Critical thinking as a self-regulatory process component in teaching and learning

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This article presents a theoretically grounded model of critical thinking and self-regulation in the context of teaching and learning. Critical thinking, deriving from an educational psychology perspective is a complex process of reflection that helps individuals become more analytical in their thinking and professional development. My conceptualisation in this discussion paper argues that both theoretical orientations (critical thinking and self-regulation) operate in a dynamic interactive system of teaching and learning. My argument, based on existing research evidence, suggests two important points: (i) critical thinking acts as another cognitive strategy of self-regulation that learners use in their learning, and (ii) critical thinking may be a product of various antecedents such as different self-regulatory strategies.

El pensamiento crítico, como un componente de autorregulación, en el proceso de enseñanza - aprendizaje. Este artículo presenta un modelo teórico básico del pensamiento crítico y la autorregulación, en el contexto de la enseñanza y el aprendizaje. El pensamiento crítico, derivado de la perspectiva de la psicología educativa, es un complejo proceso de reflexión que ayuda a las personas a ser más analíticas en su pensamiento y en su desarrollo profesional. La conceptuación en este informe sostiene que, ambas orientaciones teóricas (el pensamiento crítico y la autorregulación), operan en un sistema dinámico e interactivo de enseñanza y de aprendizaje. El argumento se basado en pruebas de investigación existentes y sugiere dos puntos importantes: (i) los actos de pensamiento crítico como otra estrategia cognitiva de autorregulación, que los estudiantes utilizan en su aprendizaje, y (ii) el pensamiento crítico puede ser un producto de diversos antecedentes, tales como diferentes estrategias de auto-regulación.

Critical thinking is an important theoretical orientation that serves to help students' motivation in the teaching and learning processes. The concept of critical thinking arises from the practice of reflective thinking (Leung & Kember, 2003; Phan, 2007, 2008a), where this construct has been shown to relate positively to students' academic success (Lee & Loughran, 2000). Critical thinking helps individuals to think and analyse critically about their own learning, and to strive and develop expertise in their areas of professionalism. In the area of teaching and learning, for example, the practice of critical thinking has provided pre-service student teachers with the skills to improve and develop their pedagogical teaching skills. More recently, considerable research interest has been directed towards understanding the process of critical thinking, and how this concept may fit into the main framework of self-regulated learning and motivation (e.g., Leung & Kember, 2003; Phan, 2007, 2009). Further to this research development, researchers in educational psychology have recently acknowledged that motivation and its related constructs may vary in terms of subject area and sociocultural context (Boekaerts, 2001; Heikkilä & Lonka, 2006; Walker, Pressick-Kilborn, Arnold, & Sainsbury, 2004).

In view of the important theoretical and educational implications that arise from critical thinking, this article explores how this practice may fit in with the framework of self-regulation. In the first part of this article, I present a theoretical overview of self-regulated learning and the notion of self-regulated learners. This is followed by a discussion pertaining to critical thinking and the impact this practice has on students' academic learning. In particular, I discuss my research involving critical thinking in the context of educational psychology and the teaching and learning processes. I conclude this article by proposing a conceptualisation that accentuates a possible dialectical relationship between the two theoretical orientations.

An Overview of self-regulated learning

Understanding the concept of self-regulation is important to the professional well being of individuals. Self-regulated learning, according to Zimmerman and Risemberg (1997), is a self-initiated action that involves goal setting and regulating one's efforts to reach the goal, self-monitoring (metacognition), time management, and physical and social environment regulation

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(Chen, 2002). Since its emergence as a theory in educational psychology, self-regulation has been written on and researched extensively (e.g., Boekaerts & Niemivirta, 2000; Pintrich, 2004; Pintrich & De Groot, 1990; Vermunt & Verloop, 1999; Martínez & De la Fuente, 2004; Villach & Llanos, 2007). There is a voluminous body of research in motivation that reflects the importance of self-regulation in mathematics, social studies, and writing (e.g., Hammann, 2005; Stodolsky, Salk, & Glaessner, 1991; Wolters & Pintrich, 1998).

