of them are significant to the process of critical thinking and would support other features of academic assertiveness including the ones mentioned above. Self-esteem could have a great impact on the way in which the learner deals with a critical thinking task which imposes a certain difficulty to him or her. When facing situations of critical thinking, learners with low self-esteem may perceive the ‘whole learning self as being the problem, while those with high self-esteem conceive of the learning matter as being the problem and tend to isolate it from the way they feel about themselves’ (p:156). This leads to a change in the way the problem is approached which is easier than changing oneself (Moon, 2008).

To sum up, academic assertiveness as mentioned earlier in this section is a ‘set of emotional and psychological orientations and behaviors that allow the learner to handle the challenges presented to the ‘self’ within the process of critical thinking and learning development’ (Moon, 2008, p.158). The set of factors identified earlier establish a solid ground for the above-mentioned capacity. The issues sustaining academic assertiveness in its relation to critical thinking are well documented in the literature but are not discussed in terms of classroom practices.

1. 1.6. Critical thinking disposition

Critical thinking trespasses knowledge acquisition and the application of skills only. Critical thinking is both a ‘systemic inquiry and a mental attitude, a complex set of abilities and a process of dealing with ideas’ (Cromwell, 1992, p. 39). One can have the ability to think critically but not the ability to exercise it or the opportunity to apply it
due to some circumstances (Norris, 2003). Case, (2004) argues that “No amount of skill will overcome the limitations of closed-minded, prejudicial thinking” (p: 8).

Paul (2000) recognizes that critical thinking is not limited to skill development. Strong critical thinking is associated with traits of mind: intellectual humility, intellectual courage, intellectual perseverance, intellectual integrity, and confidence in reason. These are all traits of mind that educators can nurture in their students to promote a disposition toward critical thinking. The latter entails that critical thinking if fostered; it should be done on epistemological bases to reach a dispositional stage. Paul further argues that the development of these habits among weak critical thinkers is restricted to their own self-interest. Intellectual discipline and intellectual values together, constitute genuine education, enabling students to truly transform their thinking.

Halpern (1996) also addresses the necessity of having the appropriate attitude in order to become a critical thinker. She describes a performance-competence distinction that becomes pronounced when students learn critical thinking skills but do not use them. A strong critical thinker must exhibit the following six characteristics: Willingness to Plan. The habit of thinking through responses before answering questions; Flexibility: a willingness to be open to new options and suspend judgment in order to gather pertinent information; Persistence: the motivation to keep working when answers do not come quickly or easily; Willingness to Self-Correct: the openness to acknowledge and learn from mistakes; Being Mindful: a habit of monitoring one’s own comprehension and progress; Consensus-Seeking: the ability to use communication and compromise to achieve agreement with others (p. 25).

The talk about the dispositional side of critical thinking can not be done without referring to the Delphi report (1990) mainly because it is a landmark reference and particularly because it matches the goals of the present study in terms of the categorization they have given to critical thinking dispositions. The Delphi panel found that critical thinking has a necessary attitude, a disposition and habit of mind without which the process can not be performed.

Differently put, critical thinking is not only a set of thinking abilities it is a mode of thinking in which the person as a critical thinker should be immersed in and
predisposed with. It is in a way or in another related to the person and the habits of mind and attitudes he/she is involved in while thinking critically as mentioned in earlier chapters.

According to the Delphi panel report; there is an inevitable urge to relating critical thinking skills to dispositions. The Delphi panel experts claim that the proper exercise of each cognitive skill can be correlated with its cognitive disposition to do so. The latter is at the heart of the whole process of critical thinking. Facione, Sánchez, Facione, and Gainen (1995) hypothesized three possible ways that critical thinking skills and dispositions toward critical thinking might interact.

First, overall disposition toward critical thinking may nurture a student’s decision to attempt the use of critical thinking skills. In turn, successful use of critical thinking skills will then reinforce the student’s disposition toward critical thinking. Second, there may be relationships between specific combinations of dispositions toward critical thinking and specific critical thinking skills. Third, there may be a one-to-one connection between each disposition toward critical thinking and each skill associated with critical thinking (Facione, 1995).

The dispositional side of critical thinking is strongly related to the person as a critical thinker as it is associated with series of attitudes and mind sets. This constellation of attitudes and attributes describes the overall disposition to think critically. According to Dewey, (1997) the situations which the individual has to deal with on a daily basis require the development of a certain set of ‘mind habits’ which demand excellence in reflective judgment. The Delphi research (1990) highlighted the importance of the dispositional side by proffering that “the disposition towards critical thinking can be understood in terms of positive habits of mind” (p: 15). The experts go further to claim that a “person or group strongly disposed toward critical thinking is habitually truth-seeking, open-minded, analytical, systematic, inquisitive, confident in reasoning, and judicious” (p: 16). In the findings of the Delphi research, the panelists disseminated affective dispositions which seem to characterize critical thinkers. There was a consensus on the view that there is a ‘critical spirit a probing inquisitiveness, a keenness of mind, a zealous dedication to reason, and a hunger or eagerness for reliable information which good critical thinkers possess but weak critical thinkers do not seem
to have. According to them “affective dispositions are necessary for the critical thinking skills identified to take root and to flourish in learners” (p: 17). The panelists came up with very important recommendations concerning the dispositional side of critical thinking. They put a strong emphasis on modeling the critical thinking spirit, nurturing those attitudes in students and objectively determining whether they have fully developed and integrated with the high quality execution of critical thinking skills. For the panelists, these are important instructional goals of education. According to the experts of the Delphi research, what can be called a good critical thinker is a ‘person habitually disposed to engage in, and encourage others to engage in, critical judgment. He\'she is able to make such judgments in a wide range of contexts and for a wide variety of purposes. The cogent justification for promoting these affective dispositions characterizing the dimension ‘critical thinker’ are rooted in the critical thinker’s personal and civic values. As mentioned in the Delphi report, ‘the process of critical thinking is believed to contribute to the fair minded analysis and resolution of questions. It is a powerful tool in the quest for knowledge which can help individuals to trespass the blind, sophistic and irrational defense of intellectually defective or biased opinions’. Each of the mentioned authors recognizes that thinking critically is a combination of both skills and dispositions. Moreover, due to the rapid change in all professional fields and the increasing sources of information, individuals possessing internal motivation and tendency to think critically as a habit adding to their level of skills will be prepared to deal with the complexities of life.

1. 1. 6. 1. Reflexive and reflective disposition

Dispositional attributes function within a framework of “reflexivity” and “reflectivity”. These two dimensions operate as a process. In the quest of exploring the nature of critical thinking, Van Gyn and Ford (2006) examine dispositions in a multidisciplinary association. They explained how critical thinking functions within and across academic disciplines. They also elaborated a definition that emphasised what they call a reflexive disposition which is “a feature of thinking that is characterized by a reflexive disposition that guides the mindful application of intellectual habits and
intellectual resources during intellectual deliberations towards an evaluative judgment on a challenge, situation or task” (Van Gyn, 2007, p. 13).

The contextual and conceptual framework they set for critical thinking is a model which encompasses three dimensions: intellectual deliberations, intellectual habits and a reflexive disposition (Van Gyn and Ford, 2007).

First, intellectual deliberation encompasses the identification of a task for investigation, interpretation of background information and existing evidence, application of appropriate thinking strategies, making judgments on the basis of appropriate criteria and building justification for judgments. This dimension accounts for the core skills and sub skills of critical thinking in the Delphi report (1995).

Second, intellectual habits encompass intellectual curiosity, respect for truth and reason, fair and open mindedness, tolerance for ambiguity and complexity, courage to take a position, and willingness to engage in collaborative inquiry (Van Gyn 2007). These intellectual habits corroborate with the general dispositions for critical thinking and the set of sub components noted in the Delphi report.

The third and last dimension is reflexive disposition which is essential for students to engage in critical thinking. It is a specific type of reflexive process (Van Gyn, Ford, 2006) which necessitates attention. It is also the common ground between reflective writing and progress in critical thinking. Reflexive disposition involves the ability to self-regulate in order to reflect on the strengths and limitations of intellectual deliberation (skills dimension) and the use of intellectual habits (dispositional attributes) in making a judgment. The process involves “stepping back” or “decentering” from actual personal prerequisites and assumptions and disciplinary or social norms (Van Gyn, 2007). Adapting and changing perspective as a thinker by pondering on experiences, personal assumptions, perceptions and principles and then self-regulate. The reflexive nature of this disposition resides in the fact that the thinker self regulates to the new perspective after the pondering stage. As mentioned in the literature about reflexivity of thinking by Beauchamp (2006), reflexive disposition is also explained by what he calls “reflection- on-action” and “reflection-in-action”. These two components
work as a continuum in the sense that past experience is connected to and combined with tacit knowledge (Sable, 2012). The first refers to the stage of decentering and looking back at past experience (reflection-on-action), and the second (reflection-in-action) refers to the stance or perspective that is being built by connecting past experience knowledge to the new situation knowledge and then monitoring.

The major theme in all these versions is that assumptions which are held consciously are not as dominant as those being developed (or reformed) in action. In fact, there is a certain mental flexibility taking place through inquisitiveness that is the indicating feature of a reflexive disposition. These distinctive criteria of a reflexive disposition also suggest mindfulness and its extension into the classroom-based reflective practice.

1. 1.7. Critical thinking skills

Critical thinking has been defined from different perspectives. However the one definition relevant to the present study is the one devising critical thinking into critical skills and dispositions. The experts of the Delphi panel found that good critical thinking includes both a skill dimension and a dispositional dimension. Critical thinking skills are defined according to the APA Delphi experts’ definition of critical thinking which meets the requirements of the measurement of critical thinking skills progress via the CCTST (California Critical Thinking Skills Test).

In general, critical thinking skills are the set of skills that enable a learner to process any given piece of information. These skills could be improved and taught. They go hand in glove with critical thinking dispositions (will be discussed in the following section) which are the attitudes and the mindset a person can have about knowledge processing to accomplish the process of critical thinking. The experts of the Delphi research found critical thinking to include the following skills which have other sub skills. (1) Interpretation, (2) analysis, (3) evaluation, (4) inference, (5) explanation and (6) self-regulation. Each of these skills has a list of sub skills. 1) Interpretation includes categorization, decoding significance, clarifying meaning. 2) Analysis includes examining ideas, identifying arguments, analyzing arguments. 3) evaluation involves assessing claims and arguments. 4) Inference includes querying evidence, conjecturing
alternatives and drawing conclusions. 5) Explanation involves stating results, justifying procedures and presenting arguments. 6) Self-regulation includes self-examination and self-correction (Facione, 1990).

The Delphi panel of experts gives the following definitions to the earlier mentioned skills and sub skills to offer a full understanding of the core cognitive skills dimension of critical thinking. (Facione, 1990)

**a. Interpretation:** To comprehend and put across the meaning or significance of a wide range of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria.

**a. 1. Categorization:**

- To formulate in an appropriate way categories, distinctions which build a framework within which understanding, describing or characterizing information is performed.

- To be able to describe experiences, situations, beliefs, events in a way that takes on comprehensible meanings and can fit in appropriate categorizations, distinctions, or frameworks. This process is manifested in the recognition of a given problem and defining its character while eliminating all types of prejudice to inquiry. Determining a functional method of categorizing and sub classifying information and make a comprehensible account of a personal experience in a certain situation as well as being able to classify data, findings or opinions using a specific classification schema.

**a. 2. Decoding significance:**

Decoding significance revolves mainly around ‘detecting, attending, and describing the informational content, claims, intentions, motives, purposes, social significance, values, views, rules, procedures, criteria, or inferential relationships expressed in convention-based communication systems, such as in language, social behaviors, drawings, numbers, graphs, tables, charts, signs and symbols’.

**a. 3. Clarifying meaning:**
It includes paraphrasing or making explicit, via “stipulation, description, analogy or figurative expression, the contextual, conventional or intended meanings of words, ideas, concepts, statements, behaviors, drawings, numbers, signs, charts, graphs, symbols, rules, events or ceremonies” (p: 8). The above mentioned is used to remove confusion and ambiguity through designing a rational procedure do so.

b. Analysis: Is defined as the process of identifying the anticipated inferences relating ‘statements, questions, concepts, descriptions or other forms of representation intended to express beliefs, judgments, experiences, reasons, information, or opinions’.

b. 1 Examining ideas:

It is deciding on the task of different expressions within the context of argumentation, reasoning or persuasion. It also includes comparing or contrasting ideas, concepts, or statements. Identifying issues or problems and determining their component parts, and also identifying the conceptual relationships of those parts to each other and to the whole. This is illustrated in the instance of recognizing a phrase to have the power to prompt a ‘sympathetic emotional response’ which might have a persuasive effect on a given audience to be in agreement with an opinion. Another instance is to closely scrutinize related schemes in a given problem and localize points of similarity and variance in them. In addition to having the ability to figure out how to break into smaller more manageable parts any given intricate assignment, and to be able to define an abstract concept.

b. 2 Detecting arguments:

To be able to determine if a set of descriptions, questions, statements or visual representations conveys or is meant to convey reasons supporting certain claims or viewpoints.

c. Evaluation: To evaluate the reliability of statements which might be viewpoints, claims or perceptions, personal experiences, judgments, beliefs or any other representation, and review the logical bounds or intended inferences linking the abovementioned.
c. 1 Assessing arguments:

To assimilate the factors pertinent to judge the degree of integrity that could be attributed to a source of information or opinion. To assimilate the contextual significance of questions, information, principles or rules and to assess the adequacy, the level of confidence to place in the probability or truth of any given representation of an experience, situation, judgment, belief or opinion.

c. 2. Assessing arguments:

“Judging whether the assumed acceptability of the premises of a given argument justifies one's accepting as true (deductively certain), or very probably true (inductively justified), the expressed conclusion of that argument” (p: 9). It also includes determining whether an argument stands on false or doubtful assumptions or presuppositions and then to determine how crucially these affect its strength. Moreover and within the same line of thought, assessing an argument requires being able to differentiate between reasonable and fallacious inferences and to determine the extent to which an argument is weakened or strengthened by additional information.

d. Inference: To recognize constituents required to sketch reasonable conclusions;

to formulate speculation and hypotheses as well as mull over significant information and to presume the consequences generated from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation.

d. 1. Querying evidence:

Meticulously identify assertions which necessitate support and to formulate a strategy for seeking and gathering information which might supply that support. It is exemplified in the attempt to build up a persuasive argument supporting a personal opinion aiming at judging the kind of information background deemed necessary and worthwhile to design a plan acquiescing a clear argument to the availability of such information.
d. 2. Conjecturing alternatives:

Devise various alternatives to solve a problem, to put forward a series of assumptions concerning a given question, to plan the formulation of alternative hypotheses vis-à-vis an event, to build up a multiplicity of different procedures to achieve some goal. Similarly to sketch presumptions and plan a variety of potential outcomes of decisions, positions, policies, theories, or beliefs.

d. 3. Drawing Conclusions:

‘Employ proper approaches of inference to determine the position, opinion or point of view one should take regarding a given matter or issue. Using an appropriate level of logical effectiveness to draw conclusions from any given set of statements, descriptions, questions and the assumptions they entail. In addition to having the ability to successfully employ different reasoning strategies’.

e. Explanation: “being able to state the outcomes or results of one's reasoning and justify that reasoning in terms of the evidential, conceptual, methodological, criteriological and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments” (p:10).

e. 1 Stating results:

“Produce accurate statements, descriptions or representations of the results of one's reasoning activities so as to analyze, evaluate, infer from, or monitor those results” (P:10).

e. 2. Justifying procedures:

“Present the evidential, conceptual, methodological, criteriological and contextual considerations which one used in forming one's interpretations, analyses, evaluation or inferences, so that one might accurately record, evaluate, describe or justify those processes to one's self or to others, or so as to remedy perceived deficiencies in the general way one executes those processes”(p:10).

e. 3. Presenting arguments:
‘Presenting reasons for accepting some claim and meet objections to the method, conceptualizations, evidence, criteria or contextual appropriateness of inferential, analytical or evaluative judgments’.

**f. Self-regulation:** “Self-consciously monitoring of 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” (p:11).

**f.1 Self-examination:**

‘Reflect on one's own reasoning and verify both the results produced and the correct application and execution of the cognitive skills involved and make an objective and thoughtful meta-cognitive self-assessment of one's opinions and reasons for holding them.

Judge the extent to which one's thinking is influenced by deficiencies in one's knowledge, or by stereotypes, prejudices, emotions or any other factors which constrain one's objectivity or rationality. To reflect on one's motivations, values, attitudes and interests with a view toward determining that one has endeavored to be unbiased, fair-minded, thorough, objective, respectful of the truth, reasonable, and rational in coming to one's analyses, interpretations, evaluations, inferences, or expressions’.

**f. 2. Self-correction:**

‘To spot points where self-examination reveals errors or deficiencies and to be able to design reasonable procedures to remedy or correct those mistakes and their causes” (The Delphi Repot 1998, p: 12).

Another finding of the Delphi Project clearly indicates that improvement of critical thinking skills comes from all facets of an individual’s life, such as self-evaluation of one’s own critical thinking and reasoning processes, increasing life experiences, and engaging in program specific learning that fosters the development of
critical thinking skills rather than learning a specific body of knowledge or list of logical operations to follow (Facione, 1990).

Similarly, the definition of critical thinking given by Jones et. al (1995) considers seven facets of critical thinking such as: 1) interpretation, 2) analysis, 3) evaluation, 4) inference, 5) presenting arguments, 6) reflections, and 7) dispositions. Within each of these skill categories are sub-skills that define critical thinking as well (NPEC, 2000). Critical thinking skills are different from dispositions in that they could developed through teaching. In this concern, Sternberg (1990, 1988), Ennis (1989), and Lipman (2003) assert that critical thinking skills are not static but a form of intelligence which could be taught. According to Behar-Horenstein and Niu (2011), Sternberg (1990) does not define a specific approach concerned with the teaching and learning of critical thinking skills. Instead, he offers general strategies to develop or select a ‘program/curriculum’ that would advance critical thinking. They advocate that the focus of instructors should be shifted towards sharpening “students’ intellectual operating in meta-components, performance components, and knowledge-acquisition strategies” (p: 51). Meta-components are concerned with higher order mental processes which entail planning, monitoring, and evaluating individuals’ actions. Performance components refer to the steps taken or strategies used. Last, knowledge-acquisition strategies component involves the ways that individuals connect old to new material and apply new material’ (Behar-Horenstein & Niu, 2011). Sternberg (1990) also proffers that not receiving explicit instruction of critical thinking skills during formative years makes of students not prepared to face everyday critical thinking tasks required from them.

The attempt to understand critical thinking skills was the focal point of several pieces of literature (Erwin, 1998; Facione, 1990, Van Gelder, Bissett, & Cumming, 2004; Vanderstoep & Pintrich, 2003). Critical thinking skills were considered by many as being equivalent to problem solving. According to Garrison (1991), critical thinking includes problem solving and creative thinking, which develops and translates academic experience to practical real life experiences. He suggested a model of critical thinking that encompasses five problem-solving stages: problem identification, problem definition, exploration, application and integration.
Confirming what Garrison proffered, Erwin (1998) connected critical thinking to problem solving in real life situations. He claims that even though critical thinking and problem solving are two distinct constructs, they overlap in many aspects, especially in regard to processes to find solutions for open-ended problems in our daily lives. He considered problem solving as “a step-by-step process of defining the problem, searching for information, and testing hypotheses with the understanding that there is a limited number of solutions” (p. 1), while he defined critical thinking as a broader term, which “involves constructing the situation and supporting the reasoning behind a solution.

1.1.8. The Relationship between Critical Thinking Dispositions and Critical Thinking Skills

The dispositional and skills dimension of critical thinking operate in a cognitive interplay that would bring about the ability to thinking critically. In the Delphi study, Peter Facione (1995) elaborated definitions of what constitutes critical thinking skills and dispositions. The critical thinking skills identified by the panel of experts in that study were Interpretation, Analysis, Evaluation, Inference, Explanation, and Self-regulation. Following the lead of Facione (2000) three critical thinking skills, Analysis, Evaluation, and Inference were the skills measured in this study and were used in for their inclination toward objective testing and measurement. In addition to a complete list of critical thinking skills, the Delphi study identified a list of critical thinking dispositions that are needed for critical thinking. They are as follows: Inquisitiveness, Truth-seeking, Open mindedness, Analyticity, Systematicity, Maturity of judgment and Confidence in reasoning. In fact, a great deal of studies (Facione, 1990, 1995, 2000; Sable, 2012) suggests that every critical thinking disposition is responsible for a set of critical thinking skills. This denotes that, critical thinking disposition has a predictive value concerning the acquisition of skills. Joining Facione, Sable (2012) has come up with a dichotomy relating critical thinking skills to dispositions based on the claims of Facione (1990, 2007) and the Delphi report. The table below illustrates this dichotomy.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Interpretation: categorizing data, decoding significance, clarifying meaning; recognizing and avoiding the possible one-sided use of critical thinking skills</td>
<td>Open-mindedness, flexibility in considering alternatives and opinions</td>
</tr>
<tr>
<td>Analysis: examining ideas, identifying arguments, analyzing arguments</td>
<td>Belief in arguments based on evidential, conceptual, methodological, criteriological, or contextual considerations</td>
</tr>
<tr>
<td>Evaluation: Assessing claims, assessing arguments</td>
<td>Fair-mindedness in appraising reasoning</td>
</tr>
<tr>
<td>Inference: Querying evidence, conjecturing alternatives, drawing conclusions</td>
<td>Concern to become and remain generally well-informed, general inquisitiveness; trust in the process of reasoned inquiry</td>
</tr>
<tr>
<td>Explanation: stating results, justifying procedures, presenting arguments</td>
<td>Willingness to articulate evidential, conceptual, methodological, criteriological, or contextual considerations</td>
</tr>
<tr>
<td>Self-regulation; self-examination, self-correction (pervades all CT skills)</td>
<td>Inclination toward truth seeking; believing truth emerges from thinking strategies; willingness to apply heuristics, using multi-logical perspectives</td>
</tr>
</tbody>
</table>

Table1: The relationship between critical thinking skills and dispositions Sable (2012).

In this regard, Facione 1995 claims that the interaction between CTS and CTD could be hypothesised on three levels. First, in the most general terms, the overall disposition toward CT could be perceived as the departing point and the cultivating
ground which pushes the individual to take the decision as to attempt the use of CT skills. Consecutively, using CTS successfully could reinforce the disposition toward CT. in the opposite case; learners would become less convinced by critical thinking as an approach to manage future problems. This suggests that the general education curriculum should focus on global applications of CT and a general nurturing process. This interpretation denotes that a trial to improve a given skill or sub-skill or even to nurture a single disposition in isolation would be unwise.

A second hypothesis is that there might be room for an interactionist relationship between specific combinations of CT dispositions and CT skills. Facione (1995) suggests that “open-mindedness and inquisitiveness might lead one to ask interpretive and analytical questions. Cognitive maturity and CT confidence might lead one toward more sophisticated inferences and judicious explanations. Truth-seeking might lead toward more effort in conjecturing alternatives or in honest self-correction” (p3). Differently put, there is an interaction between dispositional attributes and skills of critical thinking but within stimulating patterns.

A third hypothesis was suggested by Perkins, Jay and Tishman (1993), positing that there is a one to one relationship connecting each CT skill to a CT disposition. He goes on to proffer that the this connection is of a conceptual as well as behavioural nature; in the sense that, the disposition toward analyticity should be perceived as belonging to the core concept of the cognitive skill of analysis. According to Facione (1995) if the above assumptions were true, it would be assumed that a series of statistical correlations coupling each specific CT skill with one and only one CT dispositional dimension would be found.

In fact, the predictive power of critical thinking dispositional attributes has been investigated in many studies taking into account many constructs and psychological characteristics. Beyond the mere correlational relationship, it would be more reasonable to posit that the disposition toward critical thinking strengthens CT skills and that success with CT acquisition of skills supports the disposition (Facion, 1995).
1.6. Relationship between critical thinking, metacognition and self-regulation

1.6.1. Critical Thinking and Metacognition

The close ties between metacognition and critical thinking have been discussed by several scholars in the literature (Brookfield, 1989; Dewey, 1933; Garrison, 2002; Willingham, 2008). The importance of metacognition to critical thinking is expressed in the definition of the terms. When discussing higher order thinking and what it entails, Dewey (1933) posited that higher order thinking refers to the induction of reflection through questions and the active monitoring of an individual’s inquiry for the purposes of improving his or her understanding. He emphasized that higher order thinking implies an inward contemplation that causes connections between ideas and facts. Brookfield (1989) also argued that critical thinking includes both a commitment to seek truth, as well as a commitment to maintain reflective scepticism by the individual. Metacognition is central to an individual’s development of critical thinking as it offers a drive to improve and facilitate one’s critical thinking (Davison and Sternberg, 1998; Corliss, 2005; Dominowski, 1998). Davison and Sternberg (1998) proffered that based on one’s knowledge of his or her own thinking, she or he will be able to strategically perform the tasks of encoding problems, forming mental models, identifying possible obstacles and selecting strategies to reach learning goals. The control and regulation aspects of metacognition aid learners make alterations in plans and strategies accordingly during the critical thinking process (Corliss, 2005). A number of studies in previous literature have stressed the vital role that metacognition plays in a person’s improvement of critical thinking or higher order thinking skills (Bielaczyc & Collins, 1999; Brown & Campione, 1994; Brown, Ash, Ruthford, Gordon, Campione, & Nakagawa, 1993; Hatano & Inagaki, 1992; Lin, 1999; Miller, 1978; Wineburg, 1997). In a study comparing novice and expert problem solvers, Dominowski (1998) found that, compared to experts, novice problem solvers rarely monitor their own problem solving process although it makes the problem solving more effective. He argued that metacognitive probing promotes a more reflective problem solving approach. In another study that examined the effects of metacognition on expertise, Hatano and Inagaki (1992) found that learners who constantly modified their actions based on their
reflection journals showed more frequent construction and enrichment of their conceptual knowledge than those who failed to reflect on their actions. They concluded that systematic reflection journals of reflective learners on the effects of their actions and the consequences prompted them to constantly improve their thinking skills. In a second study examining the effects of metacognition and aptitude on problem solving skills among fourth and fifth graders, Swanson (1990) found that students with high levels of metacognition needed fewer steps to find solutions for problems than lower metacognitive individuals. She found that high aptitude is only important in performance when metacognitive ability is low. In a sense, metacognitive skills can compensate for insufficiency in aptitude when students solve open-ended problems. Her study showed that high metacognitive ability positively influenced problem-solving performances. Among different groups with various combinations of levels of aptitude and metacognition, the group with both high aptitude and high metacognition was found to have a richer array of heuristics and strategy subroutines than other groups. The result of Swanson’s (1990) study showed that metacognition can reinforce general aptitude and can substitute for a lack of aptitude by supporting children with another domain specific to problem-solving. So far the present section has accounted for the self-regulatory nature of critical thinking and the way awareness of metacognitive processes could improve high order thinking skills.

