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Teachers' metacognitive awareness and metacognitive instructional practice: A mixed method study in Egypt

perihan magdi

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INSTITUTIONAL REVIEW BOARD

To: Perihan Magdi

Cc: Dena Riad

From: Atta Gebril, Chair of the IRB

Date: Feb 6, 2019

Re: Approval of study

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Thank you and good luck.

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Teachers' metacognitive awareness and metacognitive instructional practices: A mixed method study in Egypt

A Thesis Submitted by

Perihan Sayed Magdi Alhefnawy

Submitted to the Department of International & Comparative Education

In partial fulfillment of the requirements for
The degree of Master of Arts
in International and Comparative Education
has been approved by

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Teachers' Metacognitive Awareness and Metacognitive Instructional Practice: A Mixed

Method Study in Egypt

A Thesis Submitted to

The Department of International and Comparative Education

in partial fulfillment of the requirements for the degree of Master of Arts

By Perihan Magdi Alhefnawy

Under the Supervision of Dr. Mustafa Toprak

January 2020

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Chapter 1: Introduction

1.1. Background and Significance

        1.1.1. 21st century skills and learning to learn.

The field of educational psychology has been experiencing a change in the way it views cognition and learning since 1960s (Schunk, 2008). This change has been described as a "cognitive revolution" that moves away from behaviorist conceptions of conditioning and moves towards viewing learners as "active constructors rather than passive recipients of knowledge" (Brown, 1994, p. 6). The "cognitive revolution" has been transmitted to the classroom and schools, who must cope with the new change that focuses on "the process rather than the product of learning" (Schraw & Moshman, 1995, p. 368). In response, a paradigm shift was originated in the 1980s by researchers who started replacing the outcome-based model with learning acquisition models that have new approaches that are all centered in one principle: learning to learn (Boekaerts, 2002).

        "Learning to learn" gained a recent global momentum not only among educational psychologists but also among policy makers. For example, an initiative has been undertaken by three of the world's biggest technology companies (Microsoft, Intel, and Cisco), educators in developed countries as well as international organizations including the World Bank, UNESCO, OECD and IEA, in which they attempted to define the skills needed for the 21st century workforce (Griffin, Care, & McGaw, 2012). Learning to learn was placed as a central skill among the 21st century skills (Binkley, 2012). In response, education reform initiatives took place in several nations with the concept of learning to learn as a main focus in each initiative (Adamson & Darling-Hammond, 2015). The European Union, for instance, considered "learning to learn" as one of the key competencies for lifelong learning. The EU's definition of "learning to learn" is: "the ability to pursue and persist in learning, to organize one's own learning, including through effective management of time and information, both individually and in groups" (European Commission, 2006, p. 8). Such global interest is mainly because of the great value of "learning to learn" in students' learning and its relevance in this rapidly changing world.

        Before discussing the value of learning to learn, it is worth highlighting these interchangeably used terms; learn to learn, metacognition (MC) and self-regulated learning (SRL). In some cases, SRL and learn to learn are viewed as synonyms (Thoutenhoofd & Pirrie, 2015). "Learn to learn" is considered a more familiar term to practitioners. However, some

researchers use the term SRL instead (Dignath-van Ewijk & van der Werf, 2012) while others view MC as the equivalent term to "learning to learn" (Adamson & Darling-Hammond, 2015; Binkley, 2012; Brown, 1994). Other scholars find SRL and MC as two terms that are used reciprocally (Dinsmore, Alexander & Loughlin, 2008; Veenman, 2011). This surely causes confusion in the field. The conceptual differences and overlap between the two constructs MC and SRL are discussed in Chapter 2.

   1.1.2. The educational value of MC and SRL in learning. Boekaerts and Cascallar (2006) described SRL as "a key construct in the field of education" (p. 199) for the important role it plays in academic achievement and learning. A study by Zimmerman and Martinez-Pons (1986) revealed that SRL is the best predictor of standardized test achievement compared to gender and socioeconomic level. Zimmerman (2013), in a paper discussing his long journey in the field of SRL, concluded that research showed how students who regulate their learning reach a level of mastery faster than students who do not, and show more motivation to sustain their effort to learn. He also found that SRL is needed not only for academic achievement but also for lifelong learning including learning new skills after graduation for new jobs, promotion or in self-employment. SRL is needed even for self-entertainment activities including hobbies, sports and viewing their future in an optimistic way (Zimmerman, 2002).

   In a similar vein, Flavell's (1979) early belief of the emerging field of MC at his time as an "interesting and promising" (p. 906) field of investigation turned out to be true. He argued for the role of MC in all areas of learning and development. Later on, Wang, Haertel and Walberg (1990), in their intensive meta-review of what influences learning, concluded that MC is the most important predictor in learning. This can be justified due to its indispensable role in everyday reasoning, social interactions and scientific thinking (Schneider, 2008). MC is viewed as the bridge between cognitive psychology and educational practice (Kuhn & Dean, 2004) and even as the bridge between other various areas "between decision making and memory, between learning and motivation, and between learning and cognitive development" (Nelson & Narens, 1994, p. 1).