So what is self-regulation and how does it lead to individual differences in student learning? According to Zimmerman (1989), self-regulated learners are those who are "metacognitively, motivationally, and behaviourally active participants in their own learning process" (p. 4). In a more simplistic form, a self-regulated learner is more inclined to set task-related, reasonable goals, take responsibility for his or her learning, and maintain motivation (Heikkilä & Lonka, 2006). It is also assumed that students who are regulated in their learning are able to use and change a variety of cognitive (e.g., rehearsing, memorising, organising) and metacognitive (e.g., goal setting, planning, monitoring, self-evaluation) strategies to accomplish academic tasks. Subsequent research (e.g., Corno, 2001; Weinstein, Husman, & Dierking, 2000; Zimmerman, 2002) adhering to the theoretical framework of self-regulation has shown that self-regulated learners manifest a number of distinctive characteristics (see Montalvo & Torres, 2004).

As described by Weinstein (1996) more than a decade ago, research development pertaining to self-regulation is diverse and has resulted in various thematically-related theoretical models and paradigms (see Boekaerts, Pintrich, & Zeidner, 2000; Puustinen & Pulkkinen, 2001 for analysis). Although there are various theoretical models of self-regulation, most frameworks assume that self-regulated learners engage in the use of both cognitive and metacognitive strategies for learning (Vanderstoep, Pintrich, & Fagerlin, 1996; Wolters & Pintrich, 1998). Furthermore, most theoretical models of self-regulation assume learners also endorse adaptive motivational beliefs in learning (Pintrich & De Groot, 1990; Zimmerman, 1989, 1994).A possibly important view is that self-regulation is a proactive process (Zimmerman, 2008), where this enables learners to acquire academic skill, such as setting goals, selecting and deploying strategies, and self-monitoring one's own effectiveness. It is not, in contrast, a reactive process that happens as a result of impersonal forces.

One particular model, for example, is the Pintrich (2000) model of self-regulation. Pintrich's (2000) theoretical framework is based on the socio-cognitive perspective of learning (Bandura, 1997, 2001; Schunk, 2001), where self-regulatory processes are organised according to four phases: (i) planning, (ii) self-monitoring, (iii) control, and (iv) reflection or evaluation. Within each of these four phases, self-regulation activities are in turn structured into four areas: cognitive, motivational/affective, behavioural, and contextual (see Table 1). According to Pintrich (2000), the four phases of self-regulatory processes described (see Montalvo & Torres, 2004; Pintrich, 2000) reflect a general sequence that learners go through as they carry out the specific tasks; however, these phases are not hierarchically or linearly structured (Montalvo & Torres, 2004). Accordingly, the four phases can occur simultaneously and dynamically, producing multiple interactions between the different processes and components. The Pintrich framework is comprehensive and global, providing a basis for educators to analyse in detail the different cognitive, motivational/affective, behavioural and contextual processes that nurture and enhance self-regulated learning (Pintrich, 1999).

Likewise, the Zimmerman (1998) theoretical model of self-regulation describes three cyclical phases that are similar to those discussed in Pintrich's (2000) model (Pintrich & Zusho, 2002; Zimmerman, 2002). The forethought phase, referring to processes and beliefs that occur before efforts to learn, encompasses two major processes: task analysis (including goal setting and strategic planning) and self-motivational beliefs (including self-efficacy beliefs, outcome expectations, intrinsic interest/value, and learning goal orientation). The performance phase, referring to processes that occur during behavioural implementation, falls into two classes: self-control (including the use of imagery, self-instruction, attention focusing, and task strategies) and self-observation (refers to self-recording personal events or self-experimentation). The self-reflection phase, referring to processes that occur after learning efforts, encompasses two major classes of processes: self-judgment (including self-evaluation and causal attributions) and self-reaction (involves feelings of self-satisfaction and positive affect; adaptive/defensive responses). The Pintrich and the Zimmerman models of self-regulation, as well as others, have spawned various theoretical and empirical contributions from researchers over the past three decades (e.g., Boekaerts *et al.*, 2000; Corno, 1989; Miller & Brickman, 2004; Pintrich, 2000; Schunk & Zimmerman, 1994, 1998; Zimmerman, 2002; Zimmerman & Schunk, 1998).