1. 6.2 Critical thinking and self-regulation

Self-regulation is defined as being learners’ experience of monitoring and controlling the learning experience through cognitive, metacognitive strategies and motivational strategies (McManus, 1998). These strategies are inherently related to critical thinking as self-regulation is part of the cognitive skills and sub skills set in the consensus list of CT by the panelists of the Delphi report (Facione, 1995). Schraw, Crippen, and Harley (2006) divided these strategies into three different sets. The first strategy set includes the learner’s cognitive skills to process information such as making connections or analyzing information. The second set is concerned with metacognitive processes like the ability to reflect on previous actions continuously. The last set deals
with the beliefs and attitudes that impact the use and development of cognitive and metacognitive skills (Schraw, Crippen, and Harley, 2006).

Berger (2011) offers a developmental neurocognitive perspective of self-regulation and proffers that “Self –regulation is a developmental ability based on cognitive processes”. The concept capturing the essence of this issue is the “ability to manipulate attention; the ability to inhibit automatic responses and the ability to maintain current goals and requirements. According to her, “self- regulation process takes place when personal emotions and actions are adapted to situational requirements and social standards and norms that an individual internalizes”. She goes further to claim that the development of self-regulation can be conceptualized as a gradual transition from external control to internal and efficient self- control as all these processes are generated by specific brain networks and mechanisms.

This developmental nature of self-regulatory mechanisms is considered as being the vital link relating genetic predispositions, early experience and later adult functioning (Eisenberg et al, 2010) as discussed in previous sections of cognitive development, epistemology and critical thinking skills and dispositions.

Among the various conceptualizations of self-regulation, the one perceiving it as a necessary condition to learning along with the neurocognitive view abovementioned are assets to the present research. The definitions concerned with self-regulation and learning focus on the academic context. The implementation of self-regulation in the learning context gives rise to the definition of a learner as being one who is proactive in the effort to learn by being aware of his or her own strengths and limitations and being guided by personally set goals and task-related strategies (Zimmerman, 2002). This type of learner monitors his or her behaviour in terms of goals and self-reflects on his or her increasing effectiveness. This enhances self-satisfaction and motivation to continue to improve the learning methods (Zimmerman, 2002).

With the necessary cognitive skills and the desire to practice such skills, a learner will have the required tools to know how to modify his or her inquiry process when necessary. The significance of self-regulation to individual critical thinking is
demonstrated in several ways. First, self-regulation initiates an individual’s effort to improve his or her critical thinking process. According to Dewey (1933), the learning cycle includes several iterated phases. Before any inquiry, a learner must perceive a need to solve a problem. He or she then searches for relevant information, constructs personal meaningful solutions and finally puts the ideas into action. Dewey (1933) proposed that the learners’ awareness of these phases of inquiry helps them understand and select strategies and learning activities. Most importantly, self-regulation helps one to take actions to constantly modify the directions of his or her own critical thinking. Secondly, self-regulation provides learners with better management of their cognitive strategies and coordination of learning resources; when teachers make students aware of all the critical thinking skills, students will be more mindful about exercising their critical thinking skills. When students form the habit of monitoring and constantly adjusting their critical thinking skills, self-regulation and critical thinking could form a self-enclosed support circle. The more self-regulated a student becomes, the better a critical thinker he or she will become and vice versa.

1.7. Critical thinking and Academic performance

The relationship between critical thinking and academic performance has been highlighted since the consideration of critical thinking as an educational outcome. In the context of higher education, success in academia has been related to higher critical thinking ability. Numerous studies concerned with tertiary education advocate that there is a strong relationship between critical thinking and academic achievement measured by GPA (Cabrera, 1992; Williams, et al, 2003; Williams & Stockdale, 2003). Williams and Stockdale (2003) found that students with higher critical thinking abilities received As and Bs and very rarely received Ds or Fs. However, students with low critical thinking abilities received Bs and Cs. In a study of over 1100 university students, scores on CCTST correlated significantly with GPA (Facione, 1995). Similarly, studies by Vendrely (2007), Jenkins (1998) and Facione (1997) found similar results. However, these studies do not provide a clear indication of whether high critical thinking abilities result in higher academic achievement, or whether it is higher academic achievement that leads to high critical thinking ability. In this regard, Karbalaei (2012) proffers that a
well-designed pedagogy of critical thinking which encourages students’ critical knowledge, skills, and dispositional attributes may yield to improvement in students’ academic success and simultaneously encourage the abilities required for transfer and competency in the professional context.

In fact, a positive correlation between critical thinking ability either represented in dispositional attributes or skills and academic achievement would encapsulate the importance of critical thinking within academia only. Consequently, it would be more appropriate to reconsider relating higher critical thinking ability to high academic achievement allowing room for a wider perspective which considers critical thinking beyond academia. When connecting school grades to critical thinking ability, the focus is put on knowledge based approaches in teaching and outcomes. Nevertheless, what would be more efficient is fostering critical thinking skills and dispositions for the sake of producing academically assertive students rather than academically successful students if success is measured by school grades (Moon, 2009). An academically assertive student would be able to function within the standards of personal and professional requirements.

1.8. Writing, critical thinking and learning

1.8.1. Writing, Critical Thinking

One of the aims of the present research is to shed light on the interconnectedness between critical thinking and writing. It was hypothesized that Reflective writing is a pedagogical strategy, among others, that could enhance Critical Thinking skills and dispositions of undergraduate students. In that, there is an assumption that the cognitive processes underlying both concepts interweave. For a further understanding of this interplay, there should be an elaboration on how writing and thinking are related.

In the process of inquiry about teaching strategies or pedagogical practices that enhance critical thinking skills and dispositions, writing is a strategy that appears at the front page of numerous research studies in a variety of fields and disciplines. First, It is worth mentioning that one of the notable features of writing research is that it has been
primarily concerned with the higher level thinking processes. It has paid relatively little attention to the basic processes involved in translating thought into visual form as language processing is in a big part a matter of translating content in an alternating way connecting thought to external means of communication be they oral or written. The natural implication is that understanding writing requires understanding the processes involved in producing and evaluating thoughts rather than the processes involved in translating these thoughts into language (David Galbreith et al. 2007). In cognitive psychology, writing is perceived as a form of thinking and this is illustrated in Kellog (1999), as he claims that “Thinking and writing are twins of the mental life”. He also proffers that the study of writing offers insight into the psychology of thinking. The study of writing as a means of thinking could be accounted for through several arguments. According to Kellog (1999), quality writing is achieved via quality thinking. Hence writing is a circuit and a tool to thinking as it does not only reflect the ability to think well, but is also a means to promote this ability. When writing about a given subject, a person learns more about his/her knowledge and opinions concerning that subject. This knowledge translating attribute is an essential constituent of writing as a skill. It is hence assumed that developing one’s thinking about a given subject could be reached through writing.

This notion is central to the claims of the present research as it relates the writing process to critical thinking. The most evident bond between critical thinking and writing is the use of writing to represent the thinking process. The ability to write cogently is connected to critical thinking both in the sequencing and the outline of evidence. The relationship between critical thinking and writing trespasses the process of jotting down the content of a critical mind onto paper or screen. A translation of thoughts into a written version gives room to review. It is hence a chance to enroll in metacognition about own critical thinking as one judges whether the content of the written production is conform with what was originally intended to say or not (Moon, 2008). This assumption is also clarified in Hayes and Flower’s original model of the cognitive processes involved in writing (Hayes & Flower, 1981), which has a huge influence on the development of the field. The model tackles writing from a metacognitive point of view positing three basic types of processes in writing: (i) planning, which involves
setting goals and generating and organising ideas to satisfy those goals; (ii) translating, which involved translating ideas into words; and (iii) reviewing, which involved reading and editing the already produced text. The model lies primarily on the assumption that the process of writing is like the process of goal directed thinking in which the writers construct and organize text in order to complete the task. This process has a hierarchical and recursive nature. In the flower and Hayes model, the cognitive act of writing is divided into three major stages namely the task environment, the writer’s long term memory and the writing processes as depicted in Figure 1 the stages interrelate with one another during the composition task. According to figure 1, “task environment” refers to any provided information about the task such as the rhetorical problem which is the first stage writers go through. The rhetorical problem involves a focus on the elements of “topic, audience and exigency”. The reason behind the importance of the rhetorical problem is the fact that before engaging in a writing task, a writer needs to clarify the topic he is going to emphasise, his/her targeted audience and the role he/she is going to play in this writing task. The written text will determine and limit the writer’s choices concerning the next step (Flower & Hayes, 1981).
Figure 1. Structure of the Writing model proposed by Flower and Hayes (1981)
The writer’s long term memory refers to the stable knowledge about the topic, the audience, and the knowledge on how to plan in order to complete the writing task. This phase is the one in which the writer retrieves the related ideas or information for his/her writing from the long-term memory. The first obstacle at this point is retracing resources and reconstructing and reorganizing stored information to fit the requirements of the writing task (Flower & Hayes, 1981). The three aforementioned writing stages are continuously monitored and the system works as an agent that organizes and generates different writing strategies. The three stages are more clearly depicted in figure 1. If we look closer at these stages we would find that those writing phases put the writer in a situation of problem solving and decision making. According to flower and Hayes, in rhetoric and composition, there is a strong belief that sees the writing process as a series of decisions and choices. The strategies writers use to go about choosing diction, organisational patterns and content, or when they engage in the process of informing, expressing or persuading guide them to make choices. There is constant need to give answers to “exigencies”. This is similar to the cognitive processes of critical thinking. Critical thinking requires you to approach a subject from multiple angles. The word "critical" suggests that one should come to the topic with heightened awareness of fallacies, missing information and contradictions. The individual should also be aware of assumptions and generalizations that have been made about the topic in the past. As a writer, the use of critical thinking enables the creation of new knowledge rather than simply reporting on what already exists. While composing, writers go through different steps as mentioned above such as questioning, analysing existing information with an open mind or retrieving some information and connect it to the existing one to construct new knowledge, assessing the validity of your ideas, problem solving, decision making and self-monitoring the strategies used to about all this. Resnick (1987) stressed that writing should provide an opportunity to think through arguments and that, if used in such a way, could serve as a “cultivator and an enabler of higher order thinking.

Marzano (1991) suggested that writing used as a means to restructure knowledge improves higher-order thinking. In this context, writing may provide opportunity for students to think through arguments and use higher-order thinking skills to respond to complex problems.
Kurfiss, (1988) and Applebee (1984) suggested that writing improves thinking because it requires an individual to make his or her ideas explicit and to evaluate and choose among tools necessary for effective discourse.

To summarize the cognitive aspect of writing process, Hayes and Flower cognitive model of writing process lies on four key points:

1. “The process of writing is best understood as a set of distinctive thinking processes which writers orchestrate or organize during the act of composing” (p: 366).

2. “These processes have a hierarchical, highly embedded organization in which any given process can be embedded within any other” (p: 366).

3. “The act of composing itself is a goal-directed thinking process, guided by the writer's own growing network of goals” (p: 366).

4. “Writers create their own goals in two key ways: by generating both high-level goals and supporting sub-goals which embody the writer's developing sense of purpose, and then, at times, by changing major goals or even establishing entirely new ones based on what has been learned in the act of writing” (Flower and Hayes, 1981. P: 366).

Consequently, strategies used in writing are planning, idea generating, self-evaluation, self-monitoring and reflecting. Writers understand deeply what they are writing about whether the task caters to their interest, seek further information, become motivated about the content, plan and organize their thoughts. This shows that strategies and approaches to learning are simultaneously used when engaging in writing tasks (Lieneman &Reid, 2008). When individuals start to write essays and other forms of English discourses, they start to think in abstraction, conceptualize, elaborate, substantiate, analyse, generalise and interpret. This helps them make sense out of new concepts by connecting them with lived experience. Hence, they start to engage in deep approaches to learning. These strategies show that writing and critical thinking overlap in many areas when it comes to processes underlying both of them in the sense that the same skills are used when engaging in one of the activities. Most importantly, both of them involve building up knowledge as a form of a step by step learning.

Writing makes the individual exert effort in the use of cognitive strategies such as self-regulation. When self-regulation is used in composition writing, specific strategies
are used in the writing process. There is a simultaneous interplay of the learning approaches and self-regulation during that process (Evans, Kirby & Fabrigar, 2003). Individuals who are self-regulated achieve tasks successfully because they make attempts to bridge the gap between their current status and goals they want to achieve (Leventhal and Cameron, 1987). According to Zimmerman (1986) self-regulation and as mentioned in an earlier section about self-regulation and critical thinking, self-regulation focuses on how students activate and alter their learning practices in specific contexts. As the student writer progresses, they develop their own strategies in writing such as planning and self-monitoring which is a stage of self-control. When the writer can adapt his or her own strategies according to some specific requirements such as changing tasks, audience and interpersonal states they become self-regulated.

1. 8.2. Writing as a circuit to learning

The writing to learn model is at the heart of writing and is given much interest in university setting. This model claims that writing is a process which involves building up learning and content understanding and helps producing higher order conceptual skills. A saying that captures the essence of this approach is attributed to E.M Foster “How can I know what I think until I see what I say” (Auden, 1962). The latter saying has been subject to elaboration and research to give birth to pedagogy of WTL model. It focuses on personal, expressivist, journal, and other forms of exploratory writing. Britton, et al. (1975) identified three functional types of writing: transactional to transmit information, poetic to create beautiful objects and expressive to explore and reflect upon ideas. The last category is the one inherent to the WTL movement which Britton and his colleagues claim could be important to learning at every developmental stage. By highlighting the personal and psychological value of writing in academic settings (Britton, et al. 1975), and by bringing to surface the effective ways in which language organizes thought and experience, Britton and his colleagues attribute credit to the fact that cross curricular writing programs could always promote student learning.

Furthermore, the writing to learn paradigm fosters the idea that considerate faculty feedback is vital as the instructors participate actively in the process of learning.
According to Janet Emig in her landmark article ‘Writing as a Mode of Learning’, which represents an authentic document for the writing to learn paradigm, ‘writing is neur linguistically integrative, connective, active and is available for immediate visual review’ (Emig, 1977. P: 124). With all the aforementioned characteristics, writing remains a unique form of learning. In the 1980s, the bulk of literature foregrounding writing as an essential learning process grew bigger. Applebee (1984) summarized the results of a research spotting the centrality of writing and reached the following corpus:

1. Writing involves a variety of recursively operating sub processes namely planning, monitoring, drafting, revising, editing rather than a linear sequence.
2. Writers differ in their uses of the processes.
3. The processes vary depending on the nature of the writing task.

A considerable number of studies followed Emig (1971, 1977) focusing on writing in more limited environments. Note taking in an example that was considered as being at the intersection of writing and learning. It was found that note taking is a study technique that is more effective than reading or listening alone, though the results were potentially relying on the strategy used to take notes (Di Vesta and Gray (1972), Fisher and Harris (1973), Schultz and di Vesta (1972) and Applebee (1984). Newell (1984) found that essay writing allowed students to generate a consistently more abstract set of associations for key concepts. The latter provided an explanation for the notion of connective nature of writing. To explain this, he made a comparison between the process of answering study questions and essay writing in terms of connectivity. He claims that answering study questions involves planning at a local level rather than at a global level. Consequently, a great deal of information is generated and is considered in isolated segments which makes it difficult to integrate into coherent contexts and, therefore in students thinking. Essay writing on the other hand, necessitates that the writer, in the process of evidence examination, incorporates elements of the prose passage into their knowledge of the topic instead of leaving the information in isolated bits. Newell (1984) attributes students’ improved understanding of the concepts presented in the prose passage to essay writing. Similarly, Langer and Appelbee (1987) proffer an insightful input to the writing to learn paradigm in their book, How Writing Shapes Thinking. They asked the following question: what contribution, if any, does written language
make to intellectual development? They reached many conclusions among which are the following:

1. Writing activities promote learning better than activities involving only studying or reading.

2. Different kinds of writing activities lead students to focus on different kinds of information.

3. In contrast to short-answer responses, which turn information into discrete small pieces, analytic writing promotes more complex and thoughtful inquiry but on a smaller amount of information (Langer & Applebee 1987 pp. 135–136).

According to the aforementioned, analytic writing as it promotes depth rather than breadth automatically overlooks any information which was not included in the production of the essay.

1. 9. Critical Thinking and Reflective Writing

1. 9.1. Reflection and Reflective writing

It is generally believed that the thinking process involves two aspects: reflective thinking and critical thinking. They are not separate processes; rather, they are closely connected (Brookfield 1987). Moon (1999) has defined reflection as being ‘A form of mental processing – a form of thinking – that we use to fulfill a purpose or to achieve some anticipated outcome. It is applied to relatively complicated or unstructured ideas for which there is no obvious solution’. This definition of reflective thinking, as it includes approximately the same characteristics of critical thinking, shows that both processes are the two faces of the same coin. When talking about reflective thinking we automatically talk about reflection which is a kind of personal reaction to experiences, situations, events or new information. It encompasses eight components that enable the thinker to achieve the abovementioned. The elements of reflection are 1) Making sense of an experience, 2) Standing back, 3) Repetition, 4) Deeper honesty, 5) weighing up, 6) Clarity, 7) Understanding, 8) Making judgments (Schon, 1987). It is also a ‘processing’
stage where information is processed and thinking as well as learning takes place with no right or wrong ways of doing it. It is all about exploring questions.

Mezirow (1990), Schon (1987), Brookfield (1987) came up with the concept that reflective thinking starts from the person as a thinker as he/she needs to identify, examine, assess and evaluate one’s own ideas and thoughts. This involves revisiting own prior experience and basic knowledge about the topic to be explored which is strongly connected to epistemic development discussed in prior section (Critical thinking and epistemological beliefs). More importantly, it includes a metacognitive process as learners have to consider and understand how and why they think the way they do. This metacognitive process is inherent as it helps to understand one’s beliefs, values, attitudes, and assumptions and hence have a handle on the general process of reflective thinking in any given situation.

The above authors proffer that reflective thinking requires that learners avow they add a valuable knowledge to every experience they encounter. It is very helpful in terms of the recognition and clarification of the important connections between what they already know and what they learn. It is that very process which enhances active learning.

The writing process can lead to the development of thinking, learning and understanding of classroom content. For writing to be beneficial to students, they must understand the subject matter being written about as a result of the writing process (Kataoka-Yahiro & Saylor, 1994; McCabe, 1994). Experiences from the real life settings are ideal for building critical thinking skills if reflection is used as a teaching tool. Reflecting on real life experiences develops critical thinking ability, fosters self-understanding, facilitates coping, and leads to improvement in critical thinking skills and hence in academic assertiveness (Craft, 2005; Kennison, 2006; Moon 2008). Reflective writing as a pedagogical strategy allows students to integrate their thoughts and experiences with didactic material to more adequately understand both the experiences and the didactic material McGuire (2009).

Reflective writing to improve critical thinking was investigated and discussed by McGuire and colleagues (2009). In that study, reflection papers were defined as “reflective writing assignments that are focused upon a specific activity (a reading or
group of readings, video, service learning, practicum, role play, guest speaker, group activity) that highlights the student’s learning from that activity” (p 96-97). In the study, social work students completed a course where instructors had assigned multiple reflection papers. Seven themes were identified that described how students felt about the utility of reflection papers: active participation, dialogue with instructor, critical thinking, connecting theory to practice, values clarification, improving written communication skills, and concerns with grading. Most students agreed that the reflective writing assignments gave them a way of participating in class, and they believed the exercises helped them to define their values and become more aware of personal biases. The students, overall, felt the exercises were helpful when the instructor gave feedback, and they believed the assignments forced them to think critically and elaborate on concepts. The researchers concluded that for a reflective writing assignment to increase critical thinking, it must be structured to facilitate integration of experience and didactic material, it must be graded by a rubric, and it must foster dialogue between student and faculty member. The articles above describe methods of implementing reflective writing exercises in the classroom to develop students’ critical thinking abilities. Craft (2005), Heinrich (1992), and Baker (1996) focus on journaling specifically. Craft (2005) mentions how journaling can actually help to improve writing skills and be used therapeutically to decrease students’ stress levels, particularly after involvement in stressful clinical situations. Heinrich (1992) describes the dialogue journal, focusing on faculty feedback and the strategy of triangulation, which includes reflection on experience, reading, and didactic elements. Baker (1996) focuses on the components of the reflective journal assignments, including identification, description, significance, and implications. Rooda and Nardi (1999) and McGuire et al. (2009) suggest slightly different reflective writing exercises. Rooda and Nardi focus on substituting reflective writing about situational problem solving for existing writing assignments while McGuire and colleagues describe writing about previous learning experiences, including classroom learning experiences, videos, and guest speakers. Therefore, both McGuire et al. and Heinrich emphasize the importance of synthesis in personal experience and classroom activities in the writing exercises. All of the above
authors mentioned that a major component of reflective writing is the feedback from instructors and the development of the teacher-student relationship.

The focal point of this research is to find an interactionist ground on which both critical thinking and reflective writing operate to enhance dispositional attributes and skills of CT. One of the pioneers of reflection and reflective practice is Gibbs (1988) who came up with the reflective cycle which is a model illustrating reflection. This cycle encourages the learner to think systematically about the phases of an experience or activity. At the same time, it helps to externalise processes of thinking and hence, develop self-awareness. The model is based on experiential learning allowing the use of description, analysis and evaluation of the experience. It helps the learner make sense of the experiences and examine their essence in an attempt to review arguments and judgments. Reflecting is not enough at this point as learners have to put into their practice the new learning and understanding they have gained. Hence, the reflective process informs the new situation. In fact, taking action is the key point as the model prompts the learner to formulate an action plan. This enables the reflective practitioner or learner to look at their practice and see what they can change in the future, how they would develop or improve their practice (Jasper, 2003). The cycle involves six steps 1) Description, 2) Feelings, 3) Evaluation, 4) Analysis, 5) Conclusion, 6) Action Plan that are made explicit through instruction in the classroom context. Gibbs (1988) model of reflective thinking is better illustrated in the following figure:
In fact, this model of reflective practice is guided by learning from experience for the sake of clarity as it makes the learning process conscious. Therefore, it allows room for the learning of physical skills (Moon, 2005). In terms of cognitive processes underlying Gibbs model, we can say that they match with Bauchamp (2006) reflection-in-action and reflection-on-action (see p 33-34).

1. **Critical thinking instruction**

Explicit instruction in critical thinking is a key component in enhancing the ability to think critically. In this regard, Senchal (2010) posited that critical thinking is
perhaps the trickiest of all 21st century skills to be taught, applied and assessed. In the
same vein, Lombard (2008) proffers that critical thinking is not only a product of simple
maturation, critical thinking skills must be explicitly taught and consistently practiced.
In the context of classroom the task of revising curriculum and engaging in a critical
thinking approach demands steady and meticulous effort. Clearly, critical thinking skills
depend to a great extent on formal learning which engages educators to commit
themselves to explicit thinking instruction (McCollister& Sayler, 2010). The
explicitness of instruction is strongly connected to metacognitive awareness.
Considering that, it is suggested that self-awareness of critical thinking skills is essential
to the advancement of critical thinking ability. The relationship between critical
thinking and metacognition is most illustrated in the fact that the process of thinking
about one’s own thinking allows room for accurate and efficient assessment and
selection of most appropriate strategies and tools of knowledge manipulation to be used
in a given situation (Bruning et al., 2004). Moreover, and as mentioned earlier in this
chapter (critical thinking and metacognition, p: 38-39), metacognition allows “a critical
thinker to be able to monitor and valuate a problem solving process, make conclusions,
react effectively to new task and situations and process information effectively”
(Lombard, 2008, p. 213).