Table 1 Phases and areas for self-regulated learning (Pintrich, 2000, p. 454)				
Phases	**Cognition**	**Motivation/Affect**	**Behaviour**	**Context**
Fore-thought planning, and activation	Target goal setting Prior content knowledge activation Metacognitive knowledge activation	Goal orientation adoption Efficacy judgments Ease of learning judgments; perceptions of task difficulty Task value activation Interest activation	Time and effort planning Planning for self observations of behaviour	Perceptions of task Perceptions of context
Monitoring	Metacognitive awareness and monitoring of cognition	Awareness and monitoring of motivation and effect	Awareness and monitoring of effort, time use, need for help Self-observation of behaviour	Monitoring changing task and context conditions
Control	Selection and adaptation of cognitive strategies for learning, thinking	Selection and adaptation of strategies for managing motivation and affect	Increase/decrease effort Persist, give up Help-seeking behaviour	Change or renegotiate task Change or leave context
Reaction and reflection	Cognitive judgments Attributions	Affective reactions Attributions	Behaviour choice	Evaluation of task Evaluation of context

The framework for understanding the learning processes has, as indicated, shifted to the conviction that learners are responsible for their own learning. Learners actively participate in the environment to construct meaning and to reorganise existing knowledge with new knowledge (Perkins, 1992). In this analysis, self-regulation provides a self-initiated action that enables learners to do the following: set goals, regulate one's own effort, engage in time management, and to monitor and evaluate existing performance. It is an important feat, as reflected by the various writings in self-regulation (e.g., Corno, 1993, 2001; Graham, Harris, & Troia, 1998; Ley & Young, 2001; Schunk & Zimmerman, 1998), that educators encourage the teaching of self-regulatory skills (see Montalvo & Torres (2004) for detailed analysis; Martínez & De la Fuente, 2004; Villach & Llanos, 2007). For example, the teaching of self-regulation by means of modelling has been recommended (Graham *et al.*, 1998; Schunk & Zimmerman, 1998); expert models (e.g., peer, adult) can perform a number of steps (planning, controlling execution, distributing cognitive resources, and reflecting on what has been done) for students to observe and assimilate. Likewise, other strategies include the direct teaching of strategies, practicing and receiving feedback from others, social support and scaffolding instruction, creating and structuring favourable learning environments.

In my contribution to the existing literature on self-regulation, I extend this discussion to the study of critical thinking practice as a possible method of instruction that could facilitate self-regulated learning. In the subsequent sections of this article, I discuss in-depth the theory of critical thinking and how this practice may fit in with the theoretical framework of self-regulation. I begin by reviewing the theory and research pertaining to critical thinking and how this practice affects students' academic learning.

Critical thinking: Theoretical overview

The notion of critical thinking, or commonly known as critical reflection, has been widely researched in various professional fields, such as psychology, education, teaching and learning, etc (Grushka, McLeod, & Reynolds, 2005; Harrison, Lawson, & Wortley, 2005; Pedro, 2005; Willsen & Binker, 1993; Yanchar, Slife, & Warne, 2008). Furthermore, similar to the various theoretical frameworks of self-regulation that have been advocated (Weinstein, 1996), critical thinking has a number of diverse and varied definitions that reflect its complexity (Petress, 2004; Yanchar et al., 2008). For example, Scriven and Paul (cited in Petress, 2004, p. 463) refer to critical thinking as a process and not as an end in itself: "Critical thinking is the intellectually disciplined process of actively and skilfully conceptualizing, applying, analysing, synthesising, and/or evaluating information gathered from or generated by: observation, experience, reflection, reasoning, or communication, as a guide to belief and action". Similarly, Warnick and Inch define critical thinking as "involving the ability to explore a problem, question, or situation; integrate all the available information about it; arrive at solution or hypothesis; and justify one's position (cited in Petress, 2004, p. 461).

Critical thinking has received considerable research interest in the field of education and psychology. This emerging interest, as reflected by the recent appearance of a journal entitled *Reflective Practice*, pertains to the importance of critical thinking and how this practice fits in with teaching and learning processes, as well as the development of specific skills required for reflection itself.

Critical thinking may be credited to the work of John Dewey (1933), who discussed extensively discussed the role of reflective thinking where he defined this practice as "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the conclusion to which it tends" (p. 9). Furthermore, according to Dewey, "reflective thinking, in distinction from other operations to which we apply the name of thought, involves (1) a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates, and (2) an act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and dispose of the perplexity" (p. 12).

Critical thinking, according to some researchers (e.g., Kember et al., 2000; Leung & Kember, 2003; Mezirow, 1998; Phan, 2007, 2008a), is a high-order phase or level of reflective thinking practice. A recent important line of research inquiry, namely Mezirow's (1991, 1998) theories regarding transformative education, has involved the theoretical postulation of reflective thinking as being categorised into four separate phases; in their order of complexity – habitual action, understanding, reflection, and critical thinking (Kember et al., 2000; Leung & Kember, 2003; Phan, 2007). Habitual action is a mechanical and automatic activity that is performed with little conscious thought. Understanding is learning and reading without relating to other situations. Reflection concerns active, persistent, and careful consideration of any assumptions or beliefs grounded in our consciousness. Critical thinking is considered as a higher level of reflective thinking that involves us becoming more aware of why we perceive things, the way we feel, the way we act, and what we do. Furthermore, critical thinking enables us to use analytical and evaluative processes to interpret and enhance meaningful understanding of classroom materials. The ability to synthesise information analytically and evaluatively suggests the use of cognitive reflection (Kish, Sheehan, Cole, Struyk, & Kinder, 1997). Finally, critical thinking provides us with relevant hindsight to avoid interpreting information that may be misconstrued and biased based on prior opinion and belief (Norris & Ennis, 1989; West, Toplak, & Stanovich, 2008).

The potency of the four phases of reflective thinking practice has been featured as an important line of inquiry in educational psychology research. Kember and colleagues (Kember *et al.*, 2000) developed an inventory, the Reflective Thinking Questionnaire (RTQ), to assess experiential thinking towards the four phases of reflective thinking. The 16 items of the RTQ are answered on a seven-point scale from 1 ("definitely agree") to 7 ("definitely disagree"); for example, "In this course we do things so many times that I started doing them without thinking about it" (habitual action), "To pass this course you need to understand the content" (understanding), "I often re-appraise my experience so I can learn from it and improve for my next performance" (reflection), and "This course has challenged some of my firmly held ideas" (critical reflection). Leung and Kember (2003) have reported reliability estimates ranging from .58 to .74 for the four subscales of the RTQ.

Attempts to explore the complexity of reflective thinking practice, as exemplified by the four phases of reflection, are still in their infancy, with only a few correlational studies published to date. In my previous work, I used causal modelling procedures to attest to the positive interrelationships between the four phases and other motivational constructs. For example, there are reasons

to believe that critical thinking is formed from the experience of the three lower phases (Phan, 2007, 2008a). In this analysis, the intricate forming of critical thinking may require derived experiences from habitual action, understanding, and reflection. The importance of critical thinking is also evident from its bivariate associations with other variables, such as achievement and self-efficacy beliefs (Bandura, 1997, 2001). Empirical evidence so far indicates the ongoing interactive dynamic that exists between critical thinking and other variables that may be conducive to learning.

Reflective thinking practice, motivational variables, and academic achievement

Research investigating the four phases of reflective thinking practice has attempted to situate this research inquiry within the classroom context and involves other motivational variables. The work of Leung and Kember (2003) has provided us with a clear understanding of critical thinking and how it relates positively to other motivational variables, notably - learning styles, goal orientations, self-efficacy beliefs, and effort. Leung and Kember's (2003) confirmatory factor analysis (CFA) study suggests that critical thinking along with reflection and understanding are associated positively to deep study strategies, whereas habitual action is more in line with surface study strategies. The evidence established from the Leung and Kember study suggests the plausibility of study processing strategies as antecedents of reflective thinking. I found from structural equation modeling that habitual action is predicted by surface processing strategies, whereas understanding is influenced by deep processing strategies (Phan, 2006, 2007). Critical thinking and reflection are also influenced by deep processing strategies (Phan, 2006).