In terms of cognitive processing, learners will be incapable of analysing and
evaluating in order to formulate judgements and opinions without employing
metacognition. Therefore, critical thinking instruction needs to be explicit, systematic
and must occur throughout educational hierarchies (Hove, 2011). The developmental
nature of metacognition is similar to any other high order thinking skill. It comes to
fulfilment during puberty and requires practice to attain full functioning. If not ready to
use metacognition, students will blunder in their “strategy toolbox” and would elaborate
a random tool to help them. However, accomplished thinkers would make use of
metacognitive strategies to select suitable tools: If proven ineffective, this tool is rapidly
altered and an efficient one is selected (Hove, 2011). One method that encompasses the
previous mentioned characteristics is metacognitive scaffolding. To help students
develop critical thinking ability, a scaffold instructional approach is vital to first, make
students aware of the different skills involved in the process of critical thinking and second, to engage them in the process of sharpening those skills.

1. **Critical thinking and metacognitive scaffolding**

   Educational or Instructional Scaffolding is a teaching method based on decomposing a complex task into smaller elements or steps. It enables students to solve a problem, carry out a task or achieve a goal gradually with the external assistance of the mentor or facilitator (Pinantoan, 2013). According to Lange (2002), there are three major steps involved in the process. First, “development of instructional plans to lead the students from what they already know to a deep understanding of new material” (p: 1). Second, “the execution of the plans, wherein the instructor provides support to the students at every step of the learning process” (Lange, 2002, p: 1). Third, letting go of the model or the “fading away” phase in which the learner internalizes the process model and starts using it without explicit instruction or reliance on the instructor (Wood, 1976).

   Scaffolding has been a focal point in numerous research projects since the pioneering work of Vigotsky (1978) and major work of Bruner, Wood and Ross (1976). In its original notion traced back to Wood (1976), scaffolding relies in main part on the role of the instructor or the expert in fostering the process. Not only does the instructor provide sufficient support to enable the learner accomplish the goal of the scaffold, but also provides support in the form of modelling to highlight the important features of the task, and delivers clues that allow the learner to reflect (Wood, 1976). In this trend, the instructor’s role involves perceptual, cognitive and affective components (Stone, 1998; Van de Pol, 2010). In the same vein, Hannafin et al. (1999) suggest four types of scaffolding: conceptual, metacognitive, procedural, and strategic. First, conceptual scaffolding guides learners regarding what to consider and helps them reason through complex problems. Second, metacognitive scaffolding facilitates metacognitive thinking and supports metacognitive processes, including planning, monitoring, and evaluating. Third, procedural scaffolding emphasizes how to utilize resources and tools. Finally, strategic scaffolding provides guidance on how to approach learning tasks or problems...
(Yun-Jo and Li, 2014). In other words, scaffolding focuses on either the object or the meta level of learning (Nelson, 1996). The object level is concerned with cognitive activities aiming at knowledge acquisition and/or skills, and which is also called metacognitive knowledge. However, the meta level forms a kind of regulator of the object level through monitoring and controlling those cognitive activities and which is referred to as metacognitive skillfulness (Veenman, et. al, 2006). According to Flavell (1979), metacognitive knowledge is the “individual’s declarative knowledge about the interactions between persons, tasks, and strategy characteristics” (p: 908). However, metacognitive skillfulness refers to the individual’s procedural knowledge for regulating his/her own problem solving and learning activities (veenman, 2005). It entails four components: (1) planning, (2) monitoring, (3) evaluating, and (4) revising (Brown, 1987). These skills are not only essential for effective problem solving, but also for critical thinking. Mastering declarative knowledge alone does not assure that it is further used for regulation of learning strategies and conduct (Veenman, 2006). Metacognitive knowledge might be inconsistent or inadequate, the learner could be unsuccessful to detect possible relevance of applying that knowledge in a given situation or there may be a lack of required skills to perform the task. Therefore, metacognitive skills are needed to control and monitor the learning behaviour and acquire skills like goal setting, planning, evaluation, and self-regulation (Veenman, 2011). In fact, metacognitive knowledge and metacognitive skillfulness are the two faces of the same coin and work hand in glove to accomplish the learning task.

In general, scaffolding is used as a way to increase the metacognitive awareness of the learners concerning the high order thinking skills and develop their regulation in the process of using those skills. Students should dispose of a metacognitive skillfulness to accomplish the essential regulation of the metacognitive knowledge.

In accordance with the aforementioned, metacognitive scaffolding is one of the best ways to boost students’ ability to think critically and actively throughout the learning process. It helps learners reflect on what they learn and how they learn it. Its ability to develop metacognitive skillfulness, metacognitive awareness and self-regulation in a context of explicit instruction of the skills allows for an accurate and
systematic approach of learning. Moreover, it develops students’ reflexive disposition which corresponds to the willingness to engage in critical thinking. As mentioned in the section about reflective and reflexive disposition (p, 30), it is a type of reflective process that makes students engage in critical thinking and the process encompasses self-regulation to reflect on the strengths and weaknesses in the thinking process and monitor them.

Brown, et al. (2009) contends that one useful approach to foster critical thinking skills is scaffolding, which both as a pedagogical technique and a process offers structure for critical thinking. Scaffolding as a process encompasses ‘construction and deconstruction of a cognitive element structure’ to simplify it for the accommodation of students’ learning styles and needs (Wood, Bruner & Ross, 1976). In a study conducted on the effect of metacognitive scaffolding on students' design problem solving and metacognitive Skills Yun-Jo and Li (2014), a positive impact was found on students’ design problem solving processes. Concerning metacognitive skills, the experimental group showed significant improvement in the planning subscale. In the same vein, and based on Hannafin et al.’s (1999) scaffolding taxonomy, a research was conducted by An (2010) to investigate the effect of conceptual, metacognitive, procedural, and strategic scaffolds the improvement of ill-structured problem solving. Results showed that metacognitive scaffolds were effectively helpful in developing problem solving plans, monitoring and evaluation self-progress, and in making necessary changes to improve students’ learning process. However, it is worth mentioning that only few studies examined the effect of metacognitive scaffolding on critical thinking. One of the studies was conducted by Srinivasan, Cooks & Wang (2005) and investigated effect of using a metacognitive scaffold to support critical thinking about web content. It was designed to examine effect of metacognitive scaffolding via the use of web prompts to form a support for critical thinking. Results showed that web prompts that were used as a metacognitive scaffold help students analyse and evaluate the information they receive online.
To conclude, it could be said that metacognitive scaffolds are effective in supporting students’ metacognitive processes, including planning, monitoring, evaluation and self-regulation.

1.11. Approaches to teaching and fostering critical thinking

1.11.1. Writing across the curriculum

The prominence of writing as a pedagogical practice or teaching strategy to increase critical thinking immersed from the success of strategies such as Writing Across the Curriculum (WAC) which currently is being stressed in several Universities worldwide. According to the QEP Quality enhancement plan panel in Georgia State University, the WAC describes a range of pedagogical practices engendered in the assertion that writing plays a cardinal role in learning. The WAC aims at increasing intellectual capacity in order to improve the significance of college education.

The concept came to light in the 1980 as a result of the literacy deficiency that college students have. The pedagogical movement adopts the following principles: Writing is the responsibility of the entire academic community, writing must cross the departmental boundaries to promote the writing skills in all majors, writing must be integrated into all levels of undergraduate education, writing promotes learning, and practicing writing is a way to make students communicate well in their disciplines (Luthy, Peterson, Lassetter, & Callister, 2009). Writing across the curriculum emphasizes the inherence of integrating writing in all university courses. Since its establishment in 1995, the WAC has worked wonders in helping to prove that a well-designed writing task can be a powerful means to improve learning. Luthy (2009) argues that it is not sufficient for students to be able to write effectively and cogently in an English course. Not only they have to learn how to write in the other disciplines included in their curriculum, but they must also know how to express their thoughts via written communication and about a variety of topics. This will help students fit in the very competitive job market upon graduation.

However, at this stage we need to highlight the relationship between writing and critical thinking. The writing process can lead to the development of thinking and learning in many ways. In general, writers commonly describe writing as an act of
discovery, stressing that writing involves finding out what to say in the course of writing rather than being simply a matter of translating preconceived ideas into text. In cognitive models of writing this is typically characterized as involving active problem solving—which is a key element in the conceptualization of critical thinking abilities—to satisfy rhetorical goals. Hence text production is not a mere passive process of translating ideas into text, it transcends this to being a process in which text production is assumed to be an active knowledge constituting process. Another pertinent issue that might complete the puzzle of critical thinking and writing is the fact that the latter is a critical process itself in the sense that processes underlying writing are demanding in terms of cognitive energy and strategies. We can even go further to say that critical thinking and writing are two faces of the same coin representing thinking as building block. In accordance with the aforementioned, we can say that writing and reflection are closely related. Hence, for writing to have more sense and to be more beneficial to students they must comprehend the subject matter being written about prior to the act of writing (kataoka-yahiro & Saylor, 1994; McCabe 1994).

Numerous strategies were highlighted in the literature for the implementation of the WAC in university courses. Luthy et al. (2009) discussed techniques for teaching writing skills. At Brigham Young University (BYU), faculty members at the College of Nursing (CON) incorporated WAC. As part of the WAC process, the CON held a one-week faculty seminar to increase faculty confidence in the WAC principles. The CON also implemented the Writing Fellow Program, which used undergraduate students who were above average writers to consult and advise individual nursing students on their writing assignments. According to the recommendations of Lashley and Wittstadt (1993), assignments were decomposed into smaller, more controllable assignments that follow a sequence of building blocks.

McCabe (1994), belonging to the field of political science, is experienced at the integration of writing assignments into different levels courses. Due to the principles of WAC, he assigned beginning level students a choice of topics for which they had to read pros and cons and then argue either side. In addition, hand outs containing general suggestions about writing were given to participants, and were allowed to be peer reviewed. In higher level courses, faculty members asked students to prepare three-page
analyses about each of the seven broad themes covered in class and at the end prepare final drafts about five of the topics. In almost every case, the “initial student reaction was one of unhappiness at what they perceived to be additional requirements, and requirements they argued had little to do with political science” (p. 11). As the semester progressed, students said they “genuinely benefitted from the insights of other members of the group” (p. 11). The papers showed evidence that students realized there are two sides to every argument, and the strength of the argument depends on the evidence they used to support it. McCabe said that writing is “a vehicle for integrating university curricula, which are likewise typically, viewed by students as simply a series of courses, having little to do with each other” (p.12). He also points out his emphasis is on clarity in both assignments and in the student responses.

Writing Across the Curriculum emphasizes the importance of including writing in all college courses. Being able to write effectively in an English course will not suffice; students must learn how to write in their respective disciplines and how to express themselves using written communication over a variety of topics (Luthy et al., 2009). Not only will this help students to be competitive in the job market upon graduation (Luthy et al., Thorpe & Kulig, 1997), but also helps them learn valuable course content (Allen, Bowers, & Diekelman, 1989). The Writing to Learn (WTL) paradigm is at the core of writing and is receiving a great deal of attention in university settings, particularly in programs of nursing (Allen et al., 1989; Emig, 1977). The WTL model stresses the fact that writing is a process through which content is learned and understood, writing skills are critical thinking skills, writing involves developing an understanding, and writing helps to produce higher order conceptual skills. In addition to these tenets, the WTL concept involves the idea that thoughtful feedback is vital and the instructor participates actively in the process of learning. For this reason, students were provided thoughtful feedback to participants regarding each reflective writing exercise. The WAC concept is based on this concept, given evidence from the fact that one of the main principles of the WAC concept is that learning is promoted through writing (Luthy et al., 2009).

The idea of WTL is discussed in many pieces of published literature. Bowers and McCarthy (1993) debate a health issue course where changes have been made in course
content to reflect the WTL strategies. Before implementing WTL strategies, students read one textbook and wrote one 10-20 page term paper due at the end of the course. Mid-term and final exams were based on students’ ability to recall information. After implementation of the WTL strategies, course readings from various sources were assigned based on clarity and appropriateness to specific topics.

Exams were also rewritten to shift from retaining content to truly understanding it. The questions asked students to integrate information instead of just recall it. As a result of these changes, faculty reported increased satisfaction among students. Students felt they were developing a closer relationship with their instructors due to the increased and detailed feedback. Faculty reported the new assignments made it easier to identify students who were struggling early in the semester. Overall, the feedback regarding these changes was positive; however, faculty reported a large increase in workload due to the interactive nature of the assignments. Drabick, Weisberg, Paul, and Bubier (2007) also use a form of short writing assignments. In their study, the researchers randomly assigned psychology course sections to either writing or thinking condition.

This study involved a total of 978 undergraduate participants, of which 512 were assigned to the writing groups where they completed in class “minute papers”. These papers include in class writing as a response to a question, often concerning what the student found unclear or valuable in any course. The questions in these specific writing sections emphasised the point of views concerned with controversial psychology issues and simultaneous application of course content to everyday life. Students were asked to write for five minutes about the topic. When it comes to the thinking sections, students were asked to think for five minutes about the topic. After these two processes, students conducted a class discussion on the topic for 10 minutes. Following every three writing or thinking assignments, students took a multiple-choice exam. The writing sections group performed significantly better on both factual (p=0.006) and conceptual questions (p=0.02) on the exams than students in the thinking sections. A limitation to this study is that it is not clear if the students in the thinking group used their five minutes to actively think about the topic. Also, the sections, not the individual participants, were randomly assigned to conditions in the study by Drabick and colleagues. Wade (1995) agrees that writing has advantages over oral expression. According to Wade, written assignments
ensure that all students are participating, which is required for active learning. Further, written assignments can be formatted to allow students to rewrite and reconstruct as needed. Wade also agrees with the concept of short, focused writing assignments. In her courses, she assigns questions for each major topic in the course. Then she allows students to select any six assignments to complete during the semester. Although they are not graded, the instructor makes detailed comments on all assignments, emphasizing the importance of feedback on all writing assignments. Short, focused writing assignments, or microthemes, are also being used to help students to think critically (Allen et al., 1989). In his research, Allen and colleagues suggest that a portfolio of all writing examples throughout the curriculum should be kept track of, and that professors should boost students to do so. These portfolios mirror students’ “growing competence in both writing and thinking skills” (p. 9). Other research articles describe the use of the writing portfolio as a tool to measure of critical thinking in general and a way to promote critical thinking skills. Sorrell, Brown, Silva, and Kohlenberg (1997) discuss a collaborative research project between nursing and English conducted to determine if writing portfolios can be used to assess critical thinking skills in nursing students. Two nursing professors cooperated with an English professor at two different universities to assess writing portfolios. Four students from each university were chosen as being “good but not necessarily outstanding” (p. 3) writers, and were designated by their professors to take part in the study. The students were asked to choose four pieces of writing that mirror critical thinking skills from any classroom or clinical assignments in nursing. The professors then evaluated the portfolios based on the Critical Thinking Skills Evaluation Instrument, which includes elements such as inductive reasoning, deductive reasoning, ability to draw logical inferences, and ability to analyse and interpret. In the article, specific examples were given from the writing samples that demonstrated each of the instrument’s items. Findings from that study suggest that students have a different view of how their writing related to critical thinking than faculty members. Students selected research papers rather than journal entries for their portfolios, indicating that students believe critical thinking is equivalent to scholarliness. It is important that students are able to differentiate between the two, and one potential strategy to help with this is the explicit teaching of Paul’s critical thinking model (Reed
Findings also suggest that portfolios can help with critical thinking assessment and with promoting critical thinking. Finally, they concluded the lack of evidence of critical thinking in the portfolios might reflect the faculty members’ emphasis on correct answers and formats. If the present research intervention shows an effect on critical thinking, faculty members could use this method to increase critical thinking, with less emphasis on correct answers and formats.

The use of free writing in the implementation of WTL strategies was the subject of two articles. The first article, by Schmidt (2004), discusses the use of writing to learn activities (including free writes, mini-essays, letters, and brainstorming) in nursing courses to reduce the level of anxiety while writing. The second article (Baird, Zelin, & Ruggle, 1998) belongs to the context of accounting. Baird and colleagues proffer that writing assignments in accounting are thought of as valuable by many faculty members because they help to develop students’ written communication skills. However, the authors advert that writing assignments promote critical thinking and learning, a premise held by the WTL paradigm. This study was performed at a university in three accounting courses, and there were both treatment and control groups. The treatment or writing group completed one free write assignment during each class period, resulting in 14 free writes in each of the treatment groups.

The free write involved answering a question or reacting to a statement about the day’s topic. Grades were awarded for participation only. Students in the treatment groups performed better on average on seven out of nine exams, which consisted of multiple-choice, essay, and case study questions and the writing group had a higher minimum score on all exams. Overall, students reacted favourably to this intervention and believed it to be beneficial to their learning. There is no clear explanation, however, as to why students in the treatment group did not score better on the other two exams. Also, there is no mention in the article of an increase in test scores indicating an increase in critical thinking skills or disposition.

The WTL paradigm assumes that writing is learning and that writing can help to develop critical thinking (Allen et al., 1989). Several strategies incorporating the WTL paradigm are mentioned, including short in-class writing assignments (Allen et al.; Bowers & McCarthy, 1993; Drabick et al., 2007; Wade, 1995); portfolios (Allen et al.;
Sorrell et al., 1997); and freewrites (Baird et al., 1998; Schmidt, 2004). The present study’s intervention incorporated principles of the WTL paradigm in that the writing intervention was intended to increase critical thinking.
METHODOLOGY
CHAPTER II: Methodology

2.0 Introduction

This chapter provides a description of the research design, sample, setting, recruitment techniques, participants and method of measurement for this intervention study. To test the effectiveness of Reflective Writing as a pedagogical strategy in promoting critical thinking skills and dispositions in college students, two case studies were conducted in two different colleges using three different measurement tools/instruments. ARC (Assessment Rubric for Critical Thinking Skills through writing) and the CCTST (California Critical Thinking Skills Test) and CCTDI (California Critical Thinking Dispositions Inventory) pre-test and post-test were administered and both of which are accounted for in detail in subsequent sections. The chapter also includes an explanation of the reliability and validity of the instruments. Finally, a description of each portion of the reflective writing interventions is provided.

2.1 Purpose of the study

The present study sets out to investigate the impact (should any exist) of a Reflective Writing Intervention, as a scaffold activity, on the improvement of students’ critical thinking performance in critical thinking skills and dispositions. To this end and for the sake of reliability and validity of this research, the researcher has opted for two different case studies in different contexts but both using the same intervention to investigate the hypothesis. The effect of reflective writing intervention is going to be investigated and measured using two different measurement tools in the two separate case studies. The first study is a one semester long reflective writing intervention as a part of a writing course for Business college third year students majoring in Marketing, Finance, and Business Management and whose written productions were subject to assessment using the ARC for evidence of critical thinking skills progress. The second study was ten sessions long reflective writing intervention among semester 5 (BA) students at the Faculty of Education Rabat majoring in Applied Linguistics and EFL
teaching methodology. To test whether the intervention impacts the development of critical thinking skills and dispositions, the California Critical Thinking Test CCTST and the CCTDI to measure critical thinking skills and dispositions pre-intervention and post-intervention tests were administered.

2.2. Research questions

Based on the goals of the research, the following questions were formulated:

Question 1. To what extent does a Reflective writing intervention impact Moroccan College students’ performance in Critical thinking skills and dispositions?

Question 2. To what extent do critical thinking dispositions predict the academic achievement of Moroccan Faculty of Education students?

Question 3. To what extent do critical thinking dispositions predict the acquisition of critical thinking skills of Moroccan Faculty of Education students?

3. Hypotheses

H1: Students who receive supplemental instruction on reflective writing develop better critical thinking skills and dispositions.

H2: Critical thinking dispositions are a predictor of academic achievement

H3: Critical thinking dispositions are a predictor of critical thinking skills acquisition

2.4. Research Design

The present study is a quantitative research and adheres to a quasi-experimental design and in specific terms to a level III pre-test post-test design more particularly for the second intervention (CCTST and CCTDI pre and posttests). The testing nature of the study requires such a type of design which in most part relies on previous research and where variables are tested through experimentation. It is used to compare participant
groups and measure the degree of change occurring as a result of treatments or interventions. In addition, a pre-test post-test design designates the course of variables in relation to one another (Wood & Ross-Kerr, 2011). This design was most appropriate for the present study which involves an experimental group consisting of 30 students from the Faculty of Education as a convenience group who volunteered to enroll in the reflective writing intervention in addition to a control group consisting of 15 students from the same institution who also volunteered to be part of the study. The Business College group did not consist of a control group however; the effect was measured within the same group consisting of thirty students using a critical thinking through writing rubric as mentioned earlier. It was hypothesized that reflective writing intervention has an impact on critical thinking skills and dispositions. Therefore, the direction of the variables has been defined.

In the two interventions students were enrolled in different courses but shared some overlapping areas in terms of their need and use of critical thinking skills. In the First study, students were enrolled in business and management, marketing and finance courses each of which requires a certain degree of critical thinking especially in situations of problem solving and decision making. In the second study, Faculty of Education students were enrolled in extensive courses of language teaching and pedagogy. They studied theoretical concepts that are meant to be applied in teaching contexts consequently; critical thinking skills are needed and reflective writing intervention about some of the concepts and methods they have studied provides them with an opportunity to reflect upon and practice what they have learned. Based on the studies described in the previous chapter, enough literature exists to predict the relationship between the independent variable (reflective writing intervention) and the dependent variables and scores on three critical thinking instruments. The plan was to test the significance of that relationship.
2. 5. Explanation of the two studies

The following figures explain the procedure followed in the two studies. Study 1 measures the impact of reflective writing on critical thinking skills of Business College students (Knowledge Computer and Business Institute), using the Arc Rubric. The second study (Study 2) measures the impact of reflective writing intervention on both critical thinking skills and dispositions of faculty of education students using the pre and posttests of CCTST and CCTDI.

**Study 1: Reflective Writing Intervention for Business and Computer College students**

![Diagram of first study using the ARC](image)

Figure 3: Diagram of first study using the ARC
Study 2: Reflective Writing Intervention for Faculty of Education Students

As far as the first study (1) is concerned, during the first week of the term, students enrolled in writing courses and were introduced to reflective writing as part of the course. The entire group participated in the reflective writing intervention and was assigned weekly writing homework for one academic semester. Upon completion of the course, five written productions were selected based on presence during the intervention. They were assessed and scored using the ARC described later in this chapter. Regarding the second study (2), both control and experimental groups completed the CCTDI and the CCTST pre-intervention tests. Then, the experimental group participated in the 8 weeks long daily reflective writing intervention, consisting of 15 assignments described later in this chapter. Both groups completed a CCTST and CCTDI post-intervention tests.
2.6. Rationale for choosing convenience sampling method

Convenience sampling was the most appropriate method to account for the goals of this research. It is a non-probability method of sampling in which the researcher’s judgment is not used to select a representative sample of elements. Rather, the primary selection criterion relates to ease of obtaining a sample as the latter is readily available with all the characteristics in which the researcher is interested. Ease in this sampling strategy includes the cost of locating elements of the population and the geographic distribution of the sample in addition to willingness to cooperate. Examples of convenience samples include mall intercept interviews, class of students and other easily accessed samples in which individuals are invited to take part or volunteer in a study following unsystematic recruiting (Dörnyei 2007). Although the notion of representativeness is in times less of a concern when using this method, the researcher must assert that the selected sample is representative of the whole targeted population to avoid all doubts about the validity and reliability of the findings and hence, the research (Battaglia et. al., 2004).

The following sections will be devoted to a detailed discussion of each of the two studies conducted in the present thesis.

2.7. Study 1

The aim of this first study is to measure the effect of reflective writing intervention on critical thinking skills using the ARC among Business College students.

2.7.1 Study context

The setting for study 1 included one Business Institute in Rabat offering classes in Business management, Finance, Marketing and Computer sciences. All the class subjects are taken in English particularly for the third year Bachelor students and Masters’ students. The sample was taken from the third year Bachelor (semester five) students majoring in the three branches mentioned above. All respondents had participated in different internships in diverse companies and institutions (belonging to both private and public sectors) according to their fields of expertise. The professional context of their internships provided them with an opportunity to apply and integrate the
knowledge they have acquired through these experiences which were considered in the intervention both in essay writing and in class reflective dialogues.

2.7.2. Research Sample

The research study used a convenience sample of thirty (30) third year students enrolled in the same common core writing class that the researcher taught and observed for one year (two academic semesters). The writing class is meant to give students basic concepts and technics of writing and prepare them for the end of the year capstone project they had to realise and submit. The class consisted of students of three majors namely Business and management, Marketing, and Finance. They belong to an age category ranging from 20 to 23 years old. The majority of respondents (86.7%) were between the ages of 20 and 23. The group involved 18 (60%) males and 12 (40%) females participants.

The age is an important factor in this study as mentioned in the previous chapter about cognitive maturity and epistemological stages of learners. Significant changes on the quality of the thinking process and thoughts produced occur during the period of higher education. According to numerous studies stated in the literature review part (Perry, 1985; Magolda 1992, Belenky, Clinchy, Goldberger and Tarule 1986; Sprenger 2005; Kuhn, 2000, 2001; Stebre 2009), learners start to think critically when they reach a level where they understand the constructed nature of knowledge and start becoming metacognitively aware of the knowledge building process by adding and relating existing facts to new ones and self-regulate themselves to do so. In addition, the full myelination of the brain part responsible for high order thinking skills which is the pre-frontal lobe does not occur until age 20. This process was described by Stebre (2009) as Neuromaturation. Therefore, based on the goals of this research, which is enhancing critical thinking skills and dispositions in University students, the age factor should be taken into account as critical thinking is not fully developed until the period of higher education.
2.7.3 Rationale for Study 1 research sample

Critical thinking is highly regarded in the context of business education. Barnett (2002) found that critical thinking ranked as the highest cognitive strategy in business courses. Similarly, critical thinking plays a primordial role in business educational programs as it sets a positive correlation between CT as a subclass of metacognitive skills and course performance (Tempelaar, 2006). In the field of business and management, students need to be able to think outside the box and target new visions for the future. To this end, a predisposition with critical thinking skills is required at the level of business and management higher education to enhance students’ ability of, and tendency towards decision making and problem solving as these two constructs are the heart of efficient leadership.