I have also made attempts to explore, empirically, the relationships between the four phases of reflective thinking (Leung & Kember, 2003; Mezirow, 1998; Phan, 2007) and other related motivational variables. Apart from the two major learning strategies (Biggs, 1993; Kember, 2000; Marton & Säljö, 1976; Murphy & Tyler, 2005; Phan & Deo, 2007), I explored whether the trichotomous model of achievement goals (mastery goals, performance-approach goals, performance-avoidance goals)(Elliot, 1997; Elliot & Church, 1997; Elliot & Harackiewicz, 1996) and work-avoidance goals would act as antecedents of the four phases of reflective thinking. I found from path analysis with tertiary students that a mastery goal orientation influenced three of the four phases (with the exception of habitual action)(Phan, 2008a). Students who adopt mastery goals, in contrast to the other three types of goal orientations, are interested in acquiring new skills and improving their knowledge even in the face of obstacles. Furthermore, students who pursue mastery goals tend to adapt instinctively to the use of reflection and critical thinking, as these two complex phases facilitate a better understanding of knowledge and the development of skill improvement. In a more recent study (Phan, 2009), I found that reflection (but not critical thinking) was also influenced by both mastery and performance-approach goals.

Effort, the overall amount of time and effort expended in the process of studying (Zimmerman & Risemberg, 1997), was also found to relate positively with the four phases of reflection. In the current literature of motivation, the role of effort in achievement goals and study processing strategies has been documented in a number of studies (Dupeyrat & Mariné, 2005; Elliot, McGregor, & Gable, 1999; Fenollar, Román, & Cuestas, 2007), whereas with reflective thinking practice research is still in its infancy. In my published work in this area to date (Phan, 2008a, 2009), I found that effort is related positively to understanding and reflection (Phan, 2008a), but not habitual action or critical thinking. In my earlier research (Phan, 2007), I also examined reflective thinking within Bandura's (1997, 2001) social-cognitive framework. I found from path analytical procedures that students' academic self-efficacy beliefs were predictive of the phases of reflective thinking (with the exception of critical thinking). This absence of a significant bivariate association between critical thinking and self-efficacy, and likewise effort and deep processing strategies, is perplexing and suggests the need for researchers to advance this area of inquiry. Despite this nonsignificance, the finding between the three lower phases of reflective thinking and self-efficacy supports previous research studies (e.g., Pajares, 1996, 1997; Pajares & Johnson, 1996; Pajares & Kranzler, 1995) and emphasises the salient role of self-efficacy. Individuals who are self-efficacious are more likely to engage in reflective thinking practice in their learning.

The seminal research by Leung and Kember (2003) provided a basis for further examination of the underlying mechanism of reflective thinking practice and its relations with other motivational variables. In a longitudinal panel study (Phan, 2008b), I examined a cohort of tertiary students over a one-year period. I subjected the data to a series of structural equation models and found that epistemological beliefs positively predicted students' engagement in reflective thinking practice. This evidence, in line with existing research findings (e.g., Leung & Kember, 2003; Phan, 2006, 2007) and my previous findings (e.g., Phan, 2007, 2008a, 2009), suggests then, that there are various antecedents that shape the experience of reflective thinking practice.

A frequently recurring theme in educational psychology for educators is to help students succeed academically. Considerable research has been directed towards understanding the motivational variables (e.g., self-efficacy, future time perspective) that influence students' motivation and learning. Evidence from previous studies indicates that critical thinking affects students' learning and performance outcome. I found that engaging in critical thinking helps improve students' academic performance (Phan, 2006, 2008a, 2009), whereas the lower-order reflective thinking phases lead to academic decline (Phan, 2007, 2008a). In a recent study, I included two indexes of performance – academic achievement (e.g., consisting of quizzes, final exam) and academic learning (e.g., consisting of written assignment) – and found that critical thinking exerted positive effects on both indexes.

In conclusion, works previously cited attest to the importance of critical thinking in the context of educational psychology of teaching and learning. Unlike other areas of psychology (Baron, 2000; Sternberg, 2003; Watson & Glaser, 1980; West et al., 2008; Yanchar et al., 2008), critical thinking is emerging as a disciplinary practice in educational psychology. By all means, taking into consideration the long history and debate surrounding the meaning of critical thinking (Thayer-Bacon, 2000; Yanchar et al., 2008), I realise that no definition or paradigm is likely to be universally accepted or that it could capture the nuance that surrounds its complexity. As a separate disciplinary practice in educational psychology, critical thinking may include a number of key characteristics that I outlined previously. Indeed, from the approach that I have taken, there is evidence at present to confirm

the complexity of critical thinking (e.g., Kember et al., 2000; Leung & Kember, 2003; Phan, 2007, 2009), and how this high-order level of reflective thinking affects students' academic learning and development. The positive interrelatedness with other motivational variables also validates the potent role of critical thinking in the learning process. One critical facet of critical thinking that may be advanced further includes its intricate association to the strategies of self-regulation. Extrapolating the theoretical contentions and empirical evidence from these two lines of research may elucidate this matter.

Critical thinking and the self-regulated learner

In the preceding sections of this article, I outlined two major theories in educational psychology: self-regulation and critical thinking. Situating these two theoretical orientations within one framework, my conceptualisation in this article addresses two fundamental issues: (i) that critical thinking, as a cognitive practice, helps in self-regulated learning, and (ii) the subprocesses involved in self-regulation assist in the development of critical thinking skill. The theoretical facets of both frameworks, as indicated previously, suggest that the subprocesses involved in self-regulation and critical thinking coexist in a dynamic system of change. In the advancement of this discussion, I adhere closely to existing literature and contend that both critical thinking and self-regulation, as distinct disciplinary practices, interact intricately to contribute to students' growth and development (Ignatavicius, 2001; Kuiper, 2002; Leung & Kember, 2003; Paris & Newman, 1990; Schunk & Zimmerman, 1994; Vanderstoep et al., 1996; Weinstein & Mayer, 1986; West et al., 2008; Yanchar et al., 2008; Zimmerman, 2002).

Despite the evolving and development of different theoretical paradigms of self-regulation (Pintrich & De Groot, 1990; Pintrich & Zusho, 2002; Puustinen & Pulkkinen, 2001; Vanderstoep et al., 1996; Zimmerman, 1994, 2002), one aspect that is shared amongst researchers concerns the notion that learners use various cognitive strategies (e.g., using rehearsal, elaboration, and organisational strategies) to help them encode, recall, and comprehend classroom material. The use of these cognitive strategies reflects a commitment and a deeper level of cognitive engagement, and in turn results in better academic performance (Bandura, 1997; Paris & Newman, 1990; Schunk & Zimmerman, 1994; Vanderstoep et al., 1996; Weinstein & Mayer, 1986; Zimmerman, 2002; Zimmerman & Martinez-Pons, 1986). Furthermore, high-achieving students are more likely than low achievers to use a variety of cognitive strategies in their learning (Cleary & Zimmerman, 2000; Kitsantas & Zimmerman, 2002; Zimmerman & Martinez-Pons, 1986, 1988).

The various cognitive strategies involved in self-regulation accentuate the role of critical thinking as a subprocess that may enable learners to transform their mental abilities into performance outcome. In a similar vein, the proactive process of self-regulation may enable learners to acquire the academic skill of critical thinking, in this case, as manifested by the ability to interpret, analyse, and evaluate (Ignatavicius, 2001). Drawing from works cited previously, I outline three contentions as to why critical thinking and self-regulatory strategies are interrelated. First, as previous studies (Ignatavicius, 2001; Leung & Kember, 2003; Phan, 2006) have shown, critical thinking is a cognitive skill that enables learners to use deep processing strategies in their learning to dissect and evaluate classroom materials. This