The aforementioned sets the base for the choice of business and management, marketing, and finance sample (convenience sample) in the present study. In the light of the existing literature about the importance of critical thinking skills in business and managerial educational settings, the researcher believes that this field of study, among others, exhibits an urge for CT skills. Following the same line of thoughts, business and managerial education is one of the academic areas where students are required to act or react in a given situation under certain conditions, which allows room for assessment and evaluation of practices and learning outcomes. Moreover, the critical thinking skills which constitute the core concept of any managerial or business educational program align well with the objectives of the present research. These skills are looked at closely in the course descriptors' analysis hereafter.

As mentioned earlier, the nature of the subjects and majors of the respondents requires a strong tendency towards the use of critical thinking skills. Within every major (Business and management, Marketing, and Finance) course, descriptors stress objectives, the basis of which is decision making and problem solving. The researcher studied the course descriptors of every major and summarized them in the light of the present study’s goals and objectives and for a clearer and more accurate use of the reflective writing intervention.
2.7. 3. 1. Course descriptors of Business, Marketing, Finance major

a. Business management

- Develop skills necessary for effective leadership (negotiation skills, coaching skills, conflict resolution, and team management)

- Develop skills necessary for successful marketing strategy building and emphasize the integration of these marketing functions into an effective plan.

- Develop skills necessary for successful small business start-up and growth (development of business concepts, strategic planning, an overview of international business, and examination of important principles for businesses of any size).

- Develop personal skills necessary for success in business (goal setting, time management, teamwork, and making a positive impact in the workplace. A focus is on application of skills to maximize personal and professional effectiveness).

- Develop skills necessary for financial management from a personal and a business perspective (planning for major expenditures, the risks and returns of various investment channels).

- Workplace experience allows students to apply skills learned in the Business Management program.

- Integrate and build upon skills learned in previous Business Management courses. Students learn about strategic planning and decision making.

b. Marketing

- Develop an understanding of consumer and organizational decision making through application of behavioral sciences.

- Develop skills necessary to understanding theories and techniques of planning, conducting, analyzing and presenting market studies.
• Develop skills necessary for the analysis of a contemporary marketing case, evaluation of alternative marketing strategies and the preparation of a comprehensive marketing plan for a client.

c. **Finance**

• Develop skills necessary to approach financial management (budgeting, income tax effect and strategies, credit risk management, investment analysis, risks, alternatives, capital investment analysis, financial manager's decision-making).

In accordance with the above mentioned course descriptors of the three majors involved in the intervention, Critical thinking skills namely “interpretation, analysis, synthesis, evaluation, problem solving and reflection” are at the heart of every activity and one major educational outcome. Consequently, the promotion of those skills through reflective writing is an asset for the students. To this end, the reflective writing intervention and the assessment rubric were designed according to the critical thinking skills mentioned earlier. This will be explained in details in subsequent sections.

2. 7. 4 Measures

2. 7. 4. 1. *Assessment Rubric for Critical Thinking through writing (ARC)*

In this reflective writing intervention, written productions of respondents were scored and assessed using the Quality Enhancement Plan (Georgia State University) *Assessment Rubric for Critical Thinking (ARC) through writing*. The rubric is a psychometric test as it is a quantitative measurement of a mental characteristic which are critical thinking skills in this study. It is a standardized procedure for measuring progress of critical thinking skills through oral or written production as is the case of the present study. The Assessment Rubric for Critical Thinking (ARC) is a global rubric template developed for the College to offer a view on how student learning is being affected by the critical thinking QEP (Quality Enhancement Plan) initiative. It is designed to assess a variety of student projects from a critical thinking perspective. For example, students in a composition class may be asked to complete a paper on a specific topic. This ARC rubric template can evaluate the student’s use of critical thinking skills.
in the development of the paper or series of essays as opposed to specifically evaluating the quality of student’s writing skills. The ARC rubric template is designed to be flexible enough to address a number of student project modalities including written and oral communications. ARC Assignment Profile is designed to provide consistency and accuracy in the evaluation of the ARC at the institutional level as well as provide guidelines for the use of the assessment at the course level.

The Quality Enhancement Plan is an initiative that was first conducted at Georgia State University (USA) in 2009. It focused mainly on the enhancement of critical thinking through engaging students in the process of learning. The goal of The Quality Enhancement plan, Critical Thinking through Writing is to upsurge undergraduate students’ performance in two of the major University’s general educational outcomes namely critical thinking and written communication in the academic major. The motive behind this initiative was the belief that enhancement of critical thinking and writing will be achieved through the implementation of a university wide graduation requirement that undergraduates pass two critical thinking through writing (CTW) courses in their major. Each course, designed by the major department and approved by the General Education Assessment Subcommittee of the University Senate’s Committee on Academic Programs, will contain multiple writing-to-learn activities and assignments that address issues relevant to that major.

In accordance with the above mentioned objectives stemming from the QEP, the ARC rubric was designed to authentically assess critical thinking skills development serving a twofold process of first, raising students’ interest in thinking critically and second, allowing data assessment and measurement of students’ improvement. The assessment techniques on which the test is based fall into three categories: 1) criterion-referenced rubrics, 2) students’ reports (reflection or self–assessments), 3) students portfolios.

Criterion- referenced evaluation compares the learners with well-defined performance criteria rather than comparing them with other learners (Deyoung & Gray 2009). Tools belonging to this category of evaluation define the behavior expected at each level of performance. Hence, the tests are used to determine the learner’s mastery
of a skill, knowledge or any subject matter taught with reference to a criterion established that is usually an absolute standard (Calderon et. al 1993). In such tests, the status of the learner’s score does not depend on the scores of another learner who takes the same test in a control group, but is dependent on the established criteria set in the rubric. They are constructed to provide a measure that is interpreted in terms of specific performance criteria. It serves to identify the extent to which the individual performance has met a given criteria. As the ultimate goal of criterion reference measure is to identify weak and strong points in an individual’s performance, it helps detect the high achievers but not intelligent students and vice versa and those who have been achieving progressively at their own rate. Therefore, this measure could be both diagnostic and prognostic in nature. The ARC as a rubric follows a rating scale that is used with performance assessment. It is formally defined as a scoring guide consisting of specific pre-established criteria as mentioned earlier assessing students on performance resulting from a task. It also identifies learning criteria, levels of performance, and levels of quality, describes problems and difficulties students encounter and identifies thinking skills. The ARC assesses and evaluates six critical thinking skills through reflective writing productions. The six skills are 1) Communication, 2) Analysis, 3) Problem solving, 4) Evaluation, 5) Synthesis, 6) Reflection. These skills are defined in the rubric following criteria of performance; and each is given a 5 points likert scale score ranging from (0) =Not present, to (4) = Exemplary and in which (1) = Emerging, (2) = Developing, (3) = proficient. The ARC has been piloted and results were analyzed from a quantitative as well as a qualitative perspective to establish the quality, reliability, and validity of the assessment instrument.

The course assignment for the ARC should include all of the elements of the rubric and should be aligned with the task outlined for each element. Assignments that only evaluate some of the elements or are not aligned with the specific ARC tasks are considered incomplete and not used in the institutional analysis.

The specific elements and tasks of the ARC include:

(1) Communication: Define the problem in your own words.
(2) Analysis: Compare & contrast the available solutions within the scenario.

(3) Problem Solving: Select one of the available solutions and defend it as your final solution.

(4) Evaluation: Identify the weaknesses of your final solution.

(5) Synthesis: Suggest ways to improve/strengthen your final solution (may use information not contained within the scenario).

(6) Reflection: Reflect on your own thought process after completing the assignment. stands for a self-regulatory process through which students learn how monitor their thinking process)

“What did you learn from this process?”

“What would you do differently next time to improve?”

In the present study the ARC rubric was slightly modified to account for the purposes of the research but at the same time, keeping all its core values, accuracy, consistency and reliability. One critical thinking skill, namely “Communication”, was changed for Interpretation to meet the definitions of critical thinking adopted in the present research. The performance criteria were also slightly modified to align with goals of the study. The critical thinking skills measured by the ARC in the present study are as follows:

(1) Interpretation: Categorization, Decoding significance and clarifying meaning.

The likert scale and the performance criteria for the skill of **interpretation** are as follows:
(2) **Analysis:** Examining ideas, Detecting arguments and analysing arguments

The likert scale and the performance criteria for the skill of **Analysis** are as follows:

<table>
<thead>
<tr>
<th>Exemplary (4)</th>
<th>Proficient (3)</th>
<th>Developing (2)</th>
<th>Emerging (1)</th>
<th>Not Present (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehends and puts across the meaning or significance of a wide range of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria providing problem with numerous supporting details and examples which are organized logically and coherently.</td>
<td>Comprehends and puts across the meaning or significance of some experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria providing problem with some supporting details and examples which are organized</td>
<td>Comprehends and puts across the meaning or significance of few experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria providing problem with few supporting details and examples in somewhat organized way</td>
<td>Comprehends and puts across the meaning or significance of few or no experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria providing problem with few or no supporting details and examples in a non-organized way</td>
<td>Does not comprehend the main idea or problem.</td>
</tr>
</tbody>
</table>
### Problem Solving: Select & Defend Chosen Solution

The Likert scale and the performance criteria for the skill of **problem solving** are as follows:

<table>
<thead>
<tr>
<th>Exemplary (4)</th>
<th>Proficient (3)</th>
<th>Developing (2)</th>
<th>Emerging (1)</th>
<th>Not Present (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses specific inductive or deductive reasoning to make inferences regarding premises; <strong>addresses implications and consequences</strong>; identifies facts and relevant information correctly.</td>
<td>Uses <strong>logical</strong> reasoning to make inferences regarding solutions; <strong>addresses implications and consequences</strong>; identifies facts and relevant information correctly.</td>
<td>Uses <strong>superficial</strong> reasoning to make inferences regarding solutions; <strong>shows some confusion regarding facts, opinions, and relevant, evidence, data, or information.</strong></td>
<td>Makes <strong>unexplained, unsupported, or unreasonable</strong> inferences regarding solutions; makes <strong>multiple errors</strong> in distinguishing fact from fiction or in selecting relevant evidence.</td>
<td><strong>Does not analyze multiple solutions.</strong></td>
</tr>
</tbody>
</table>

---

(3) Problem Solving: Select & defend chosen solution.

The Likert scale and the performance criteria for the skill of **problem solving** are as follows:

<table>
<thead>
<tr>
<th>Exemplary (4)</th>
<th>Proficient (3)</th>
<th>Developing (2)</th>
<th>Emerging (1)</th>
<th>Not Present (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses specific inductive or deductive reasoning to make inferences regarding premises; <strong>addresses implications and consequences</strong>; identifies facts and relevant information correctly.</td>
<td>Uses <strong>logical</strong> reasoning to make inferences regarding solutions; <strong>addresses implications and consequences</strong>; identifies facts and relevant information correctly.</td>
<td>Uses <strong>superficial</strong> reasoning to make inferences regarding solutions; <strong>shows some confusion regarding facts, opinions, and relevant, evidence, data, or information.</strong></td>
<td>Makes <strong>unexplained, unsupported, or unreasonable</strong> inferences regarding solutions; makes <strong>multiple errors</strong> in distinguishing fact from fiction or in selecting relevant evidence.</td>
<td><strong>Does not analyze multiple solutions.</strong></td>
</tr>
</tbody>
</table>
### Evaluation: Assessing claims, assessing arguments and identify weaknesses in your chosen solution.

The likert scale and the performance criteria for the skill of Evaluation are as follows:

<table>
<thead>
<tr>
<th>Exemplary (4)</th>
<th>Proficient (3)</th>
<th>Developing (2)</th>
<th>Emerging (1)</th>
<th>Not Present (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoroughly identifies and addresses key aspects of the problem and insightfully uses facts and relevant evidence from analysis to develop potentially valid solutions</td>
<td>Identifies and addresses key aspects of the problem and uses facts and relevant evidence from analysis to develop potentially valid conclusions or solutions</td>
<td>Identifies and addresses some aspects of the problem; develops possible conclusions or solutions using some inappropriate opinions and irrelevant information from analysis</td>
<td>Identifies and addresses only one aspect of the problem but develops untestable hypothesis; or develops invalid conclusions or solutions based on opinion or irrelevant information</td>
<td>Does not select and defend a solution.</td>
</tr>
</tbody>
</table>
### (5) Synthesis: Suggest ways to improve/strengthen the chosen solution

The likert scale and the performance criteria for the skill of Synthesis are as follows:

<table>
<thead>
<tr>
<th>Exemplary (4)</th>
<th>Proficient (3)</th>
<th>Developing (2)</th>
<th>Emerging (1)</th>
<th>Not Present (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insightfully</strong> interprets data or information; identifies obvious as well as hidden assumptions, establishes credibility of sources on points other than authority alone, avoids fallacies in reasoning; distinguishes appropriate arguments from extraneous elements; provides sufficient logical support.</td>
<td><strong>Accurately</strong> interprets data or information; identifies obvious assumptions, establishes credibility of sources on points other than authority alone, avoids fallacies in reasoning; distinguishes appropriate arguments from extraneous elements; provides sufficient logical support.</td>
<td><strong>Makes some errors in data or information interpretation; makes arguments using weak evidence; provides superficial support for conclusions or solutions.</strong></td>
<td><strong>Interprets data or information incorrectly; Supports conclusions or solutions without evidence or logic; uses data, information, or evidence skewed by invalid assumptions; uses poor sources of information; uses fallacious arguments.</strong></td>
<td><strong>Does not evaluate data, information, or evidence related to chosen solution.</strong></td>
</tr>
</tbody>
</table>
(6) **Reflection:** *The learner reflects on his/her own thought process.*

The likert scale and the performance criteria for the skill of **Reflection** are as follows:

<table>
<thead>
<tr>
<th>Exemplary (4)</th>
<th>Proficient (3)</th>
<th>Developing (2)</th>
<th>Emerging (1)</th>
<th>Not Present (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insightfully relates concepts and ideas from multiple sources; uses new information to enhance chosen solution; recognizes missing information; correctly identifies potential effects of new information.</td>
<td>Accurately relates concepts and ideas from multiple sources; uses new information to enhance chosen solution; correctly identifies potential effects of new information.</td>
<td>Inaccurately or incompletely relates concepts and ideas from multiple sources; shallow determination of effect of new information on chosen solution.</td>
<td>Poorly integrates information from more than one source to support chosen solution; Incorrectly predicts the effect of new information on chosen solution.</td>
<td>Does not identify new information for chosen solution.</td>
</tr>
</tbody>
</table>
The ARC rubric is used in this study to measure progress and development of critical thinking skills of third year business students over a period of time of one semester (8 weeks). To this end, the rubric was modified and adapted in a way as to account for the eight weeks sessions of reflective writing workshop and hence the written productions by adding columns on the number of the scored reflective writing essays. The ARC was selected because it provides a reliable assessment of critical thinking skills’ progress (should any exist), it has good psychometric properties, and easily adapts to the model of reflective writing intervention tested in this study. It also provides room for computing scores for individual items using repeated measure ANOVA.

2.7.5 Reliability and validity of the rubric

Nowadays, assessment in higher education is shifting towards assessing learning instead of knowledge (Dochy, Gijbels, & Segers, 2006). The new assessment culture
aims at assessing higher order thinking processes and competences instead of factual knowledge and lower level cognitive skills, which has led to a strong interest in various types of performance assessments. This is due to the belief that open-ended tasks are needed in order to elicit students’ higher order thinking. According to Black (1998) performance assessment is concerned with “activities modelled on reality” (p. 87). Similarly, we can talk about the notion of authentic assessment involving tasks relating to the real world. Consequently, performance assessments are designed to capture more elusive aspects of learning by letting the students solve real world and authentic problems as is the case in the present study.

Using a scoring rubric to assess performance has several benefits among which we consider increased consistency of scoring, the possibility of facilitating valid judgment of complex competencies, and enhancing the learning process and outcomes (Jonsson, Svingby 2007). The basic concept behind rubrics is to assess complex competences in a credible way. Although the meaning of the term “credibility” varies in several situations and according to the different assessing purposes, scoring rubrics are believed to solve this problem. Reliability related to observation of complex behaviour is a problem that is more or less showing up for high stake assessments. However, classroom assessment targeting the enhancement of students learning is less influenced by the call for high reliability while validity is needed (Jonsson, Svingby 2007). Moreover, a scoring rubric that is used in a classroom to assess performance needs to be effectively designed, well understood and used competently. In general, performance assessment involves two parts namely a task and a set of scoring criteria (Perlman 2003) which are the components of a rubric. In the existing literature concerned with education, the term rubric refers to an assessment tool aiming to describe levels of performance on a certain task and evaluate outcomes (Hafner & Hafner, 2003). There are two types of rubrics namely holistic and analytical. In the holistic type the rater makes an overall judgment about the quality of performance, while in analytic scoring, the rater assigns a score to each of the dimensions being assessed in the task. The one type that meets the requirements of this study is the analytical scoring. It is used in the classroom and the results can help teachers identify students’ strengths or weaknesses. This is done through the assessment of critical thinking skills in reflective writing.
productions over a period of time on the basis of a performance criteria scale. The reliability of a rubric lies mainly on the reliability of scoring. The more consistent the scores are over different raters and occasions, the more reliable the assessment is thought to be (Moskal & Leydens, 2000). Therefore, variability of scoring is stressed when it comes to reliability of measurement, an issue that can come up in different ways. It is in a great part due to variations in the rater’s or raters’ judgement about a student’s performance. This form of variability can occur either across raters which is known as inter-rater reliability or in the evenness of a single rater called intra-rater reliability. Several are the factors that can impact an assessor’s judgement, just as two or more raters might come up with different judgements about the same assessment of a student’s performance. Obvious motifs behind the aforementioned are “differences in experience or lack of agreed-upon scoring routines” (Jonsson, Svingby 2007, p: 132). Other less recognizable reasons are scorers’ attitudes regarding students’ ethnicity, as well as the content which may also influence the rating of students’ work (Davidson, Howell, & Hoekema, 2000). In the present study, the ARC rubric which is the product of the Quality Enhancement plan of Georgia State University 2009 was modified. The original version of the rubric is valid and reliable as it was piloted and its results were analysed quantitatively and qualitatively to establish reliability and validity. Accordingly, additional modifications and refinements were made in order to warrant the quality of the final instrument. The results of the rubric were re-evaluated following every administration and inter-rater reliability was measured. Similarly, the actual modified version of the rubric used in this study was subject to intra-rater reliability and construct related validity tests to assure the overall reliability and validity and hence, credibility of the results. This will be explained in the following section.

2.7.5.1. Intra-rater reliability

As mentioned earlier, reliability is the amount of real information concerning a given construct, the essence of which is captured through its measurement. If a measurement’s reliability is reported to be .8, it should be concluded that 80% of the score’s variability apprehended by measurement represents the construct and the remaining 20% stand for the random variation. Uniformity of a measurement represents
higher reliability. However, according to Brown, Bull, and Pendlebury (1997), reliability is threatened when there is a lack of consistency of individual or several markers. In the present study, the rubric was scored by one rater and the kind of reliability this research needs to meet is called intra rater reliability. It refers to the extent to which there is an agreement among the several administrations of the same diagnostic test scored by a single rater (Brown, Glasswell, and Harland 2004). To investigate intra rater reliability, a statistical test namely Cronbach’s Alpha is used to gauge the rater’s consistency of judgements.

In the present research study, the rubric is scored by one rater (the researcher herself as it was not possible to find other raters who would perform the task according to the norms required for this research). In an attempt to establish validity and reliability of both the instrument and the results it yielded, the consistency of the rater’s judgment in five assignments and for every criterion (critical thinking skills/ scales) during the measurement procedure is measured using Cronbach’s alpha. The latter is a consistency estimate statistical test intended to measure internal consistency and reliability of psychometric instrument. The value of alpha ($\alpha$) ranges between negative infinity and one (1) positive. However, only positive values of ($\alpha$) make sense. A report of the alpha value above .70 is considered adequate to attribute reliability to a given psychometric instrument (Brown et al., 2004; Stemler, 2004).

2.7.1.6. Reflective writing assignments

Reflective writing in this study is used as an intervention. It is the method used, as hypothesised, to enhance critical thinking skills. First, the study assumes that reflective writing is a form of writing to learn that could through its process, depth and quality, help learners develop their critical thinking skills (Moon 2006). To investigate the objectives of the present research namely the effect of reflective writing intervention on the development of critical thinking skills, writing reflectively was introduced as part of a course. Eight reflective writing tasks were designed to fit the requirements of the course subject and those of the research following Gibbs reflective cycle (1988). The cycle is a theoretical model often used by students as a framework in coursework...
assignments that require reflective writing. The model consists of six stages which are 1) Description 2) Feelings 3) Evaluation 4) Analysis 5) Conclusion 6) Action Plan. The model is further explained in details subsequently. In class instruction was crucial to the success of the intervention. The researcher designed an instructional method to assure more depth and quality and raise participants’ metacognitive awareness about the use of critical thinking skills in a context of reflective writing. The instructional strategy comprises five steps: 1) Presentation of the topic or situation 2) Instructional scaffolding of critical thinking skills 3) Reflective dialogue about the topic/ situation/ personal experience 4) Connecting critical thinking skills to the topic/situation/ personal experience 5) writing reflectively following Gibbs’ model.

2.7.1.7. Procedure

This case study involved a sample of students enrolled in Business management, Finance and Marketing common core and taking an English writing course which was taught by the researcher herself. This provided her with an insight into the interaction among students and their reaction towards the writing course in general and the intervention in particular. Moreover, the researcher had the opportunity to assess their level prior to and after the beginning of the writing course and the reflective writing intervention. The reflective writing intervention was discussed with the pedagogical board of the school to be part of the writing class and consent was given and a syllabus was designed accordingly.

In the first three hour session of the academic semester (5) which is eight (8) weeks long, the students were made aware first of the writing course descriptors and second of the Reflective writing intervention as part of the course. Then, they were informed that the writing course would be divided in two parts of one hour thirty minutes each: the first part devoted to the writing lesson and the second to Reflective writing, the assignments of which would be given grades as a part of their course assessment. A description of reflective writing and the writing assignments was also provided. Thus during the weekly sessions of reflective writing (1h30) students were made aware of the cognitive processes and strategies that they use while writing and
thinking in addition to critical thinking skills. Furthermore, they had in class reflective dialogues guided by the researcher’s questions about different subjects of relevance to the three different majors they belonged to, namely Business management, Marketing and Finance. Discussions did not only consist of reflection on a given issue or subject, they also involved situations where students had to find a solution to a given problem, connecting theory to practice and personal experiences.

Reflective writing assignments were given as a homework that the respondents had to send to the researcher via email or hand in the following session. By the end of every session, students were asked to reflect upon their peers’ written productions and spot evidence for the use of critical thinking skills. Sessions ended with the researcher’s feedback about metacognitive awareness of critical thinking skills and the way participants could self-regulate themselves in using those skills when writing reflectively. Written assignments were corrected and given back to students on a weekly basis along with a feedback on general writing skills and the use of critical thinking skills. A copy of the assignments was kept for final scoring using the ARC (Assessment Rubric for Critical Thinking skills through Writing). The total number of assignments for each of the thirty students was eight. Some of the students were absent in some sessions but could send the assignments via email. Only five (n=5) assignments of the total number (n=8) for each student were selected to be scored for feasibility reasons and time restriction. Selection was done on the basis of attendance.

Through the last session, students were given feedback by the instructor on their general performance in the reflective writing sessions and assignments, and a general discussion was held about the effect this intervention had on the students’ way of thinking both at the personal and academic level.

2.7.1.8. The Intervention

The intervention was 8 weeks long and focused on students’ instruction and reflective discussion. The workshop was divided in two parts. The in-class instruction following a model that the researcher has designed in addition to the reflective writing assignments participants had to write following Gibbs’ model (1988) of reflective
writing. The following figure (2) demonstrates the steps of the instruction method applied in the intervention.

**Figure 5. Instruction method of the reflective writing intervention**

Reflective writing instruction started in the first session by explaining and clarifying the process through which one goes when writing in general and when writing reflectively in particular. The concept of critical thinking was introduced along with its relevance to the field of business, management and finance, and to the actual educational program. In addition, students were made aware of critical thinking skills used in this experiment as an attempt to make them metacognitively aware of the processes they go through when discussing and writing reflectively. The following sessions consisted of reflective dialogue about a topic related to their field of expertise following the above process (figure 2) and a reflective written production about the issue discussed in class.
2.7.1.9. The data analysis procedure

Data in this study is processed and analyzed via SPSS software using the one way repeated measures ANOVA as the study revolves around a within subject evaluation of the impact of the treatment over repeated points in time.

The following section describes the methodology used in the second study. It also provides a detailed description of the research design, participants, sampling, measures and the procedures in addition to a report on the intervention.

2.8. Study 2:

The aim of this study is to measure the effect of reflective writing intervention on critical thinking skills and dispositions using CCTST and CCTDI among the faculty of education students.