cognitive reflection (Kish et al., 1997), as defined by its characteristics, suggests that it could form part of the cognitive strategies used by self-regulated learners (Pintrich, 1999; Pintrich & Zusho, 2002; Zimmerman, 2002, 2008; Zimmerman & Schunk, 2001). In particular, taking into account the Zimmerman (1994, 2002, 2009) theoretical framework suggests that critical thinking may make its contribution in the self-reflection phase processes. In this analysis, the engagement of critical thinking during a given task may assist learners to handle ambiguity, take responsibility for their actions, and to develop confidence and self-efficacy beliefs when faced with rapid decision making (Kuiper, 2002). The act of critiquing and questioning, and attempting to form one's own alternative or solution may then, in turn, help foster the development of self-judgment and reflection. The development and complexity of critical thinking, in our view, require maturity, practice, nurturing, and effort over time (Ignatavicius, 2001). This long-term and detailed process, once developed, may provide learners with more informational source and wisdom to guide them in their judgment, monitoring, and reaction to imparted knowledge. By the same token, critical thinking also takes part in the cyclic self-regulatory phase that involves the subprocesses of self-efficacy beliefs, outcome expectations, intrinsic interest, and learning goal orientation (Pintrich, 1999, 2000; Pintrich & De Groot, 1990; Zimmerman, 2002, 2008).

In this cyclic process of self-regulation, the skill of critical thinking also situates in the metacognitive process of self-regulated learning. Metacognition, the ability to think about one's own thinking process before, during, and after performing a task (Beitz, 1996; McKeachie, Pintrich, & Lin, 1985), may also be fostered by the engagement in critical thinking (Ignatavicius, 2001; Kuiper, 2002). A number of research studies have been conducted so far in the area of nursing, suggesting the important interplay between metacognitive processes and individual's critical thinking and reflection in practice (Beitz, 1996; Brigham, 1993; Ignatavicius, 2001; Kuiper, 2002). For example, the nurturing of metacognitive skill via means of critical thinking enables nurses to be more autonomous in their practice. In this analysis, critical reflection and interpretation of information in an unbiased manner help learners to be more conscious and knowledgeable of their own cognition (Diekelmann, 1993; Wilson, 1994). Furthermore, critical thinking skills also facilitate the transfer of metacognitive strategies across various situations (Kuiper, 2002). The ability to analyse and critique information at a high-order level provides learners with sophisticated and complex competency to engage in deep learning strategies, expend more effort into their learning, and to be more reflective in their planning and organisation. More research is needed to examine how the process of critical thinking propels individuals toward developing metacognition over time.

Second, based on existing evidence, the disciplinary practice of critical thinking is shaped by deep processing strategies (Phan, 2006), achievement goals (Phan, 2008a, 2009), and personal epistemology (Phan, 2008b). In terms of self-regulation, the key issue is concerned with the strategies that individuals may use to form their skill in critical thinking. The complexity of critical thinking suggests it is a long-term development process that requires practice, nurturing, effort, and reinforcement over time (Ignatavicius, 2001). One strategy that may be used to promote the growth of critical thinking is by means of self-regulation. In the area of nursing, for example, research evidence has shown that

critical thinking skills are embedded within self-regulation strategy use (Kuiper, 2002). Kuiper (2002) found in her study that prompting self-regulation could serve as a pedagogical method to promote critical thinking in diverse clinical areas. According to the author, one self-regulation strategy that may be used includes clinical evaluations; in this approach, newly graduate nurses are asked to reflect and self-evaluate their performance using self-regulated learning prompts. Based on this evidence, it is pertinent that we encourage the use of self-regulation strategies as these strategies may provide the necessary internal support or scaffolding to help learners develop their expertise in critical thinking skills. More research is therefore needed to explore how self-regulation strategies may assist in the acquiring and development of critical thinking in education.

Drawing from existing research studies in critical thinking (Beitz, 1996; Ignatavicius, 2001; Kuiper, 2002; Phan, 2007, 2008a, 2009) and theoretical frameworks and research concerning self-regulation (Boekaerts et al., 2000; Corno, 1989, 1993, 2001; Graham *et al.*, 1998; Ley & Young, 2001; Miller & Brickman, 2004; Pintrich, 2000; Schunk & Zimmerman, 1994, 1998; Zimmerman, 2002; Zimmerman & Schunk, 1998), researchers may wish to explore further the acquisition of critical thinking by means of self-regulation and what can be done to expedite this process. For example, the self-monitoring strategy of metacognitive self-regulation (e.g., assessing comprehension while reading)(Pintrich, 2000; Zimmerman, 1998) may provide a basis for learners to develop the skills of reflection. Likewise, another motivational belief that may be adaptive to critical thinking is self-efficacy. Researchers have shown that adaptive motivational beliefs such as students' judgments of their capability to learn relate positively to cognitive and metacognitive strategies (Hammann, 2005; Pintrich & De Groot, 1990; Schunk, 1991; Zimmerman & Kitsantas, 1999). Research situating academic self-efficacy within the context of reflective thinking has also reported positive effects between students' judgments of their academic capability and the understanding and reflection phases (Phan, 2007). In essence, contextualizing critical thinking within the framework of self-regulation (Pintrich, 2000; Zimmerman, 1998) suggests that self-efficacy, as a subprocess of self-regulation (Pintrich, 1999, 2000; Pintrich & De Groot, 1990; Pintrich & Zusho, 2002; Zimmerman, 2002, 2008), may facilitate the developmental process of critical thinking skills over time.