2.8.1. Study context

This study is conducted at the faculty of education, Mohamed V University, Rabat. The faculty receives students from all the regions of Morocco and offers a variety of classes in sciences of education, language pedagogy, and higher education research. The sample chosen for this study measuring the impact of reflective writing on critical thinking skills and dispositions is a two classes group (control and experimental) of English Language and pedagogy branch. All class subjects are taken in English and core content classes are designed to enrich students’ knowledge in Applied linguistics and EFL teaching methodology.

2.8.2. Research design

The study follows type three pretest posttest experimental designs to test the impact of reflective writing on the improvement of critical thinking skills and dispositions (should any exist). It was designed to use descriptive and inferential statistics to analyze the collected data. A quantitative research design was followed to find the association between the dependent and independent variables. In opting for a quantitative research design, the researcher chose to compare the mean scores of groups
to determine the interaction between variables namely critical thinking skills / dispositions and reflective writing.

2.8. 3. Research Sample

The sample used in this research study is a convenience group of 45 students from the faculty of education. The subjects are bachelor students from all regions of Morocco accepted in the English language and pedagogy program upon success in file selection process and entry exam. The study program consists of a variety of courses related to Educational sciences, pedagogy and language teaching methodology. Upon program completion, students are prepared to take an entry exam to one of the teacher training colleges existing in different regions of Morocco to graduate as high school teachers of English. Mastery of the English language is an asset in this study due to the fact that the critical thinking skills and dispositions tests (CCTST and CCTDI) are in English and because the English language might be a factor inhibiting the student’s aptitude to transmit and show their critical thinking abilities. In addition, language education is a field of expertise which provides the study subjects with an opportunity to apply and integrate the knowledge they have acquired through their classes in real situations and reflect upon them. In accordance with the goals of the study, two groups namely control and experimental were needed to assess the effect of reflective writing on critical thinking skills and dispositions (should any exist). The experimental group consisted of 30 students while the control group included 15 students. The subjects’ age differed considerably as they belonged to an age category between 21 and 29 years. Students of both groups volunteered to take part in the study by taking the two “pre” and “post” tests of the CCTST and CCTDI and the reflective writing intervention (experimental group).

2.8. 3. 1. Rationale for the research sample

Critical thinking is widely believed to be one important goal and component of the BA program the students were enrolled in. They are constantly compelled to use critical thinking due the nature of the courses they take and the tasks they are required to
do as future teachers. As students, the knowledge they get from Educational theories and concepts, Pedagogy and teaching methods in addition to curriculum design sets the ground for critical thinking skills to be used. Moreover, it offers room for further integration and application of that knowledge into different contexts.

2.8.4. Measures

The problem addressed by this study is to discover whether reflective writing could improve the critical thinking performance of students majoring in English studies through a writing workshop as an extra instructional activity. The question to be asked at this point is: How might writing in a separate writing intervention affect the five dimension skills as defined by the Delphi report, namely: analysis, inference, interpretation, explanation and evaluation that are inherent to critical thinking. To find answers to this question there is a seminal need to go through a range of procedures which are going to construct the image of this complicated puzzle.

To measure the progress of this generic skill through reflective writing, the California Critical Thinking Skills Test College level (CCTST) and California Critical Thinking Disposition Inventory (CCTDI) at the beginning pretest and end posttest (experimental/control) were used. The tests were administered to assess the impact of the reflective writing workshop as an extra instructional component. The purpose of the application of the California Critical Thinking Skills and the California Critical Thinking Dispositions Inventory is to determine if individuals have received appropriate instruction and practice in developing critical thinking skills. Additionally, it is useful to determine if students are adequately equipped to apply these skills in the world beyond their college experiences. Last, it is used to assess whether reflective writing is a pedagogical strategy that could promote critical thinking skills and dispositions. Results from the CCTST and CCTDI not only measure critical thinking but also the effectiveness of general education in its entirety. Therefore, the two tests which are believed to satisfy the requirements of this study are described in details hereafter.
2.8. 4. 1. The California Critical thinking Skills Test (CCTST)

The CCTST is a cognitive, multiple choice educational assessment tool designed to assess selected core critical thinking skills (Facione, 1990). It measures the growth and progress in critical thinking skills achieved by college students. The theoretical construct behind the CCTST is the conceptualization of critical thinking clearly expressed by the panel of 46 American experts who participated in the Delphi research project which was conducted during the years between 1987-1989 for the American Philosophical association. The CCTST targets five cognitive skills as they were defined in the Delphi research: Interpretation, analysis, evaluation, explanation, and inference. The CCTST reports on six scores, an overall score on Critical thinking cognitive skills, and five sub scores reporting on the abovementioned reasoning skills. The CCTST does not test any content area knowledge. Questions are framed in the context of everyday issues. All necessary information needed to answer the question correctly is presented in the question stem. The fact that the CCTST measures only critical thinking and not content knowledge makes it possible to use this instrument as a pretest and posttest to measure improvement in critical thinking that occurs during any educational program or staff development exercise.

On all forms of the CCTST, the test items range in difficulty and complexity. Together the items provide a measure of overall critical thinking and a measure of five or more useful skill descriptions that can be used to guide staff development and curriculum development. The items use everyday scenarios, appropriate to the intended test-taker group. The response frame is in multiple choice formats. The instrument is typically administered in 45 minutes. There are varying numbers of items on each form, but in each case the length of the instrument is set to permit maximum performance within the range of possible effort for the intended test-takers group.

CCTST also provides an array of scale scores describing strengths and weaknesses in various skill areas. As a generic skills test, the score scale is qualitatively interpreted as “Superior, Strong, Moderate, Weak, and Not manifested”.
Critical thinking is a holistic process, but different individuals and groups of individuals have been shown to have relative strengths and weaknesses in several easily addressed areas:

- Analysis
- Inference
- Evaluation
- Explanation
- Induction
- Deduction

Each subtest of the CCTST is similar in structure. The subtests present test-takers with different types of questions with the goal of analyzing or interpreting information presented in texts, charts, or images; drawing accurate and warranted inferences; assessing inferences and explaining why they indicate strong or weak reasoning; and explaining why a given evaluation of an inference is either strong or weak (Facione & Facione, 2010). Ten versions of the CCTST are available, ranging from formats relevant to public education to those appropriate for graduate students. While the tests are different in terms of complexity, all provide objective assessment of critical thinking skills. Analysis, evaluation, and inference are particularly denoted on the CCTST as well as the elements of deductive reasoning and inductive reasoning.

On the CCTST analysis is the ability to pull apart arguments and points of view to show why people think the way they do. It is the means to comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria (Facione & Facione, 2010). This includes the skills of categorization, decoding, significance, and clarifying meaning.

CCTST includes identifying the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation.
intended to express beliefs, judgments, experiences, reasons, information or opinions. Included in this category is examination of ideas, detecting arguments, and analyzing the elements of argument. On the CCTST evaluation is the ability to decide how strong or weak an argument may be. It is the means to assess the credibility of statements or other representations that are accounts or descriptions of a person’s perception, experience, situation, judgment, belief, or opinion. It is also designed to assess the strength of relationships among statements, descriptions, questions, or other forms of representations (Facione & Facione, 2010).

a. CCTST Scale Score Descriptions

The CCTST is designed as a holistic measure of the construct Critical Thinking, with embedded scales that can be used to examine the embedded concepts as well.

Overall: The reasoning skills Overall Score describes overall strength in using reasoning to form reflective judgments about what to believe or what to do. To score well overall, the test taker must excel in the sustained, focused and integrated application of core reasoning skills including analysis, interpretation, inference, evaluation, explanation, induction and deduction. The Overall Score predicts the capacity for success in educational or workplace settings which demand reasoned decision making and thoughtful problem solving.

Analysis: Analytical reasoning skills enable people to identify assumptions, reasons, and claims, and to examine how they interact in the formation of arguments. Analysis is used to gather information from charts, graphs, diagrams, spoken language, and documents. People with strong analytical skills attend to patterns and to details. They identify the elements of a situation and determine how those elements interact. Strong interpretation skills can support high-quality analysis by providing insights into the significance of what a person is saying or what something means.

Interpretation: Interpretative skills are used to determine the precise meaning and significance of a message or signal, whether it is a gesture, sign, set of data, written
or spoken words, diagram, icon, chart or graph. Correct interpretation depends on understanding the message in its context and in terms of who sent it, and for what purpose. Interpretation includes clarifying what something or someone means, grouping or categorizing information, and determining the significance of a message.

**Inference:** Inference skills enable us to draw conclusions from reasons and evidence. We use inference when we offer thoughtful suggestions and hypotheses. Inference skills indicate the necessary or the very probable consequences of a given set of facts and conditions. Conclusions, hypotheses, recommendations or decisions that are based on faulty analyses, misinformation, bad data or biased evaluations can turn out to be mistaken, even if they have been reached using excellent inference skills.

**Evaluation:** Evaluative reasoning skills enable us to assess the credibility of sources of information and the claims they make. We use these skills to determine the strength or weakness of arguments. Applying evaluation skills, we can judge the quality of analyses, interpretations, explanations, inferences, options, opinions, beliefs, ideas, proposals, and decisions. Strong explanation skills can support high-quality evaluation by providing the evidence, reasons, methods, criteria, or assumptions behind the claims made and the conclusions reached.

**Explanation:** Explanatory reasoning skills, when exercised prior to making a final decision about what to believe or what to do, enable us to describe the evidence, reasons, methods, assumptions, standards or rationale for those decisions, opinions, beliefs and conclusions. Strong explanatory skills enable people to discover, to test and to articulate the reasons for beliefs, events, actions and decisions.

**Induction:** Decision making in contexts of uncertainty relies on inductive reasoning. We use inductive reasoning skills when we draw inferences about what we think must probably be true based on analogies, case studies, prior experience, statistical analyses, simulations, hypotheticals and familiar circumstances and patterns of behavior. As long as there is the possibility, however remote, that a highly probable conclusion might be mistaken, the reasoning is inductive. Although it does not yield
certainty, inductive reasoning can provide a solid basis for confidence in our conclusions.

**Deduction:** Decision making in precisely defined contexts where rules, operating conditions, core beliefs, values, policies, principles, procedures, and terminology completely determine the outcome depends on strong deductive reasoning skills. Deductive reasoning moves with exacting precision from the assumed truth of a set of beliefs to a conclusion that cannot be false if those beliefs are true. Deductive validity is rigorously logical and clear-cut. Deductive validity leaves no room for uncertainty, unless one alters the meanings of words or the grammar of the language.

**Time needed for administration:** The CCTST is administered with a preset time limit of 45 minutes. Each item requires that the test-taker makes an accurate and complete interpretation of the question. It would not be a sign of a poor test if some individuals complete the CCTDI in 20 to 30 minutes. However, incomplete tests are not taken into account in the statistical data processing.

2.8.4.2 **California Critical Thinking Disposition Inventory (CCTDI)**

The CCTDI is an English language educational assessment tool designed to assess selected critical thinking dispositions, attributes or habits of mind. The CCTDI measures these attitudes and attributes, assessing the ‘willing’ side of being able to think well’.

An important component of the APA Delphi Study was the discussion of the dispositional side of the critical thinker. One must be disposed to think critically as well as have the skills to do so. The importance of the dispositional side of critical thinking was described by the Delphi experts in these terms: Cognitive skills are like physical skills -- through education, training and exercise an individual can gain even greater proficiency in their use.

CCTDI was developed in response to the description of the ideal critical thinker as an attempt to measure the disposition to engage in problem solving and make decisions using critical thinking. The California Critical Thinking Disposition Inventory
was developed to examine ways to observe the attributes and attitudes of the ideal
critical thinkers in their beliefs and thoughts which reveal their thinking process.
Psychometric methods are used to measure the ability to capture the factors describing
the ideal critical thinker. Drs Noreen and Peter Facione developed the CCTDI in the
early 1990s. Seven factors were identified named and described according to the
findings of the Delphi report. Items related to these factors were retained in the
instrument. All forms of the CCTDI measure the attributes that influence the
individual’s capacity to learn and to effectively apply critical thinking skills.

The disposition toward truth-seeking or bias, toward open-mindedness or
intolerance, toward anticipating possible consequences or being heedless of them,
toward proceeding in a systematic or unsystematic way, toward being confident in the
powers of reasoning or mistrustful of thinking, toward being inquisitive or resistant to
learning, and toward mature and nuanced judgment or toward rigid simplistic thinking.

The constructs being measured are universally referred to as these constructs:

- Truth-seeking
- Analyticity
- Open-mindedness
- Systematicity
- Confidence in Reasoning
- Inquisitiveness
- Maturity in Judgment

Respondents are invited to indicate the degree to which they agree or disagree
with each of the 75 items. Responses are recorded in six-point Likert format ranging
from "strongly agree" to "strongly disagree". The forced choice framework for each item
prompt is intentional (there is no neutral option). CCTDI prompts express familiar
opinions, beliefs, values, expectations and perceptions.
Each idea (item) is consonant with or in opposition to a recognized critical thinking dispositional attribute. This construct driven method has resulted in scales that are rich in definition rather than narrow in scope, and yet with psychometric properties that inspire confidence in the resulting measures.

The instrument has been demonstrated to perform well in a wide range of individuals and groups. No specialized educational level or content knowledge is presumed. The items use no technical vocabulary or critical thinking jargon. The CCTDI has been used successfully in individuals from the high school age level to graduate level students and working professionals in the United States and in more than 40 countries around the world.

**Time needed for administration**: The CCTDI is administered with a preset time limit of 30 minutes. The items require only a statement of agreement or disagreement. It would not be a sign of a poor test if some individuals complete the CCTDI in 15 to 20 minutes. However, incomplete tests are not taken into account in the statistical data processing.

**a. CCTDI Score Array**

**Truth seeking**: Truth-seeking is the habit of being continually keen on the best possible understanding of any given situation; it is following reasons and evidence where ever they may lead, even if they lead one to question valued beliefs. Truth-seekers ask hard, sometimes even frightening questions; they do not ignore relevant details; they strive not to let bias or preconception color their search for knowledge and truth. The opposite of truth-seeking is bias which ignores good reasons and relevant evidence in order not to have to face difficult ideas.

**Open mindedness**: Open-mindedness is the tendency to allow others to voice views with which one may not agree. Open-minded people act with tolerance toward the opinions of others, knowing that often we all hold beliefs which make sense only from our own perspectives. Open-mindedness, as used here, is important for harmony in a pluralistic and complex society where people approach issues from different religious,
political, social, family, cultural, and personal backgrounds. The opposite of open-mindedness is intolerance.

**Analyticity**: Analyticity is the tendency to be alert to what happens next. This is the habit of striving to anticipate both the good and the bad potential consequences or outcomes of situations, choices, proposals, and plans. The opposite of analyticity is being heedless of consequences, not attending to what happens next when one makes choices or accepts ideas uncritically.

**Systematicity**: Systematicity is the tendency or habit of striving to approach problems in a disciplined, orderly, and systematic way. The habit of being disorganized is the opposite tendency. The person who is strong in systematicity may not know of a given approach, or may not be skilled at using a given strategy of problem solving, but that person has the desire and tendency to try to approach questions and issues in an organized and orderly way.

**Confidence in Reasoning**: Confidence in reasoning is the habitual tendency to trust reflective thinking to solve problems and to make decisions. As with the other attributes measured here, confidence in reasoning applies to individuals and to groups. A family, team, office, community, or society can be trustful of reasoned judgment as the means of solving problems and reaching goals. The opposite habit is mistrust of reasoning, often manifested as aversion to the use of careful reason and reflection when making decisions or deciding what to believe or do.

**Inquisitiveness**: Inquisitiveness is intellectual curiosity. It is the tendency to want to know things, even if they are not immediately or obviously useful at the moment. It is being curious and eager to acquire new knowledge and to learn the explanations for things even when the applications of that new learning are not immediately apparent. The opposite of inquisitiveness is indifference.

**Maturity of Judgment**: Maturity of judgment is the habit of seeing the complexity of issues and yet striving to make timely decisions. A person with maturity of judgment understands that multiple solutions may be acceptable while yet appreciating the need to reach closure at times even in the absence of complete
knowledge. The opposite, cognitive immaturity, is imprudent, black-and-white thinking, failing to make timely decisions, stubbornly refusing to change when reasons and evidence would indicate one is mistaken, or revising opinions randomly without good reason for doing so.

2.8.4.3 Validity and reliability of the CCTST and CCTDI

Both tests are valid and have been used in a lot of studies measuring the development of critical thinking abilities in the field of education and professional development.

a. Content, construct and criterion validity of CCTST

Content validity refers to test’s ability to capture a portion of the area intended to measure (APA Delphi study report, Test manual, 2013). The content validity of the CCTST is directly related to its relationship to the APA Delphi Report research. The CCTST research program, which began in the 1970s, demonstrates through the psychometric item analysis methods and a set of procedures analyses developed by Drs. Peter and Noreen Facione that a range of closed-framed items/questions can categorize strong thinkers from weak thinkers in groups of test-takers across the academic disciplines and professional fields (CCTST Test manual, 2013). Validity of the present test resides also in its being free of any “unintended distractors” that might influence the test taker’s choice of answers. The instrument (CCTST) should match the educational and reading level of the test takers. Items used in the CCTST are continuously refined to assure accurate capturing of the reasoning process and to depict common human errors resulting from weak reasoning. Following the same line of thought, an appropriate array of difficulty should be presented to the test takers allowing an accurate scaling of scores. Concerning construct validity, it is depicted through correlational studies in which critical thinking scores are correlated with other measures that prove significant to include the externally assessed criterion. There is a noteworthy correlation between total scores and college level grade point average (GPA), Total Score: Pearson $r = .719,
Construct validity of the CCTST is supported by the pretest-posttest measure of significant gains in cases which have received courses in critical thinking (Facione, 1990), as well as by the high and significant correlation \( r = 0.667, p < 0.001 \) reported between the CCTST and the CCTDI being reported in several pilot and study samples (Facione & Facione, 1992).

Criterion validity refers to the tests’ ability in predicting criterion based behaviour that is external to the test itself. The CCTST has the ability to predict meaningful measures about the anticipated achievement learning outcomes. This has been demonstrated through numerous independent research studies which have shown the test’s validity to measure high order thinking ability and predict success in educational and professional programs.

The data from ongoing validation studies produces internal consistency estimates (Kuder Richardson - 20) ranging from .68-.80. The Kuder-Richardson -20 is the comparable statistic to Cronbach’s alpha used for dichotomously scored instruments and scales. For an instrument with multidimensional scales, a KR-20 above.70 indicates a high level of internal consistency.

### b. Content, construct and criterion validity of CCTDI

Content validity is the assessment of how representative the test is of every construct. First of all, content validity of the CCTDI items is embodied in its relationship to the APA Delphi research data, and encompasses the educators reviews at all levels upon administration or completion of the test as a personal assessment. Another principle of content validity is assuring the employment of sensible methods in the test construction. This test is an attitudinal measure, and particular methods and protocols were used in its making of. These aspects are specifically sensed in the prompts included in the test as they express familiar opinions, beliefs, values, expectations and perceptions, and no technical vocabulary or critical thinking jargon is
used. In addition, item prompts were developed in the form of attitudinal items to capture the agreed upon description of the ideal critical thinker (APA CCTDI test manual, 2013).

Construct validity is typically demonstrated by correlation to other studies where, for instance, CCTDI scores are correlated with other measures that require the inclusion of construct and not correlated with those that do not.

Criterion validity is concerned with the predictive ability of an instrument about some external criterion behaviour. The CCTDI has the ability to predict measures indicating performance in a selected learning outcome through the score in the attitudinal mind-set items. Scores of the test have depicted this predictive function in peer-reviewed independent published research (Godzyk KE, 2008; Tiwari A, Lai P, So M, Yuen K, 2006; Kwon N, Onwuegbuzie AJ, Alexander L, 2007).

The present test demonstrates a strong internal consistency (a minimum Alpha of 0.80 for attribute measures). Internal consistency reliability for the seven individual scales in the initial CCTDI pilot sample ranged from .71 to .80, with the alpha for the overall instrument reaching .91. Strong values have been observed consistently in samples collected over the past 15 years (ranging from .60 to .78 on the scales and .90 or above for the overall measure) (APA Delphi study report, Test manual, 2013).

The CCTDI is cited in a large and growing literature, reflecting findings in both the United States and other nations around the world.

2.8.4.4 Reflective writing assignments

In the present study Reflective writing is used as an intervention to investigate its effect on the progress of critical thinking generic skills and dispositions. It is assumed that reflective writing is a form of writing to learn that could through its process, depth and quality, help learners develop their critical thinking skills (Moon 2006). For that, the experimental group was subject to an experiment consisting of introducing reflective writing as a scaffold method. The workshop included in class reflective dialogues/discussions about topics and issues of interest to the participants, in addition
to activities and readings they had as part of school program. Reflective writing assignments following Gibbs reflective cycle (1988) about the same issues were taken as a homework that was sent after every session. The model consists of six stages which are 1) Description 2) Feelings 3) Evaluation 4) Analysis 5) Conclusion 6) Action Plan. The written assignments were not scored but were corrected and evaluated for proof of critical thinking skills.

3. 8.5. Procedures

Two instruments, the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Dispositions Inventory (CCTDI), are administered as pre-test/post-test to measure the progress of the critical thinking skills and dispositions as a result of the enrollment in the reflective writing intervention. These instruments are administered through a company called Insight Assessment, based in Millbrae, California, United States of America.

Insight Assessment gives permission to use the range of tests they offer after a purchase request study. Only stakeholders and PhD candidates can purchase and use them. Upon request acceptance, the researcher established an account on her own expenses with Insight Assessment during the summer preceding data collection. This involves purchasing 180 tests (CCTST, CCTDI), setting up a personal profile and creating two sets of passwords so that students from the two groups would log on differently in order to keep the control and experimental results separate. As a test client, access to a platform where results are registered and processed is provided. The researcher also made arrangements to use the computer lab at the Faculty of Education campus, as the pre-testing and post-testing of both groups are online, and to have students take the tests under the same conditions.

Consent was signed between Insight Assessment and the purchaser not to publish any copies or examples of the tests used in the study as they are copyrighted. Results are processed and instantly reported for further statistical analysis. A manual is provided for the use of both the CCTDI and CCTST to avoid any confusion or inconsistency in the score arrays description as well as validity and reliability of the instruments.
During the first meeting, students in both the experimental and control groups are notified that their groups (namely control and experimental group) are the subject of a pedagogical study and participants in the experimental group are asked to attend regularly as in the opposite case would cause results to be affected. A date was set for both groups to take the CCTST and CCTDI pretests at the multimedia lab, Faculty of Education. Each student creates a login name and password at the time of the pre-test to be used again at the time of the post-test. This information is kept on file in the researcher’s Insight Assessment account in case students need to reference them to log on at the time of the post-test. Only the research can have access to the results’ platform, which is secured with a password, and can manage and organize the groups’ scores. Upon completion of the reflective writing intervention, another meeting was scheduled for both groups to take the CCTST and CCTDI posttests following the same protocols. Preset time limit for the CCTST is 45 min including and 30 min for CCTDI including 75 agreement items

Results were instantly generated and processed using descriptive and inferential statistics. Details of the intervention are provided hereafter.

3. **8.6. The Intervention**

The present study’s reflective writing intervention is a means to investigate the impact of such a pedagogical strategy on the developmental nature of critical thinking skills and dispositions of undergraduate students majoring in educational sciences. Reflective writing was defined as an assignment that is focused on an activity that students have experienced, such as class readings or lessons, personal life experience or group activities, which highlights what the student learned from the activity (McGuire et al. 2009). The reflective writing assignments in this study were not measured, although the researcher provided feedback to the students. The intervention was 10 sessions long. The first part of the intervention included daily meetings of 45 to 50 minutes with the experimental group. Due to time inconvenience, the second part of the intervention was set up in one 45 to 50 min session per week. In-class instruction and attendance were crucial factors to the success of the intervention. The researcher designed an
instructional method to assure more depth and quality and raise participants’ metacognitive awareness about the use of critical thinking skills in a context of reflective writing. The instructional strategy comprises five steps which are as follows: 1) Presentation of the topic or situation 2) Instructional scaffolding of critical thinking skills 3) Reflective dialogue about the topic/ situation/ personal experience 4) Connecting critical thinking skills to the topic/situation/ personal experience 5) Writing reflectively following Gibbs model. The following figure better articulates the instructional method.

Figure 6: Instruction method of the reflective writing intervention

2. 8.7 The Data analysis procedure

The statistical analysis was performed using SPSS 18.0. Data for this study is generated from the CCTST and the CCTDI tests online platform application and results
are analyzed using SPSS. These statistical tests are used to investigate the impact of reflective writing intervention on Critical thinking skills and dispositions development. They will allow an assessment of mean scores of experimental and control groups in terms of the outcomes measures used in the present study (CCTST, CCTDI). Mixed design (2 2) ANOVA was used to measure gains resulting from the treatment (reflective writing), both at the pretests and posttest and for both groups. Pearson correlation was used to determine relationship between critical thinking and academic performance, in addition to the relationship between critical thinking dispositional attributes and skills of critical thinking.

The demographic data gathered from participants were analysed using SPSS 18.0. The sample was categorized using descriptive statistics, including means, standard deviations, percentages, and frequency counts. Demographic data included age, gender.

2.8. 8. Threats to Internal Validity

The sample described belongs to one faculty. The participants may not be representative of the entire EFL population. There is also a possibility that data quality will suffer due to the Hawthorne effect. The Hawthorne effect refers to participants’ CCTST and CCTDI scores changing because they were participating in a study (Depoy & Gitlin, 2005). Scores could also change because participants completed the CCTST and CCTDI twice (pre and post-tests). In other words, participants may improve scores simply because they had completed the test previously. There were also participants from the experimental group who were not committed to the study and did not attend regularly nor completed all the reflective writing assignments for various reasons.

2.8. 9. Ethical considerations

The risks of participating in this study were minimal. In order to ensure protection from risk, all potential participants were informed of the study both in written and verbal forms. Participation was voluntary, with no consequences to students who declined participation or to participants who withdrew from the study. Completed CCTST and CCTDI instruments are stored in a locked online platform only accessible to
the researcher and the Insight Assessment Inc. assistant (Mr Christian Smit). The tests were scored by Insight Assessment Inc., and scores were then saved into a computer database protected with a password. The same process was followed for the second CCTST and CCTDI administration. Course grades were not affected by participation or nonparticipation in the research, and students were informed of this both verbally and in writing. Reports to any future audiences will contain no student identifiers.
CHAPTER THREE: RESULTS AND DISCUSSION
CHAPTER III: Presentation and interpretation of the results

3.0 Introduction

The present chapter includes the presentation, interpretation and discussion of the results of the two studies conducted to measure the impact of Reflective writing intervention on development of critical thinking skills and dispositions using two different instruments namely the ARC (Assessment Rubric for Critical Thinking Skills through writing) and the CCTST (California Critical Thinking Skills Test) and the CCTDI (California Critical Thinking Disposition Inventory) pre-test and post-test in two different settings. The study also used two different samples in two different settings to measure the effectiveness of the intervention in developing critical thinking skills and dispositions. The samples were selected from the Faculty of Education Mohamed V University and from Knowledge Computer and Business Institute (Business, Marketing and Finance students).

Data are organised and displayed through the use of figures and tables and group statistics in order to identify and discern any patterns that could provide the most appropriate and accurate interpretation of this research study results.

The presentation and discussion of findings is organised as follows:

1) Measuring the impact of reflective writing Intervention on progress of critical thinking skills among Business college students using the ARC (Assessment Rubric for Critical Thinking through writing), the results of which were processed via SPSS using repeated measures ANOVA.

2) Measuring the impact of reflective writing intervention on progress of critical thinking skills and dispositions among Faculty of Education students through the CCTST. And CCTDI (pre-test, post-test) using mixed design ANOVA.

3) Measuring the correlation between critical thinking dispositions and academic achievement of faculty of education experimental group on scores of the CCTDI pre and post-tests.
(4) Measuring the correlation between the acquisition of critical thinking skills and critical thinking dispositions of faculty of education students on scores of the CCTDI pre and post-tests.

The presentation and discussion of results involves display of data, group statistics, tests’ results with interpretations and conclusion.

The research tools are described in details in the methodology section and copies of the ARC rubric are provided as Appendix 1. Concerning the CCTDI and CCTST, consent was signed with Insight Assessment not to publish any copies of the two tests as they are copyrighted. Samples of the reflective writing interventions’ assignments are also attached as Appendix 4 and 5. For a better articulation of the results, every study answers a given set of questions.

3.1. Study 1

3.1.0 Introduction

This study aimed at investigating the effectiveness of reflective writing intervention as a metacognitive scaffold on improving critical thinking skills among Moroccan Business College students using the ARC (Assessment Rubric for Critical Thinking through writing) through one academic semester. It also sought to investigate the relationship between time and frequency of exposure to reflective writing and development of critical thinking skills.

The intervention was based in design on the APA Delphi Report Facione’s (1990) definition of critical thinking as a general concept and the panel’s definition of critical thinking skills namely (analysis, interpretation, Evaluation, Synthesis and Reflection). This chapter reports results on the intervention.

3.1.1. Results of hypothesis testing

It was hypothesised in the current study that Business college juniors’ critical thinking skills would improve following one academic term (8 weeks) reflective writing
intervention. After assessing students’ written productions using the ARC, scores were analysed via SPSS and the results are hereunder presented.

The one way repeated measures analysis of variance ANOVA was used to determine if there was a significant progress in performance of critical thinking skills through (time) the five selected and scored reflective writing assignments as a result of the treatment. It was used to measure change in mean scores of participants in the CT skills.

The ARC rubric results were entered in SPSS and processed and progress on performance results were displayed in separate cases for each critical thinking skill depending on the number of reflective writing assignments that the whole class has submitted (sessions in which students were absent or did not submit written assignments were not included in the study) and the scales mentioned earlier in the chapter. Each of the skills results will be presented and interpreted separately.

The thirty participants submitted a reflective writing assignment every session during five weeks (n=30) each of which were scored and processed using one way repeated measures analysis of variance ANOVA. This statistical test was conducted to evaluate the null hypothesis that there is no change in critical thinking skills (Interpretation, analysis, problem solving, evaluation, synthesis, reflection) as a result of reflective writing treatment over eight weeks using the ARC. Results of critical thinking skills score processing are accounted for in separate cases for the sake of clarity.
a. 1.1. Results of ANOVA

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<th>Assignment/Session</th>
<th>Interpretation M</th>
<th>Interpretation Std</th>
<th>Analysis M</th>
<th>Analysis Std</th>
<th>Problem Solving M</th>
<th>Problem Solving Std</th>
<th>Synthesis M</th>
<th>Synthesis Std</th>
<th>Evaluation M</th>
<th>Evaluation Std</th>
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Table 2. Linear progression mean score and standard deviation of “Critical Thinking Skills” per session/assignment.

Descriptive statistics of Critical thinking Skills’ mean scores show a continuous progress in the skills over the five weeks / sessions treatment. In session (1) which represents the first reflective writing assignment, students mean scores were higher compared to the last session (5).

In order to inspect effects of the intervention on the Critical Thinking Skills one way repeated measures ANOVA was calculated. The results of the ANOVA indicated a significant time (five sessions) and practice (Instructional scaffolding/reflective writing assignments) effect on the students’ scores. Thus, a main effect of the intervention was found. The statistical calculations for every critical thinking skill measured in the ARC rubric are as follows:

A. Interpretation: statistical results of the skill of interpretation show progress over the 5 sessions, Wilks’ Lambda =.11, F (4, 26) =52, 28, p<.01, n² = .89 computed
using alpha= .05. Gain in this skill indicates that the treatment impacted positively student’s ability to decode significance, clarify meaning in addition to discerning and avoiding prejudiced use of critical thinking skills.

B. Analysis: statistical results of the skill of “Analysis” show progress over the 5 sessions, Wilks’ Lambda =.06, F (4, 26) =92.49, p<.01, n² = .93 computed using alpha= .05. Gain in this skill indicates that the treatment impacted positively student’s ability to examine ideas, identify arguments and analyse them.

C. Problem solving: Statistical results of the skill of “Problem solving” show progress over the 5 sessions, Wilks’ Lambda =.12, F (4, 26) =45.12, p<.01, n² = .87 computed using alpha= .05. Gain in this skill indicates that the treatment impacted positively student’s ability to identify, define and find solutions to problems using logical reasoning.

D. Synthesis: Statistical results of the skill of “synthesis” show progress over the 5 sessions, Wilks’ Lambda =.14, F (4, 26) =38.37, p<.01, n² = .85 computed using alpha= .05. Gain in this skill indicates that the treatment impacted positively student’s ability to combine parts of a sum in a new different way by determining alternatives and thinking flexibly.

E. Evaluation: statistical results of the skill of “Evaluation” show progress over the 5 sessions, Wilks’ Lambda =.14, F (4, 26) =38.17, p<.01, n² = .85 computed using alpha= .05. Gain in the skill indicates that the treatment was fruitful in developing students’ ability to state results, provide justifications for procedures and presenting arguments.

There was a significant increase in the scores over time/sessions suggesting that the instructional scaffolding of reflective writing treatment develop critical thinking skills in this study.
3.2. Study 2

3.2.0 Introduction

This study adopted a quasi-experimental design to evaluate the effectiveness of a reflective writing intervention on the improvement of critical thinking skills and dispositions among the Faculty of Education students over a period of ten weeks using CCTST and CCTDI pre-test and post-test. This intervention was developed based upon the APA Delphi Report Facione’s (1990) definition of critical thinking as a general concept and the panel’s definition of critical thinking skills, in addition to Gibbs model of reflection 1988. The study also investigated the relationship between critical thinking dispositions and academic achievement (should any exist) of the students on scores obtained in the CCTDI pre and post-tests. Furthermore, it examined the relationship between the acquisition of critical thinking skills and academic achievement of the students on scores obtained in the CCTST pre and post-tests.

This section describes the sample and setting of the study, including demographic similarities and differences. It also lists the results of the reflective writing intervention on critical thinking skills and dispositions, according to the CCTST and CCTDI and the tests’ subscales. The statistical measures used are Pearson’s correlation, mixed design ANOVA.

3.2.1 Age and gender information of the participants

The sample consisted of a control group (N=24) and experimental group (N=27) junior (third year university students) Sciences of Education students from the faculty of education, University Mohamed V, Rabat. The majority of respondents (86.7%) were between the ages of 22 and 25. The experimental group involved 19 (60%) males and 10 (35%) females participants, while the control group consisted of 14 (63%) males and 10 females (36%). Junior students were chosen in this study for several reasons. First, because at their stage, students are believed to have acquired the ability to think critically as the prefrontal lob has reached full myelination. The majority of participants have already completed the Bachelor’s degree in the faculty of Humanities before
enrolling in Semester 5 and 6 BA programs at the faculty of Education. Second, because the program they study English studies with focus on language and pedagogy of English which is the language of the tests.

<table>
<thead>
<tr>
<th>Age of Subjects</th>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>N</td>
<td>27</td>
<td>22</td>
<td>29</td>
<td>24.69231</td>
<td>24</td>
</tr>
<tr>
<td>Control</td>
<td>N</td>
<td>24</td>
<td>22</td>
<td>28</td>
<td>24.16667</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 3: Age information of the subjects

<table>
<thead>
<tr>
<th>Gender Information of Subjects</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
<td>60,7</td>
<td>63,0</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>35,7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>96,4</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14</td>
<td>63,2</td>
<td>36,8</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>36,8</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Gender Information of subjects

3.2.1.1. Age differences between groups (control/experimental)

Due to the non-normal distribution of measures, non-parametric statistical tests were performed for the age variable to determine similarities between the control and experimental groups. The Mann and Whitney U is used as the sample number both in control and experimental is less than thirty. The Mann and Whitney does not require equal sample size. According to the Mann-Whitney U test, there was no significant difference between control and experimental groups on age p=0.62; z= 0.49 as shown in the table 5 below.
<table>
<thead>
<tr>
<th></th>
<th>Control group</th>
<th>Experimental group</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>24</td>
<td>27</td>
</tr>
<tr>
<td>Mean</td>
<td>24.16</td>
<td>24.69</td>
</tr>
<tr>
<td>SD</td>
<td>2.26</td>
<td>2.03</td>
</tr>
</tbody>
</table>

Table 5: Age differences between groups (control/experimental)

3.2.2. Results of hypotheses testing

Both the CCTST and CCTDI contain subscales that measure several critical thinking attributes. The CCTST contains the following subscales: inductive reasoning, deductive reasoning, analysis and interpretation, inference, evaluation and explanation. The CCTDI includes the following subscales: truth seeking, open mindedness, analyticity, systematicity, confidence, inquisitiveness, and maturity of judgment. All of the pre-intervention measures, including CCTST and CCTDI total scores and subscale scores, were compared between the control and experimental groups to determine any differences in baseline. The following results are automatically generated from the Insight Assessment CCTST and CCTDI application platform. This information is outlined in Tables 6 and 7 below.

3.2.2.1 Differences in Baseline Measures of the pre Intervention tests for control and experimental groups
a. CCTST

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Experimental group</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTST</td>
<td>Mean</td>
<td>SD</td>
<td>SEM</td>
<td>Mean</td>
<td>SD</td>
<td>SEM</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>Overall</td>
<td>9.87</td>
<td>2.3</td>
<td>0.5</td>
<td>8.78</td>
<td>2.1</td>
<td>0.5</td>
<td>0.33</td>
<td>0.99</td>
</tr>
<tr>
<td>Deductive reasoning</td>
<td>4.5</td>
<td>1.1</td>
<td>0.2</td>
<td>3.1</td>
<td>1.2</td>
<td>0.3</td>
<td>-0.06</td>
<td>0.96</td>
</tr>
<tr>
<td>Inductive reasoning</td>
<td>4.3</td>
<td>1.6</td>
<td>0.6</td>
<td>4.9</td>
<td>1.4</td>
<td>0.4</td>
<td>0.01</td>
<td>0.94</td>
</tr>
<tr>
<td>Analysis</td>
<td>3.4</td>
<td>1.3</td>
<td>0.4</td>
<td>2.7</td>
<td>1.2</td>
<td>0.3</td>
<td>0.10</td>
<td>0.92</td>
</tr>
<tr>
<td>Inference</td>
<td>3.9</td>
<td>1.9</td>
<td>0.3</td>
<td>3.6</td>
<td>1.3</td>
<td>0.3</td>
<td>0.56</td>
<td>0.58</td>
</tr>
<tr>
<td>Total</td>
<td>15.66</td>
<td>2.34</td>
<td>0.8</td>
<td>14.61</td>
<td>2.36</td>
<td>0.8</td>
<td>-0.04</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Table 6: Base line differences in pre-test CCTST for control and experimental groups

b. CCTDI

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Experimental Group</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTDI</td>
<td>Mean</td>
<td>SD</td>
<td>SEM</td>
<td>Mean</td>
<td>SD</td>
<td>SEM</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>Truth seeking</td>
<td>38.94</td>
<td>7.11</td>
<td>1.19</td>
<td>38.47</td>
<td>4.36</td>
<td>0.75</td>
<td>0.33</td>
<td>0.74</td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>43.06</td>
<td>5.79</td>
<td>0.94</td>
<td>43.26</td>
<td>4.67</td>
<td>0.80</td>
<td>-0.16</td>
<td>0.87</td>
</tr>
<tr>
<td>Analyticity</td>
<td>47.32</td>
<td>5.03</td>
<td>0.84</td>
<td>45.09</td>
<td>6.32</td>
<td>1.08</td>
<td>1.77</td>
<td>0.08</td>
</tr>
<tr>
<td>Systematicity</td>
<td>42.94</td>
<td>5.64</td>
<td>0.94</td>
<td>43.82</td>
<td>6.57</td>
<td>1.13</td>
<td>0.68</td>
<td>0.55</td>
</tr>
<tr>
<td>Confidence</td>
<td>43.97</td>
<td>6.78</td>
<td>1.13</td>
<td>42.79</td>
<td>6.48</td>
<td>1.16</td>
<td>0.73</td>
<td>0.47</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>46.97</td>
<td>6.69</td>
<td>1.13</td>
<td>47.71</td>
<td>6.77</td>
<td>1.11</td>
<td>-0.47</td>
<td>0.64</td>
</tr>
<tr>
<td>Maturity</td>
<td>45.31</td>
<td>6.76</td>
<td>1.12</td>
<td>46.44</td>
<td>6.49</td>
<td>0.80</td>
<td>-0.81</td>
<td>0.42</td>
</tr>
<tr>
<td>Total</td>
<td>307.73</td>
<td>29.72</td>
<td>4.95</td>
<td>307.59</td>
<td>26.16</td>
<td>4.49</td>
<td>0.17</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Table 7: Base line differences in pre-test CCTDI for control and experimental groups

There were no significant differences pre-intervention between the control and experimental groups on overall and subscales CCTDI scores. The possible range for total CCTDI scores is from 70 to 420. Total CCTDI mean score for the control group was 307.73+29.72, and total CCTDI mean score for the experimental group was
307.59+26.16. This means that both groups are similar at the dispositional level and have the attitudes and attributes to think critically (Facione, 1998).

However, there were significant differences on overall and subscales CCTST scores between control and experimental groups, with the control group scoring higher in overall and in the subscales of critical thinking. The range for total CCTST scores is from 0 to 34. Total CCTST mean score for the control group was 15.66+2.34, and total CCTST mean score for the experimental group was 15.61+2.36.

3.2.3. Impact of reflective writing intervention on critical thinking skills and dispositions

In order to examine main effect of reflective writing intervention on critical thinking skills and dispositions among the students, differences were calculated for overall change in CCTST, and overall change in CCTDI using the overall score. This difference measures the amount of increase or decrease in the total scores and each of the subscales. Descriptive statistics illustrating the change in means and standard deviations of CCTDI and CCTST are presented in tables 14 and 15 respectively.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean (SD)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTDI 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>284.33(19.02)</td>
<td>24</td>
</tr>
<tr>
<td>Experimental</td>
<td>285.00(22.44)</td>
<td>27</td>
</tr>
<tr>
<td>CCTDI 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>274.83(19.53)</td>
<td>24</td>
</tr>
<tr>
<td>Experimental</td>
<td>296.66(18.02)</td>
<td>27</td>
</tr>
</tbody>
</table>

**Table 8: Descriptive Statistics of overall change in CCTDI scores Pre, post-test**
<table>
<thead>
<tr>
<th>Group</th>
<th>Mean (SD)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTST 1</td>
<td>Control</td>
<td>9.87 (2.04)</td>
</tr>
<tr>
<td></td>
<td>Experimental</td>
<td>8.78 (2.13)</td>
</tr>
<tr>
<td>CCTST 2</td>
<td>Control</td>
<td>8.51 (2.04)</td>
</tr>
<tr>
<td></td>
<td>Experimental</td>
<td>10.44 (2.99)</td>
</tr>
</tbody>
</table>

Table 9: Descriptive Statistics of overall change in CCTST scores pre/post-test

Table 8 and 9 above illustrate differences in means and standard deviations of CCTDI and CCTST pre-test/ post-test among control and experimental groups. The results show that the experimental group outperformed the control group in overall critical thinking dispositions scores, M = 296, 66, SD (18, 02) and in overall critical thinking skills M = 10, 44, SD (2, 75).

Differences in CCTST and CCTDI overall scores between the control and experimental groups were calculated using mixed design 2 (Group: experimental, control) 2 (Time: pre-test, post-test) ANOVA. Total scores and each set of subscales were tested for differences between control and experimental groups with regard to the average change in overall scores and subscales. The following figures 7 and 8 show results of the split plot ANOVA concerning CCTDI and CCTST pre and post-tests respectively.

3.3.2.1 CCTDI overall score

The CCTDI overall score is a composite score which weighs each of the scale score equally, as each is critical to the ideal critical thinking mind set.
Critical thinking dispositions’ overall scores differed significantly between control and experimental groups from pre-test to post-test. Therefore, the interaction between reflective writing intervention and critical thinking dispositions was significant, $F (1, 49) = 34.59, p < .001$ see M/SD tables. The experimental group demonstrated a sharp progress in critical thinking dispositions between pre-test and post-test as a result of the intervention. Surprisingly, the control group’s scores dropped. This indicates that at least one CCTDI subscale differed by group.

### 3.2.3.2 CCTST overall score

The CCTST overall score is the most informative measure of an individual’s critical thinking skills. To score high in the overall, the individual must show strength in
all of the cognitive skills areas related to critical thinking.

![Estimated Marginal Means of MEASURE_1](image)

**Figure 8: CCTST overall score split plot ANOVA results**

Critical thinking skills’ overall scores differed significantly between control and experimental groups from pre-test to post-test. Therefore, the interaction between reflective writing intervention and critical thinking skills was significant, $F (1, 49) = 14,12$, $p<.001$ see M/SD tables. This indicates that at least one CCTST subscale differed by group. As illustrated in the figure, the control group scored higher than the experimental group at pre-test. However, the experimental group’s scores at post-test show a significant gain in critical thinking skills’ development, which confirms the positive impact of the reflective writing intervention on development of critical thinking skills’ acquisition.

To examine the impact of the reflective writing intervention on critical thinking
skills and dispositions, individual differences in sub skills of CCTST and attributes of CCTDI were calculated using mixed design ANOVA. A general overview of progress in individual subcomponents of CCTDI and CCTST (Skills and dispositions) is presented in table 16. The results of the split plot ANOVA are shown in the figures (7-20). The interpretation of individual sub skills and dispositions scores is also provided following each table.

<table>
<thead>
<tr>
<th>Scale Metrics of CCTDI</th>
<th>df 1</th>
<th>df 2</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truth Seeking</td>
<td>1</td>
<td>49</td>
<td>42.47</td>
<td>.000</td>
</tr>
<tr>
<td>Open Mindedness</td>
<td>1</td>
<td>49</td>
<td>49.57</td>
<td>.000</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>1</td>
<td>49</td>
<td>33.24</td>
<td>.000</td>
</tr>
<tr>
<td>Analyticity</td>
<td>1</td>
<td>49</td>
<td>19.39</td>
<td>.000</td>
</tr>
<tr>
<td>Systematicity</td>
<td>1</td>
<td>49</td>
<td>48.59</td>
<td>.000</td>
</tr>
<tr>
<td>Confidence</td>
<td>ir 1</td>
<td>49</td>
<td>18.15</td>
<td>.000</td>
</tr>
<tr>
<td>Reasoning Maturity Judgement</td>
<td>0: 1</td>
<td>49</td>
<td>29.25</td>
<td>.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sub skills of CCTST</th>
<th>df 1</th>
<th>df 2</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis</td>
<td>1</td>
<td>49</td>
<td>13.39</td>
<td>.000</td>
</tr>
<tr>
<td>Inference</td>
<td>1</td>
<td>49</td>
<td>9.70</td>
<td>.000</td>
</tr>
<tr>
<td>Evaluation</td>
<td>1</td>
<td>49</td>
<td>15.83</td>
<td>.000</td>
</tr>
<tr>
<td>Induction</td>
<td>1</td>
<td>49</td>
<td>48.69</td>
<td>.000</td>
</tr>
<tr>
<td>Deduction</td>
<td>1</td>
<td>49</td>
<td>7.39</td>
<td>.000</td>
</tr>
</tbody>
</table>

**Table 10: Scale scores of CCTDI and CCTST ANOVA results**

**3.2.3.3 CCTDI sub skills Individual split plot ANOVA**

Each of the seven constructs measured by the CCDTI is an important mind-set attribute. Scores on each of the CCTDI scales ranges between 10 and 60. Each of the seven constructs has a numerical score range defining a specific qualitative category
ranging from strong negative to strong positive. The interpretation of every category is provided in details in the methodology chapter, and an explanatory chart is made available in the appendices section.

Not all participants in both groups will show high scores (pre-test/post-test) in all the dispositional attributes. Some individuals will be seen to have stronger scores for certain mind sets and weaker for others. When taken as a group of seven attributes the overall profile (See overall mixed design ANOVA in figure 6, p 127) has implications for how amenable an individual is for training in higher order skills.

a. Truth Seeking

![Figure 9: Truth Seeking mixed design ANOVA results](image-url)
Truth-Seeking is the habit of always desiring the best possible understanding of any given situation. It is following reasons and evidence wherever they may lead, even if they lead one to question cherished beliefs. Truth-seekers ask hard, sometimes even frightening questions. They do not ignore relevant details; they strive not to let bias or preconception colour their search for knowledge and truth. The opposite of truth-seeking is bias which ignores good reasons and relevant evidence in order not to have to face difficult ideas. As can generally be observed in the figure above, the control group outscored the experimental group at pre-test which proves that the control group was more amenable to train high order skills but scored lower in post-test as they have received no treatment in reflective writing. In order to examine main effects of the intervention on the disposition attribute of Truth Seeking, mixed design ANOVA was calculated 2 (pre and post test scores) 2 (group: control, experimental). The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Consequently, a main effect of the intervention was found, F (1, 49) = 42.47, p<.001 computed using alpha= .05. Hence, there is significant evidence to confirm the hypothesis.
b. Open Mindedness

Open-mindedness is the tendency to allow others to voice views with which one may not agree. Open-minded people act with tolerance toward the opinions of others, knowing that often we all hold beliefs which make sense only from our own perspectives. Open-mindedness, as used here, is important for harmony in a pluralistic and complex society where people approach issues from different religious, political, social, family, cultural, and personal backgrounds. The opposite of open-mindedness is intolerance.

In order to examine main effects of the intervention on the disposition skill of Open mindedness, mixed design ANOVA was calculated. The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and
assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, $F(1, 49) = 49.57, p < .001$ computed using alpha = .05. Hence, there is significant evidence to support the hypothesis.

c. Inquisitiveness

Inquisitiveness is intellectual curiosity. It is the tendency to want to know things, even if they are not immediately or obviously useful at the moment. It is being curious and eager to acquire new knowledge and to learn the explanations for things even when the applications of that new learning are not immediately apparent. The opposite of inquisitiveness is indifference. In order to examine main effects of the intervention on the disposition of Inquisitiveness, mixed design ANOVA was calculated. The results of

![Figure 11: Inquisitiveness mixed design ANOVA results](image)

Inquisitiveness is intellectual curiosity. It is the tendency to want to know things, even if they are not immediately or obviously useful at the moment. It is being curious and eager to acquire new knowledge and to learn the explanations for things even when the applications of that new learning are not immediately apparent. The opposite of inquisitiveness is indifference. In order to examine main effects of the intervention on the disposition of Inquisitiveness, mixed design ANOVA was calculated. The results of
the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, $F (1, 49) = 35.24$, $p < .001$, computed using alpha= .05. Hence, there is significant evidence to confirm the hypothesis.

d. **Analitcity**

[Image: Estimated Marginal Means of MEASURE_1]

**Figure 12: Analyticity mixed design ANOVA results**

Analyticity is the tendency to be alert to what happens next. This is the habit of striving to anticipate both the good and the bad potential consequences or outcomes of situations, choices, proposals, and plans. The opposite of analyticity is being heedless of consequences, not attending to what happens next when one makes choices or accepts ideas uncritically. In order to examine main effects of the intervention on the disposition
of analyticity, mixed design ANOVA was calculated. The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, F (1, 49) = 19.39, p < .001, computed using alpha = .05. Hence, there is significant evidence to confirm the hypothesis.