The conceptualisation of interplay between critical thinking and self-regulation in this article is based on previous theoretical contentions and empirical evidence. In this analysis, based on my examination, I contend that the two theoretical orientations operate in a cyclic pattern. This conceptualisation accentuates the importance of critical thinking, a framework that has been featured strongly in the literature but yet underresearched in the area of educational psychology (Baron, 2000; Kember et al., 2000; Leung & Kember, 2003; Phan, 2007, 2009; Sternberg, 2003; Thayer-Bacon, 2000; Watson & Glaser, 1980; West et al., 2008; Yanchar et al., 2008). Furthermore, the directions and implications recommended in self-regulation research (e.g., Boekaerts, 1999; Kramarski & Michalsky, 2009; Montalvo & Torres, 2004; Pintrich, 1999; Pintrich & Zusho, 2002; Zimmerman, 2008) may benefit from the inclusion of critical thinking. For example, the ongoing reconceptualisation of thematically-related models of self-regulation with the inclusion of critical thinking require further empirical validation and theorisation. There is still a need for more integrative models that can help us understand how critical thinking practice fits in with the learning contexts.

In their discussion of self-regulation, Montalvo and Torres (2004) emphasised a number of current and future directions concerning this topic in educational psychology. I contribute to this discussion on self-regulation with the specific inclusion of critical thinking as another theoretical orientation. The theoretical framework of critical thinking is significant as it helps educators to shape and influence students' motivation for learning. Furthermore, critical thinking may help influence students' self-regulatory processes, but at the same time its growth may be fostered by various self-regulatory strategies. The classroom environment is a salient issue and its structure may in fact promote growth in the developmental process of both critical thinking and self-regulation (Perry, 1998; Stoeger & Zigler, 2007, cited in Zimmerman, 2008; Zimmerman, 2008). It is important that future research studies explore the microanalytical structure and mechanism that define the cyclic interaction between critical thinking and self-regulation. Various methodological approaches and strategies, such as the use of classrooms observations, portfolios, and interviews may illustrate and capture the intimate intricate relationship that connects the two frameworks.

Conclusions

In this article/paper I have discussed two major theories in educational psychology: self-regulation and critical thinking. Research interest in the area of self-regulation has spawned a number of theoretical models to explain how such a theory could explain students' motivation for learning (Corno, 2001; Montalvo & Torres, 2004; Pintrich, 1999; 2000; Wolters & Pintrich, 1998; Zimmerman, 1998, 2002). In contrast to this line of inquiry, moderate efforts have been made in the area of critical thinking and how this theoretical orientation explains students' academic success in educational psychology. Despite its diverse definitions and interpretations, research situating critical thinking in the context of motivation is still in its infancy and requires further development and validation. There is an emerging body of research currently that explores the importance of critical thinking in students' learning (Kember et al., 2000; Leung & Kember, 2003; Mezirow, 1998; Phan, 2007, 2008a). From a practical perspective, critical thinking assists individuals to think critically about their own learning and professional development.

The discussion in this article has provided a theoretically grounded conceptualisation of critical thinking and self-regulation in the context of teaching and learning. Based on previous research evidence and theoretical contentions, I integrated these two lines of theorising and research by suggesting that: (i) critical thinking acts as another cognitive strategy of self-regulation that learners use in their learning, and (ii) critical thinking may be a product of various antecedents such as different self-regulatory strategies.

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