**Systematicity**

![Estimated Marginal Means of MEASURE_1](image)

**Figure 13: Systematicity mixed design ANOVA results**

Systematicity is the tendency or habit of striving to approach problems in a disciplined, orderly, and systematic way. The habit of being disorganized is the opposite tendency. The person who is strong in systematicity may not know of a given approach, or may not be skilled at using a given strategy of problem solving, but that person has the desire and tendency to try to approach questions and issues in an organized and
In order to examine main effects of the intervention on the disposition of systematicity, mixed design ANOVA was calculated. The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, $F(1, 49) = 48.19, p<.001$, computed using alpha = .05. Hence, there is significant evidence to reject the null hypothesis.

**Confidence in reasoning**

![Estimated Marginal Means of MEASURE_1](image)

**Figure 14: Confidence in Reasoning mixed design ANOVA results**

Confidence in reasoning is the habitual tendency to trust reflective thinking to solve problems and to make decisions. As with the other attributes measured here, confidence in reasoning applies to individuals and to groups. A family, team, office,
community, or society can be trustful of reasoned judgment as the means of solving problems and reaching goals. The opposite habit is mistrust of reasoning, often manifested as aversion to the use of careful reason and reflection when making decisions or deciding what to believe or do. In order to examine main effects of the intervention on the disposition of confidence in reasoning, mixed design ANOVA was calculated. The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, F (1, 49) =48.19, p<.001, computed using alpha= .05. Hence, there is significant evidence to support the hypothesis.

e. Maturity of judgement

![Estimated Marginal Means of MEASURE_1](image)

Figure 15: Maturity of judgement mixed design ANOVA results

Maturity of judgment is the habit of seeing the complexity of issues and yet
striving to make timely decisions. A person with maturity of judgment understands that multiple solutions may be acceptable while yet appreciating the need to reach closure at times even in the absence of complete knowledge. The opposite, cognitive immaturity, is imprudent, black-and-white thinking, failing to make timely decisions, stubbornly refusing to change when reasons and evidence would indicate one is mistaken, or revising opinions willy-nilly without good reason for doing so. In order to examine main effects of the intervention on the disposition of maturity of judgement, mixed design ANOVA was calculated. The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, F (1, 49) =29.21, p<.001, computed using alpha=.05. Hence, there is significant evidence to support the hypothesis.

3.2.3.4 CCTST sub skills Individual ANOVA

a. Analysis
Analytical reasoning skills enable people to identify assumptions, reasons and claims, and to examine how they interact in the formation of arguments. We use analysis to gather information from charts, graphs, diagrams, spoken language and documents. People with strong analytical skills attend to patterns and to details. They identify the elements of a situation and determine how those parts interact. Strong interpretation skills can support high quality analysis by providing insights into the significance of what a person is saying or what something means. In order to examine main effects of the intervention on the critical thinking skill of Analysis, mixed design ANOVA was calculated. The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, $F(1, 49) = 13.39, p < .001$, computed
using alpha= .05. Hence, there is significant evidence to confirm the hypothesis.

**Inference**

**Figure 17: Inference mixed design ANOVA results**

Inference skills enable us to draw conclusions from reasons and evidence. We use inference when we offer thoughtful suggestions and hypotheses. Inference skills indicate the necessary or the very probable consequences of a given set of facts and conditions. Conclusions, hypotheses, recommendations or decisions that are based on faulty analyses, misinformation, bad data or biased evaluations can turn out to be mistaken, even if they have been reached using excellent inference skills. In order to examine main effects of the intervention on the critical thinking skill of Inference, mixed design ANOVA was calculated. The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the
students’ scores. Thus, a main effect of the intervention was found, $F(1, 49) = 9.7$, $p < .001$, computed using alpha = .05. Hence, there is significant evidence to support the hypothesis.

**Evaluation**

![Evaluation Mixed Design ANOVA Results](image)

**Figure 18: Evaluation mixed design ANOVA results**

Evaluative reasoning skills enable us to assess the credibility of sources of information and the claims they make. And, we use these skills to determine the strength or weakness of arguments. Applying evaluation skills we can judge the quality of analyses, interpretations, explanations, inferences, options, opinions, beliefs, ideas, proposals, and decisions. Strong explanation skills can support high quality evaluation by providing the evidence, reasons, methods, criteria, or assumptions behind the claims made and the conclusions reached. In order to examine main effects of the intervention on the critical thinking skill of Evaluation, mixed design ANOVA was calculated. The
results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, $F(1, 49) = 15.83$, $p<0.001$, computed using $\alpha=0.05$. Hence, there is significant evidence to support the hypothesis.

**Induction**

![Figure 19: Induction mixed design ANOVA results](image)

Decision making in contexts of uncertainty relies on inductive reasoning. We use inductive reasoning skills when we draw inferences about what we think is probably true based on analogies, case studies, prior experience, statistical analyses, simulations, hypotheticals, and patterns recognized in familiar objects, events, experiences and behaviours. As long as there is the possibility, however remote, that a highly probable conclusion might be mistaken even though the evidence at hand is unchanged, the
reasoning is inductive. Although it does not yield certainty, inductive reasoning can provide a confident basis for solid belief in our conclusions and a reasonable basis for action. In order to examine main effects of the intervention on the critical thinking skill of Induction, mixed design ANOVA was calculated. The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, $F(1, 49) = 48.69, p < .001$, computed using alpha = .05. Hence, there is significant evidence to support the hypothesis.

**Deduction**

![Figure 20: Deduction mixed design ANOVA results](image)

**Figure 20: Deduction mixed design ANOVA results**

Decision making in precisely defined contexts where rules, operating conditions, core beliefs, values, policies, principles, procedures and terminology completely
determine the outcome depends on strong deductive reasoning skills. Deductive reasoning moves with precision from the assumed truth of a set of beliefs to a conclusion which cannot be false if those beliefs are true. Deductive validity is rigorously logical and clear-cut. It leaves no room for uncertainty, unless one alters the meanings of words or the grammar of the language. In order to examine main effects of the intervention on the critical thinking skill of Deduction, mixed design ANOVA was calculated. The results of the ANOVA indicated a significant time (ten sessions) / practice (reflective writing instruction and assignments) effect on the students’ scores. Thus, a main effect of the intervention was found, $F(1, 49) = 7.39, p < .001$, computed using alpha= .05. Hence, there is significant evidence to support the hypothesis.

3.2.4. Relationship between critical thinking dispositions and academic performance of faculty of education students on the CCTDI post-tests scores

The relationship between critical thinking dispositions and academic achievement (represented in scores of semester five) was one of the goals of this study. It was hypothesised on the basis of existing literature (Stupnisky, et al, 2008, Facione, et al, 1995, Karen B. Williams, et al, 2005, Moon, 2008) that critical thinking dispositions represented in their subscales components could predict the academic achievement of students. This section examines the correlation between CTD and Academic achievement of students on the CCTDI overall scores within the experimental group and results of Semester 5 at the faculty of education during which the intervention took place. Pearson’s correlation was used to examine any existing relationships. Correlation results are presented in the following table.

<table>
<thead>
<tr>
<th>Academic scores</th>
<th>Change in overall CCTDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Achievement</td>
<td>-.43*</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.024</td>
</tr>
<tr>
<td>N</td>
<td>27</td>
</tr>
<tr>
<td>Change in overall CCTDI</td>
<td>-.43*</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.024</td>
</tr>
<tr>
<td>N</td>
<td>27</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed)
Table 11: correlation among overall change in CCTDI and Academic scores of the experimental group

The table indicates that a negative correlation exists between academic scores and the overall gains of CCTDI $r = 0.43$, $n = 27$, $p = 0.024$. Surprisingly, this suggests that progress in critical thinking dispositions is not responsible for and does not predict high academic achievement. In other words, students with high dispositions are not necessarily going to have higher academic scores. Therefore, the hypothesised relations among these two variables are rejected.

3.2.4. Relationship between critical thinking dispositions and critical thinking skills acquisition on scores of CCTDI and CCTST

Examining the relationship between critical thinking dispositional dimension and skills dimension was one of the goals of the present study. Based on existing literature (Facione, 1998; Moon, 2008; Remiene, 2002; Giancarlo, 1995), it was hypothesised that there is a positive relationship between skills and dispositions. The hypothesis examines if critical thinking dispositions could predict and promote the acquisition of critical thinking skills. This section examines the correlation between CTD and CTS of students on scores of the CCTST and CCTDI overall gain within the experimental group. Pearson’s correlation was used to examine any existing relationships. Correlation results are presented in the following table.

<table>
<thead>
<tr>
<th></th>
<th>CCTDI overall gain</th>
<th>CCTST overall gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTST overall gain</td>
<td>.38**</td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.006</td>
<td>.006</td>
</tr>
<tr>
<td>N</td>
<td>51</td>
<td>51</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.006</td>
<td>.38**</td>
</tr>
<tr>
<td>CCTDI overall gain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.006</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>51</td>
<td></td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).

Table 12: correlation between critical thinking skills and dispositions on overall gains
The table indicates that a positive but marginal correlation exists between critical thinking skills and dispositions on the overall gains in both components $r = 0.380$, $n = 51$, $p = 0.006$. This suggests that the variance in critical thinking skills test scores is potentially attributable to the differences in students’ critical thinking dispositions scores. These results are discussed in the light of concepts reviewed in literature hereafter.

3.2.6 Discussion of the results

The two studies included in the present research attempt to answer many questions that form the essence of critical thinking development through reflective writing. Several dimensions that are believed to deepen the understanding of critical thinking as a generic skill and an educational outcome have been explored and investigated to come up with results that could be applied in different contexts. The first goal of this research was to examine the impact of reflective writing intervention following Gibbs model of reflection on critical thinking skills and dispositions of two different majors (business college students and faculty of education students) and in two different settings, using two different measurement tools. CCTST and ARC were used to test for gain in critical thinking skills and CCTDI was used to test for gain in critical thinking dispositions. The second objective of the study was to investigate the role of critical thinking dispositions in predicting academic achievement. The last objective is exploring how critical thinking dispositional attributes could predict acquisition of critical thinking skills. The questions answered in this research are as follows:

Question 1. To what extent does a Reflective writing intervention impact Moroccan College students’ performance in Critical thinking skills and dispositions?

Question 2. To what extent do critical thinking dispositions predict the academic achievement of Moroccan faculty of education students?

Question 3. To what extent do critical thinking dispositions predict the acquisition of critical thinking skills of Moroccan Faculty of Education students?
The research also sets out to investigate the following hypotheses:

H1: Students who receive supplemental instruction on reflective writing develop better critical thinking skills and dispositions.

H2: Critical thinking dispositions are a predictor of academic achievement

H3: Critical thinking dispositions are a predictor of critical thinking skills acquisition.

The present section is devoted to the discussion and interpretation of the results reported on the two studies (Study 1, 2). The significance of the results will be examined, with the intention of answering the research questions that guided the study. It will also present salient details of the findings for each research question.

3.2.6.1 Summary findings and Discussion of research question 1

a. Summary findings of research question 1

Based on previous literature that suggested the effectiveness of reflective writing as a strategy to enhance critical thinking skills and dispositions (Moon, 2008; Kloss, 1994; Brookfield 1987; Mezirow 1990; Brookfield 1987; McGuire 2009; Craft 2005), it was hypothesised that Reflective writing instruction would produce significant effects on students’ performance in critical thinking skills and critical thinking dispositions.

The one way repeated measures analysis of variance in the first study yielded a mixture of statistically significant results concerning the development of critical thinking skills. They revealed that the reflective writing intervention (Instruction/Assignments/Time) produced gains in critical thinking skills of business college students. The results indicated that a five sessions RW Intervention could produce significant gains. Thus, we can conclude that critical thinking skills could be improved through instruction as the students had in class reflective dialogues and instruction about how to write reflectively and be aware of the cognitive skills
underlying both Critical thinking and reflective writing. Second, when writing reflectively about their experiences students became aware of the fact that there is a thinking process underlying such a type of writing namely justifying actions, solving problems, interpreting results, synthesizing, inference and reflection and took advantage of their recursive nature.

Similarly, the measurement of the same effect on critical thinking skills and dispositions of faculty of Education students in the second study, using a mixed design analysis of variance, yielded significant gains in both skills and dispositional attributes. The results showed that eight weeks reflective writing intervention impacted positively progress in performance of both critical thinking skills and dispositions. Moreover, the findings demonstrate that even with high critical thinking predisposition in some attitudinal attributes, as was the case for the control group compared to the experimental at pretest of the CCTDI, training is needed to develop critical thinking skills. Therefore, reflective writing as a cross curricular strategy seems to reinforce students’ ability to think critically.

b. Discussion of research question 1 findings

The discussion of the relationships among reflective writing, critical thinking skills and critical thinking dispositions has been reported and studied in previous literature such as Moon (1999, 2012, 2008), Borookfield, (1987), Mzirow (1990), Schon (1987), McGuire (2009), Craft (2005). Similar to the present study, all the previous studies provided support for reflective writing as a method that could promote general critical thinking ability. As mentioned earlier in this chapter, the appropriation of such a strategy in academic contexts was found to generate positive gains in both critical thinking skills and dispositions. Students from both institutions (faculty of education using CCTST, and Business College using ARC) scored higher in critical thinking skills following the reflective writing treatment.

In the first study, business college students received a reflective writing treatment of which the results showed gain at post intervention on the skills dimension.
Critical thinking skills measured in this study were “interpretation, Analysis, Problem Solving, Evaluation, Synthesis, and Reflection”.

Surprisingly, in the second study, faculty of education control group overall scores on the CCTST pretest were significantly higher than those of intervention group. As it is obviously noticed, the study follows a quasi-experimental design, and more specifically, ‘nonequivalent comparison group design’ which typically involves two groups and a pretest/posttest measurement. In this study, the control group did not receive any treatment and hence was used for comparison. The higher pretest scores of the control group could be also attributed to ‘compensatory rivalry effect’ where students’ behavior is impacted and altered as a result of the study. Control group students may work harder to prove that superiority of the experimental group is not demonstrated. This motivates them to score higher. At posttest, the intervention group outperformed the control group on CCTST overall scores. This is attributed to the lack of instruction in the investigated variable.

Regarding critical thinking dispositions, faculty of Education experimental group scored higher in the CCTDI posttest while the control group scores decreased significantly from pre- to post-intervention though they scored higher at pretest in some dispositions.

According to the results of the mixed design ANOVA, a significant group difference was found between pre- and post-intervention scores on the CCTST individual sub skills, indicating that at least one skill differed by group. The difference may be explained by accepting that students who received the intervention acquired several critical thinking skills that were discussed in the Delphi report (1998).

Concerning the skill of “Analysis”, gain from pre-test to posttest of the intervention group indicates that students acquired the ability to identify inferential connections among assumptions, and to examine ideas and detect arguments (parallelism). Progress in this skill also suggests strong interpretation skills as learners became able to attribute insightful significance to inferences.
When it comes to the gain in the skill of “Inference”, it demonstrates that participants developed the tools that would allow the identification of needed elements to draw reasonable conclusions. This process involves first, enquiring evidence by recognizing premises which necessitate support, and formulating a strategy that would enable searching and collecting information which might provide that support. Second, speculating alternatives in a way that learners articulate several choices or perspectives to solve a problem. Third, they draw conclusions by applying proper approaches of inference to decide on the right position or point of view that should be taken into account.

As for the skill of “Evaluation”, gains show that students have acquired the ability to assess the reliability of accounts of an individual’s perception. It encompasses recognition of relevant factors to assess the source of information they would assign to.

As far as the skills of “Induction” and “Deduction” are concerned, gains were the most significant as scores in these two skills were the highest. Deductive and inductive reasoning relate strongly to problem solving and decision making. Students seem to have understood the nature of these two skills and how they operate. In deduction, the ability to logically switch from assumptions to conclusions with a great precision seems to be fostered. Similarly, inductive reasoning can provide a confident basis for solid belief in drawn conclusions and a reasonable basis for action and which students seem aware of.

We use inductive reasoning skills when we draw inferences about what we think is probably true based on analogies, case studies, prior experience, statistical analyses, simulations, hypotheticals, and patterns recognized in familiar objects, events, experiences and behaviours. As long as there is the possibility, however remote, that a highly probable conclusion might be mistaken even though the evidence at hand is unchanged, the reasoning is inductive. Although it does not yield certainty, inductive reasoning can provide a confident basis for solid belief in our conclusions and a reasonable basis for action.
In fact, progress on critical thinking skills’ overall performance shows that reflective writing involves the same cognitive strategies resumed in skills of critical thinking. Referring back to the studies of Brookfield (1987), and Moon (1999), the thinking process involves two aspects: reflective thinking and critical thinking and both aspects are closely connected as they include approximately the same characteristics. Moreover, reflective thinking encompasses reflection which is a kind of personal reaction to experiences, situations, events or new information. It is also a processing stage where information is processed and, hence, high order thinking and learning take place simultaneously. Studies by Moon (2004) have shown that when something new is experienced the learner recollects prior knowledge and tries to make a connection into the existing cognitive or metacognitive network of ideas. When students engage in the process of reflective writing and, hence, the process of reflection, they automatically engage in high order thinking which stimulates the use of critical thinking skills. McGuire and colleagues (2009) highlighted this issue through their study about reflective writing. In that study, reflection papers were defined as “reflective writing assignments that are focused upon a specific activity which emphasizes the students’ learning from that activity”. As a result, students believed that the assignments forced them to think critically and elaborate on concepts. Additionally, seven themes were identified upon analysis of their papers which are as follows: 1) active participation, 2) dialogue with instructor, 3) critical thinking, 4) interconnections of theory and practice, 5) self-awareness, 6) improving writing skills, and 7) concerns of grading.

Moreover, the metacognitive nature of the reflective writing intervention, which in main part targets students’ metacognitive awareness about the reflective thinking process, makes them learn on more than one level and apply the critical thinking skills they were made aware of. Henter and Indreica (2014) discussed this issue in their study about reflective journal writing as a metacognitive tool for learning in higher education contexts. Their study involved Psychology and Education Sciences students (N= 55) who were tested for progress in achievement resulting from reflective journals as metacognitive training. Results of this study showed that reflective journal could raise students’ metacognitive awareness and development of self-regulatory skills. Therefore, reflective writing could be used to monitor both metacognitive dimensions.
namely knowledge of cognition and regulation of cognition as the writers have to reflect on their own strengths or weaknesses during the process of writing. In addition, reflective writing operates on other aspects related to self-management and resource management such as time management which will be discussed subsequently as another result of the intervention.

The findings of this study corroborate the claims and results of the present study. Students’ gains on critical thinking skills in both the first and second study/institution seem to have impacted their ability to know what cognitive processes are involved in their learning situation, they had clearer ideas about what they wanted to achieve and how they want to present it. In addition they learnt how to self-regulate themselves in a way that they knew what critical thinking skills should be used when faced with specific situations. Therefore, they learnt how to apply and integrate those skills in different contexts. In fact, self-regulation is one of the components that promote the use of critical thinking skills. There is a simultaneous interplay of the learning approaches and self-regulation during that process (Evans, Kirby & Fabrigar, 2003). Individuals who are self-regulated achieve tasks successfully because they make attempts to bridge the gap between their current status and goals they want to achieve and in different contexts (Leventhal and Cameron, 1987). From another perspective, the gain in critical thinking skills in both Business College Students and Faculty of Education students ascertains that critical thinking skills are not subject specific. Different academic contexts, different majors, different measurement tools but the results were positively significant in both cases. Therefore, it could be assumed that acquisition and integration of critical thinking skills is transferable. The present research originally revolves around the enhancement of critical thinking ability represented in skills and dispositions. The importance of promoting skills and dispositional attributes of critical thinking finds its roots in academic settings. In essence, this is done to develop the ability to transfer those skills and attributes into first across subjects, and second to real world contexts, as today’s learners are tomorrow’s citizens.

Trans-contextual transfer of critical thinking skills is ascertained in numerous studies. It is promoted through explicit instruction. Butler, (2012), Halpern
Moseley, et. al., (2005) ascertain that explicit instruction in critical thinking is more fruitful than implicit instruction. Halpern & Mrain 2012, Halpern 2003, came up with a four stages model to teach critical thinking skills explicitly. It involves (a) explicit critical thinking skills instruction, (b) encouraging students’ disposition toward effortful thinking and learning, (c) directing learning activities in ways that increase the probability of trans-contextual transfer, and (d) making metacognitive monitoring explicit and overt. The aforementioned stages operate as a cycle of which the final result is applying transferred critical thinking skills first across subjects and second to real life situations. Furthermore, Halpern (1998) explains that transfer revolves mainly about the recognition and recall of the right skill that is needed in a certain context. This process is referred to as the ‘Achille’s heel of transfer’ (Halpern, 1998). It is considered as a memory problem since recognition of the needed skill includes the aptitude of outer cues to prompt the process of retrieval in the long term memory. Therefore, information about a thinking skill is moved to the working memory where it is consciously processed. This process depends heavily on the way the information about the skill or the skill itself was learned. When teaching critical thinking skills for transfer, the focus of the learning process is on the structure of the problem or the issue, hence, the underlying criteria become significant and prominent instead of the subject specific or domain specific surface criteria. When the structure of the problem is taught explicitly, learners tend to memorize it easily and meaning is attributed to the issue or problem. In the same line of thought, once this process takes place, the learner starts connecting the concept to a web of other interconnected and embedded concepts. When consciously processed, they act as cue for recall. At this level, the connecting process depends to a great extent on the learner's epistemological stage and beliefs and his/her perception of knowledge.

Another component that is vital to the completion of transferability of critical thinking skills is self-regulation or monitoring. It refers to the self-awareness and planning functions that guide the use of thinking skills (Butler, 2012). Students need to monitor their thinking process, checking whether progress is being made toward an appropriate goal, ensuring accuracy, and making decisions about the use of time and mental effort. In the process of explicit instruction of critical thinking skills, learners
should be made aware of the metacognitive monitoring skills used and the process through which they go as they self-regulate. Therefore, critical thinking transcends the subject matter in which it initially develops as transfer involves the capacity to go beyond the information given. The above claims explain how the acquisition of critical thinking skills is not and should not be context specific. It also explains the gain in scores of critical thinking skills in the two different institutions that took part in this research and of which the experiments followed the same principles that were explained above.

At the same time, the results show the effectiveness of reflective writing in different academic contexts. As discussed in the literature concerned with this construct, reflective writing showed success in professional contexts as well as in academic contexts in promoting critical thinking skills and dispositions. As its nature dictates, this type of writing is more salient when it comes to problem solving situations. It is a very adaptable process and could be used alongside with many other concepts for training, learning, personal development and self-improvement. The fact that it allows room for reflection both on actual situations and former experiences of learners makes of it an operative strategy for all majors to promote critical reflection. In almost all the fields (psychology, biology, sciences, mathematics, nursing, engineering, teaching, medical studies and others) in which reflective writing has been used to enhance critical thinking, results indicated a tangible progress both in attitudinal and skills levels of critical thinking. Therefore, reflective writing is not subject specific. Writing across the curriculum doctrine that was discussed in the literature review section encapsulates the essence of non-subject specificity of reflective writing. The principle behind the WAC is the assertion that writing in general and with all its types boosts the learning process and increases the intellectual capacity needed at the university level. The movement advocates that writing must cross the departmental boundaries to endorse the writing skills in all majors and hence boost learning. When well-designed, a writing task belonging to any type of writing is able to improve learning and thinking. The results of the present study illustrate well the successful functioning of reflective writing across the curriculum as in both academic contexts in this study (faculty of education and business college) critical thinking skills and dispositional level of students were boosted.
As for the study’s objective concerning the dispositional side of critical thinking which was investigated in the second study using the CCTDI, results illustrate that there was a salient progress in the dispositional attributes as a result of the reflective writing treatment. Both control and experimental groups’ scores were different at pretest of the CCTDI but not significantly. The control group scored higher in three of the dispositions namely “truth seeking”, “open mindedness” and “systematicity”. However, their scores decreased significantly at posttest in all dispositions. Similarly, the treatment group scored higher in “inquisitiveness”, “analyticity” and “maturity of judgment” dispositions at pretest. Both groups’ scores were equal at pretest only in one disposition which is “confidence in reasoning”. At posttest, the experimental group outperformed the control group in all dispositions which supports the assumed effectiveness of reflective writing intervention in enhancing critical thinking dispositions.

As mentioned earlier, the second study follows a quasi-experimental, and more specifically, ‘nonequivalent comparison group design’ which typically involve two groups and a pretest/posttest measurement. In this study, the control group did not receive any treatment and hence was used for comparison. The comparison group’s higher scores at pretest in some attitudinal dispositions of critical thinking is attributed to the “maturation-effect” which results from differential rates of normal growth. The same applies to the experimental group higher scores in the other three attitudinal dispositions at pretest.

According to the mixed design Analysis of variance results, a significant group difference was found between pre- and post-intervention scores on the CCTDI, indicating that at least one subscale differed by group. The difference may be explained by accepting that students who received the intervention acquired several dispositions and hence different traits of characters that were mentioned in the Delphi report.

When it comes to the gain in the subscale of “inquisitiveness”, it demonstrates that students have developed an intellectual curiosity and a desire for learning. This subscale is central to the ability to think critically. Moreover, it is among the defining characteristics of the liberally educated person (Facione, 1998). According to
the Delphi report, a shortfall in the subscale of “inquisitiveness would create a central limitation in one’s potential to reach an expert level of knowledge and professionalism especially in domains like teacher education, nursing, psychology, and journalism).

For the “truth-seeking” subscale, the gain shows that students became “eager to seek knowledge in the best ways, courageous about asking questions, and honest about pursuing inquiry” (Facione et al., 1998) due to the intervention. According to Paul (1998), truth-seeking encompasses the intellectual standard of fairness and intellectual traits of intellectual integrity, perseverance, and fair-mindedness. As suggested in the literature, the reflective writing intervention may have helped education students to question if information they were receiving was true, valid, and accurate and may have helped them gain courage about asking questions of other issues (Emig, 1977; Luthy et al., 2009; McGuire et al., 2009). In addition, being attuned to counter argumentation encourages professional practice that is reflective and responsive to changes (Facione, 1998).

Concerning the subscale of “systematicity”, gains show that students became more organized, orderly, focused and meticulous in the process of inquiry. Therefore, it denotes that an organized approach to decision making and problem solving is developed and which constitutes a trademark of a considerate person. The predisposition to consider or perceive a problem in an absorbed way is a crucial part of components like management and scientific or psychological practice (Facione, 1998)

As for progress in the subscale of “open-mindedness”, results demonstrate that students developed a more tolerant attitude towards differing views and became aware of the probability of personal biases (Facione, 1998). In class reflective dialogues the participants benefited from prior to reflective writing set the ground for reflection-in-action and reflection-on-action (Beauchamp (2006) mentioned in the literature review. Students became more tolerant to their peers’ views and this allowed a room for reflection on what would constitute a larger span of possibilities and adapting one’s view by accepting another.
Regarding results of the subscale of “analyticity”, gains are explained by accepting that participants have learned how to apply reasoning via the use of evidence to solve problems, foreseeing possible conceptual or practical difficulties, and being aware of the need to intervene (Facione, 1998). Most importantly, students have developed the ability to connect observation with theoretical knowledge through the use of organized reasoning.

Gains in the subscale of “Maturity of judgment” reveal that participants became cognitively mature when it comes to thinking critically. It encompasses the ability to be judicious in one’s decision making through approaching problems by accepting that in every problematic situation there is an ill-structure and there is more than one probable option to perceive of it (Facione, 1998).

Last, the gain in the subscale of confidence in reasoning illustrates that participants developed confidence in their own process of reasoning as it starts inclining towards a more rational and sound resolution of problems. It also demonstrates that students have reached an appropriate level of critical thinking self-confidence which evolves in accordance with maturity and mastery of critical thinking skills. This is the developmental path desired for all students. According to Facione (1998), increase and decrease in critical thinking self-confidence accounts for an individual’s progress through developmental stages or levels. An increase in CT self-confidence designates comfort at a specific level of cognitive development (Facione, 1998).

According to the definitions of critical thinking dispositions proposed in the present research (Facione, 1998; McPeck, 1990), the disposition toward critical thinking involves a set of characterological attributes associated with achievement of and progress in critical thinking. With reference to the literature review about ‘reflexive and reflective depositions’, reflexivity and reflectivity of dispositional attributes are the common ground between reflective writing and progress in critical thinking. The reflexive nature of this disposition resides in the fact that the thinker self-regulates to the new perspective after a pondering stage. Then the learner engages in the process of “reflection-on-action” and “reflection-in-action” Bauchamp (2006) by decentering and
looking back at past experience, and then build a stance or perspective by connecting past experience knowledge to the new situation knowledge and then monitoring.

The two dispositional dimensions discussed earlier seemed to have been developed in this research. As was hypothesized, the reflective practice chosen in the present study created the conditions for students to establish and strengthen the disposition for critical thinking. The reflective writing practice encouraged individual and interactive examination of assumptions and the metacognitive abilities that are essential to critical thinking (Kuhn, 2000; Nelson, 1996; Nelson & Rey, 2000). Moreover, the reflexive nature of reflective writing sets the ground for progress in reflexive and reflective disposition. The gain in the critical thinking dispositional attributes of the experimental group in the second study supports the abovementioned process.

As demonstrated in the overall posttest scores of CCTDI, The general gain in dispositions for the experimental group shows that learners understood the effortful nature of critical thinking and learned how to stay engaged in the process and not abandon it as soon as they feel blocked. Hence, the idea that development of critical thinking requires effortful and intense cognitive work has been fostered through instruction, practice and self-regulation (Wagner, 1997). At beginning of the reflective writing training, some participants had higher critical thinking skills scores than others within the same group and seemed to know what skills to use in what contexts. However, they seemed not motivated to engage in the process of critical thinking where they can constantly apply the skills. Throughout the training sessions, those learners developed a will to easily engage in the effortful process of CT both by participating in the reflective dialogues and in their written productions.

Furthermore, the reflexive nature joining reflective writing and reflective disposition allowed students to find their own voice as they experienced reflection-on-action and reflection-in-action (Beauchamp, 2006; Schön, 1983) which created a solid ground for a deeper awareness of the sense of self. This finds additional evidence in the studies of developmental stages and epistemological beliefs by Belenky et al., 1986, and
Perry (1985) mentioned in the literature review. Therefore, the essence of promoting critical thinking ability resides in boosting the attitudinal constructs of the concept itself.

3.2.6.2 Summary findings and discussion of research question 2

a. Summary findings of research question 2

As a reminder, question 2 is concerned with the relationship between critical thinking dispositions and academic performance in experimental group. According to previous literature discussing the relationship between critical thinking dispositional side and academic achievement, it was hypothesized that dispositions could be a predictor of higher academic scores. Results indicate that there is a negative correlation between academic scores and critical thinking dispositions suggesting that students with higher critical thinking abilities would not necessarily have higher academic scores and vice versa.

b. Discussion of research question 2 findings

The findings of this question sustain that critical thinking dispositions do not predict higher academic scores. In the same vein, this entails that the reflective writing intervention in this study is not responsible for promoting academic achievement. Several studies support the findings of the present one. Demirhan (2014) conducted a similar study on critical thinking dispositions and academic achievement of pre-service science teachers. The results showed that while the pre-service teachers CTD scores increased, their GPA score decreased over time. Another study by Cevik (2013) on teacher candidates found that there is no correlation between CTD and Academic achievement. In this regard, King, Wood & Mines (1990) claim that in general, critical thinking should not be taken as equivalent to academic aptitude. They also propose that critical thinking ability and academic aptitude develop synchronously (King, Wood, & Mines 1990).

In the same line of thought, the disposition toward critical thinking is more responsible for “academic assertiveness” which denotes that the learners develop a voice
of one’s own. As discussed in the literature review (Moon, 2008), being academically assertive is a characterological attribute related to the dispositional side of critical thinking which allows learners to handle the challenges presented to them within the process of critical thinking and learning development. Finding a suitable ‘voice’ through which to engage in critical thinking or debate, the ability and willingness to challenge, to disagree and to seek or accept a challenge are dispositional traits that any learner should acquire to be able to function beyond academia.

3.2.6.2 Summary findings and discussion of research question 3

a. Summary findings of research question 3

This question concerned the relationship between critical thinking dispositions and critical thinking skills acquisition. Referring back to literature suggesting a close relationship between these two variables (Facione, 1990, 1995, 2007; Moon, 2008; Giancarlo, 2000; Sable, 2012), it was hypothesised that there is a positive relationship between skills and dispositions suggesting that dispositional attributes could predict acquisition and progress of skills. The Pearson correlation results show that the change in skills scores from pre-test to post test is potentially attributable to high score in dispositional attributes. Moreover, findings suggest that every critical thinking disposition might be responsible for acquisition of one or more skills. Thus, it could be concluded that higher disposition toward critical thinking would result in acquisition of skills with instruction and practice.

b. Discussion of research question 3 findings

The discussion of the relationships among critical thinking skills and critical thinking dispositions has been reported and studied in previous literature such as (Facione, 1995, 2007, 1998; Moon, 2008; Giancarlo, 2000; Sable, 2012). Similar to the present study, all the previous studies provided support for the fact that the disposition toward CT reinforces CT skills and that success with CT skills reinforces the disposition. The findings also sustain the core ideas of the whole study and those of the
Delphi report (1998) by accepting that critical thinking skills are strongly related to the consistent internal motivation to think and that specific critical thinking skills match with specific critical thinking dispositions. These assumptions would also suggest that a skills or dispositions focused curriculum or program would enhance willingness and ability to think. Similar to the results of the present research, a study by Giancarlo and Facione (1997) which was conducted on 193 high school students yielded significant positive correlation of $r = .41$ between scores of critical thinking dispositions and critical thinking skills. This suggests that the change in skills scores is possibly attributable to change in dispositions. More evidence supporting this claim is a study by Facione (1997), which used the same instruments as the present study namely CCTDI and CCTST. It was conducted on 1557 nursing students at entry to their college program and exit. A positive correlation was found $r = .17$ and a relationship was also found between students’ disposition scores on the CCTDI at program entry and their skills test scores on the CCTST at exit $r = .23$.

The abovementioned corroborates the claims of Facine (1995) and Perkins &Trishman (1993) discussed in the literature review concerning the way CT dispositions relate to CT skills. The findings of the present research ascertain that there is an operative relationship which might occur between specific combinations of CT dispositional attributes and specific sets of CT skills. Hence, the skills and the dispositional attributes interact in stimulating patterns and students who got higher scores in critical thinking dispositions developed their critical thinking skills better than those with lower scores in dispositions.
General Conclusion
Summary of the Results

This section summarizes the research findings and discusses their implications. It also elaborates on the limitations of this study and suggests areas for future research. This study extended the existing literature in three aspects.

First, this study examined the effect of reflective writing intervention on students’ critical thinking skills and dispositions. Second it investigated the relationship between critical thinking dispositions and academic achievement in the experimental group. Lastly, it investigated the relationship between critical thinking dispositions and critical thinking skills for any predictive impacts.

The research questions that guided the abovementioned assumptions are as follows:

Question 1. To what extent does a Reflective writing intervention impact Moroccan College students’ performance in Critical thinking skills and dispositions?

Question 2. To what extent do critical thinking dispositions predict the academic achievement of Moroccan faculty of education students?

Question 3. To what extent do critical thinking dispositions predict the acquisition of critical thinking skills of Moroccan Faculty of Education students?

Accordingly, the following hypotheses were formulated:

Hypothesis 1: Students who receive supplemental instruction on reflective writing develop better critical thinking skills and dispositions,

Hypothesis 2: Critical thinking dispositions are a predictor of academic achievement,

Hypothesis 3: Critical thinking dispositions are a predictor of critical thinking skills acquisition.
Answers to question 1 showed that hypothesis 1 was confirmed since in study 1, the ARC rubric results showed a gain in critical thinking skills of business college students post intervention. The same applies to study 2 in which the faculty of education experimental group scores on CCTST were higher at posttest. The gain in study 1 and 2 concerned with critical thinking skills overall performance sustains that reflective writing as an instructional method improves critical thinking skills. In addition, results show first, that the gain takes place because reflective writing involves the same cognitive strategies resumed in skills of critical thinking. Second, the metacognitive nature of the reflective writing intervention, which in main part targets students’ metacognitive awareness about the reflective thinking process, makes them learn on more than one level and apply the critical thinking skills they were made aware of. Third, self-regulation is essential to acquisition of critical thinking skills and ensures their transferability. The second part that participated in the confirmation of the first hypothesis is the experimental group overall gain on critical thinking dispositions in study 2, using the CCTDI. The results revealed that reflective writing created the conditions for students to establish and strengthen the disposition for critical thinking. Second, the reflective writing practice encouraged individual and interactive examination of assumptions and the metacognitive abilities that are essential to critical thinking. Third, the reflexive nature of reflective writing sets the ground for progress in reflexive and reflective disposition.

The second hypothesis was rejected as a negative correlation was found between critical thinking dispositions and experimental group academic scores of semester five during which the intervention took place. Thus, students with high dispositions are not necessarily going to have good marks. This suggests that critical thinking dispositions do not predict higher academic scores. In the same vein, this entails that the reflective writing intervention in this study is not responsible for promoting academic achievement.

The third hypothesis was confirmed as correlation between the two constructs namely critical thinking dispositions and critical thinking skills was positive suggesting that the disposition toward CT reinforces CT skills and that success with CT
skills reinforces the disposition. In the same vein, the results confirmed that critical thinking skills are strongly related to the consistent internal motivation to think and that specific critical thinking skills match with specific critical thinking dispositions. Hence, the skills and the dispositional attributes interact in interesting clusters and students who got higher scores in critical thinking dispositions developed their critical thinking skills better than those with lower scores in dispositions.

The aforementioned confirms the importance of critical thinking as a construct to education in general and to tertiary education in specific terms. The findings ascertain that teaching critical thinking skills within an instructional framework allows room for boosting learners’ attitudes toward the engagement in the process of critical thinking and vice versa. Therefore, making students aware of critical thinking processes and teaching them how to self-regulate would help them develop this ability and become academically assertive. In addition, the positive impact reflective writing had on the development of critical thinking skills and dispositions makes of it a pedagogical method to be incorporated in all educational programs.

**Pedagogical implications**

Given the significance that critical thinking is occupying at the academic, personal and professional levels, it is of paramount importance to be focused in academic settings.

A critical thinking approach to education in the Moroccan context would empower students to be independent, lifelong learners, responsible, and active citizens, capable of making thorough decisions, building up new knowledge, and able to face professional and societal issues. This approach to education can be taken into account efficiently only if incorporated within an institutional framework and without being subject-specific. This would require a reconsideration of the curricula in a way that their creation is done on the basis of well-designed critical thinking pedagogy that would bring about rich outcomes.
Curriculum wise and based on the findings and interpretations of the present research, significant practical implications for educators are to be taken into account. A clear knowledge of the connections between certain combinations of skills and certain combinations of dispositions can direct the development of classroom material and assignments. Questions emphasizing specific combinations of skills can be placed in contexts that would tend to reinforce certain of the dispositions. For example, exercises to strengthen skills of categorization, analysis, and interpretation might be placed in a context requiring systematic and focused database inquiry and a measure of intellectual curiosity. Exercises to develop CT skills of evaluation and self-reflection might be placed in a context of certain belief structures, such as ethical or political views, which are challenging to consider open-mindedly and evaluate objectively.

Educators should be in charge of providing lectures and discussions which nourish the pedagogy of fostering critical thinking. They should provide guidance and monitor their students’ progress and encourage them to break away from a blind reliance on the professor’s or expert’s authority. This way, students will assume a more active responsibility towards their learning and would become academically assertive by developing a voice of their own.

Limitations of the study

The present research yielded significant results regarding development of critical thinking skills and dispositions through reflective writing among undergraduate students. However, the implications of these findings do not come without limitations. First, the restricted number of participants is not representative of the larger population of Moroccan University students.

A more important limitation is the exorbitant price of the tests CCTST and CCTDI and the complicated, exhausting and time consuming procedure of purchase from Insight Assessment (USA). This contributed to the limitation of respondents who participated in the study and hence impacted results generalizability.
Second, the sampling procedure that involved random assignment of students to groups resulted in unbalanced samples which caused the comparison group scoring higher than the experimental in pre-test of the CCTST.

Third, degree of challenge that CCTST and CCTDI tests in addition to time allotted to task and the language of the test presented to students may have impacted their abilities to answer more specifically for the comparison group. The reflective writing intervention kept students in the experimental group engaged and they learned how to cope with the difficulty of the tests. This was not an option for the comparison group. Therefore, this might explain why the comparison group’s scores on both tests decreased from pre-test to post-test.

Last, the questions in the CCTST are to some extent culture based, especially in terms of the problems included. This might have impacted the learners’ ability to understand and, hence, answer those questions. At the same time, this offers room for further investigation of the relationship between critical thinking ability and culture.

In study 1, there were some limitations to the study namely the adaptation of the ARC, first to a Moroccan context, and second in specifying the meeting points and overlapping spaces connecting critical thinking skills and reflective writing skills. Second, the research does not make a straightforward distinction between prior disposition to critical thinking skills and the effectiveness of the RWI in promoting critical thinking skills. Further research using the same intervention should take larger population for the sake of result generalizability.

**Recommendations for Future Research**

One previously mentioned possibility for future research is the analysis of the qualitative data in this study. A large amount of qualitative data was produced from the study, and the data could be analysed to determine reflective themes among different majors.
Also, it would be very beneficial to attempt this study with a larger sample, over a longer period of time, with different groups of students, and with more reflective writing assignments. Another point that is worth investigating is the relationship between time spent on tests namely CCTST and CCTDI and critical thinking ability. Moreover, it would be stimulating to investigate the impact of language and culture on critical thinking ability in tertiary education and in more specific terms, in testing and measurement of critical thinking.
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Appendices

Figure 1. Critical thinking "Interpretation" skill measured via the Assessment Rubric for Critical Thinking using reflective writing treatment mean score.
Figure 2. Critical thinking “Analysis” skill measured via the Assessment Rubric for Critical Thinking using reflective writing treatment mean score.
Figur3: shows a mean plot highlighting linear progress of “Evaluation” as a critical thinking skill during the intervention
Figure 4. Critical thinking “Problem solving” skill measured via the Assessment Rubric for Critical Thinking using reflective writing treatment mean score.
Figure 5. Critical thinking “synthesis” skill measured via the Assessment Rubric for Critical Thinking using reflective writing treatment mean score
## Adapted SPC’s Assessment of Critical Thinking (ARC) Scoring Template

**Rater (scorer) name:** _____________________________**Paper ID:** _____________________________**Date:** ____________________

<table>
<thead>
<tr>
<th>CT skill</th>
<th>Exemplary</th>
<th>Proficient</th>
<th>Developing</th>
<th>Emerging</th>
<th>Not Present</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. <strong>Interpretation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categorization</td>
<td>Comprehends and puts across the meaning or significance of a <strong>wide range</strong> of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria providing problem with <strong>numerous</strong> supporting details and examples which are <strong>organized logically</strong> and <strong>coherently</strong>.</td>
<td>Comprehends and puts across the meaning or significance of <strong>some</strong> experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria providing problem with <strong>some</strong> supporting details and examples which are <strong>organized</strong>.</td>
<td>Comprehends and puts across the meaning or significance of <strong>few</strong> experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures or criteria providing problem with <strong>few</strong> supporting details and examples in a <strong>non-organized way</strong>.</td>
<td>Does not comprehend the main idea or problem.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decoding significance</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Clarifying meaning</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

| II. **Analysis** | | | | | | | 
| Examining ideas | Uses **specific inductive or deductive reasoning** to make inferences regarding premises; addresses implications and consequences; identifies facts and relevant information correctly. | Uses **logical reasoning** to make inferences regarding solutions; addresses implications and consequences; Identifies facts and relevant information correctly. | Uses **superficial reasoning** to make inferences regarding solutions; Shows some **confusion** regarding facts, opinions, and relevant, evidence, data, or information. | Makes **unexplained, unsupported, or unreasonable inferences** regarding solutions; makes **multiple errors** in distinguishing fact from fiction or in selecting relevant evidence. | Does not analyze multiple solutions. | | 
| Detecting arguments | 4 | 3 | 2 | 1 | 0 | 
| Analysing arguments | 4 | 3 | 2 | 1 | 0 | 

| III. **Problem Solving** | Thoroughly | Identifies and | Identifies and | Identifies and | Does not select | | 
|  |  |  |  |  |  | | 
| |  |  |  |  |  | | 

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**IV. Evaluation**

<table>
<thead>
<tr>
<th>Assessing claims</th>
<th>Assessing arguments</th>
<th>Identify weaknesses in your chosen solution.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insightfully interprets data or information; identifies obvious as well as hidden assumptions, establishes credibility of sources on points other than authority alone, avoids fallacies in reasoning; distinguishes appropriate arguments from extraneous elements; provides sufficient logical support.</td>
<td>Accurately interprets data or information; identifies obvious assumptions, establishes credibility of sources on points other than authority alone, avoids fallacies in reasoning; distinguishes appropriate arguments from extraneous elements; provides sufficient logical support.</td>
<td>Makes some errors in data or information interpretation; makes arguments using weak evidence; provides superficial support for conclusions or solutions.</td>
</tr>
<tr>
<td>Exemplary (4)</td>
<td>Proficient (3)</td>
<td>Developing (2)</td>
</tr>
<tr>
<td>Insightfully</td>
<td>Accurately</td>
<td>Makes some errors in data or information interpretation; makes arguments using weak evidence; provides superficial support for conclusions or solutions.</td>
</tr>
<tr>
<td>Proficient (3)</td>
<td>Emerging (1)</td>
<td>Not Present (0)</td>
</tr>
<tr>
<td>Accurately</td>
<td>Interprets data or information incorrectly; Supports conclusions or solutions without evidence or logic; uses data, information, or evidence skewed by invalid assumptions; uses poor sources of information; uses fallacious arguments</td>
<td>Does not evaluate data, information, or evidence related to chosen solution</td>
</tr>
<tr>
<td>Developing (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emerging (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Present (0)</td>
<td></td>
<td></td>
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<tr>
<td>V. Synthesis</td>
<td>Insightfully</td>
<td>Accurately</td>
</tr>
<tr>
<td>Insightfully</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>relates concepts and ideas from multiple sources; uses new information to enhance chosen solution; recognizes missing information; correctly identifies potential effects of new information.</td>
<td>relates concepts and ideas from multiple sources; uses new information to enhance chosen solution; correctly identifies potential effects of new information.</td>
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<td>--------------------------------</td>
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<tr>
<td><strong>Suggest ways to improve/strongen your chosen solution</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>VI. Reflection</strong></td>
<td>Identifies strengths and weaknesses in own thinking: recognizes personal assumptions, values and perspectives, compares to others, and evaluates them in the context of alternate points of view.</td>
<td>Identifies strengths and weaknesses in own thinking: recognizes personal assumptions, values and perspectives, compares to others, with some comparisons of alternate points of view.</td>
</tr>
</tbody>
</table>
The importance of critical thinking as an outcome for students graduating from Universities has been a focal point in numerous educational programs. It is considered a central skill of the relevant and instant connectivity to the constantly changing workforce challenges. Therefore, developing new strategies to promote critical thinking as a construct inside academia is vital to the success of educational programs. Several dimensions that are believed to deepen the understanding of critical thinking as a generic skill and an educational outcome have been explored and investigated in the present study to come up with results that could be applied in different contexts. To explore the previously mentioned dimensions, the research sets out to investigate the impact of reflective writing as a pedagogical strategy on progress of critical thinking ability of university students.

First, it examined the effect of reflective writing intervention on students’ critical thinking skills in two different case studies using CCTST and ARC to test for gain in critical thinking skills. Similarly, the CCTDI was used to test for gain in critical thinking dispositions in the second study.

The first experimental study was an 8 weeks intervention held at a Business College in Rabat (knowledge CBI) in which progress of critical thinking skills was measured using the ARC by evaluating and scoring written productions of thirty Juniors (N= 30) . A one way repeated measures ANOVA was conducted to evaluate change in critical thinking skills as a result of the reflective writing intervention. Results showed progress in the development of critical thinking skills (p< 001.) The second quasi experimental study took place at the Faculty of Education, University Mohamed V, Rabat. Fifty one (N=51) third year (BA) students of which twenty seven (N=27) participated in Reflective Writing Intervention as an experimental group for 8 weeks and took the CCTDI and CCTST pre intervention and post intervention tests to measure progress of critical thinking skills and dispositions. Results of control and experimental groups using a mixed design ANOVA show progress at the level of both dispositions, F (1, 49) = 34. 59, p<001., and skills, F (1, 49) = 14, 12 p<.001. The gains sustain that reflective writing as an instructional method could improve critical thinking skills and dispositions.

Second the study investigated the relationship between critical thinking dispositions and academic achievement for any predictive impacts in the experimental group of the faculty of Education. A Pearson’s correlation was performed on overall change in CCTDI and semester 5 academic scores of the experimental group to investigate this relationship. A negative correlation was found r = -.43*, n = 27, p =024 between the two constructs suggesting that critical thinking dispositions do not predict higher academic scores. The results suggest that critical thinking dispositions do not predict higher academic scores. Thus, this entails that the reflective writing intervention in this study is not responsible for promoting academic achievement but rather supports the paradigm of having a “voice” and being academically assertive.

Lastly, it investigated the relationship between critical thinking dispositions and critical thinking skills for any predictive impacts. A Pearson’s correlation was conducted on overall change in CCTDI and overall change of CCTST to investigate this relationship. A positive but marginal correlation exists between critical thinking skills and dispositions on the overall gains in both components r = 0.380, n = 51, p =0.006. The results sustain that the disposition toward CT reinforces CT skills and that success with CT skills reinforces the disposition. In the same vein, the results confirm that critical thinking skills are strongly related to the consistent internal motivation to think and that specific critical thinking skills match with specific critical thinking dispositions.