   MC is linked to other 21st century skills including problem solving, critical and scientific thinking as well as decision making. Several metacognitive activities apply to critical thinking (Martinez, 2006) and are essential components in problem solving (Mayer, 1998). The development of MC is believed to set the foundations for all higher order thinking such as the

awareness of sources of knowledge that is vital to understanding evidence and theory building that is considered as the core of scientific thinking (Kuhn, 2000a, b). Markedly, MC is considered as an essential component in problem solving (Mayer, 1998) in which the meta-level of operations (MC) is what determines the continuity of the use of skills even after withdrawal of instruction in other situations. This meta-level of operations is strongly connected to critical thinking, argument, and inquiry skills (Kuhn & Dean, 2004).

Empirical evidence supports such notions starting from preschool children to college students. In her review of literature, Brown (1978) shows how metacognitive activities are strongly related to effective problem solving in various situations including experimental, educational and natural settings. For young children, a longitudinal study of 43 children from pre-K to second grade reveals that children with high metacognitive knowledge show high metacognitive skills in problem solving tasks and self-guided behavior during the first two school years compared to children with low metacognitive knowledge who show more adult dependent behavior until second grade (Annevirta & Vauras, 2006). For older children, Swanson (1990) finds that sixth graders with high metacognitive knowledge outperform those with low metacognitive knowledge in problem solving regardless of their aptitude. For adults, a study on 98 university students classifying them into three decision making levels shows a relationship between MC and decision making (Batha & Carroll, 2007). Another study that examines the role of metacognitive strategies in critical thinking using think aloud protocols with ten university students of similar cognitive ability and academic achievement, but different critical thinking performance, reveals that good critical thinkers use high levels of metacognitive activity to resolve confusion and to better their performance (Ku & Ho, 2010). Similarly, Magno (2010) finds a relation between MC and critical thinking in 240 college students.

Furthermore, MC plays a vital role in facilitating learning for novice learners that is found to be even more important than intellectual ability. MC developed by older students is used in new areas of learning (Schraw, 1998a), leading to a transfer of learning in which students who lack expertise in certain areas tend to use general strategies instead of relying on their prior knowledge (Pintrich, 2002), enabling them to cope with new and unfamiliar tasks (Veenman, 2008). This notion is supported by empirical evidence (e.g: Veenman, Elshout & Meijer,1997; Veenman & Beishuizen, 2004). In addition, metacognitive skillfulness is empirically found to be a better predictor of learning than intellectual ability. An analysis of 11 previously conducted

studies comparing metacognitive skillfulness and intellectual abilities in learning performance of different students of different ages reveals that MC accounts for 18% of the variance of learning performance while intellectual ability accounts for 10% of variance (Veenman, 2008). These findings can be promising for students with lower intellectual abilities, as MC can compensate for their lower cognitive capacity (Schraw, 1998a; Veenman et al., 2006).

Such evidence places a new role for schools and teachers in particular. For example, Flavell (1987) urged schools to be "hotbeds of metacognitive development" (p. 27) through offering children opportunities to monitor and regulate their cognition, that can be achieved through conscious and unconscious modeling of metacognitive activities. Such a paradigm shift places a new responsibility on teachers and their ability to create an effective learning environment. The promotion of MC as well as the explicit and implicit modeling of MC for students are pivotal in this process.

1.2. Statement of the problem

In response to these new roles of both schools and teachers, a corresponding movement by teacher educators and researchers (e.g: Darling-Hammond & Bransford, 2007) shows an interest in discussing issues about teacher preparation and skills needed by teachers to enable them to apply concepts and teaching approaches they have not experienced or even mastered as learners at schools or college. Such an issue is found to be of a great value since research reveals a gap between theory and practice. For instance, international reports of PISA state that the majority of students in most of the member countries do not have the competency for SRL (Artlet, Baumert, Julius-McElvany & Peschar, 2003). Research also shows that teachers rarely give instructions that promote MC or SRL (Dignath & Büttner, 2018; Moely et al., 1992; Pressley, Wharton-McDonald, Mistretta-Hampston & Echevarria, 1998; Zimmerman, 2002). In addition, research in some developed countries reveals that teachers know very little about metacognitive strategies (Dignath & Büttner, 2018; Kerndl & Aberšek, 2012Leat & Lin 2003; Ozturk, 2016; Pressley et al., 1998; Veenman et al., 2006; Wilson & Bai, 2010).

There is a dawning interest in investigating teachers' regulatory and metacognitive capacities. In fact, various scholars (Dembo, 2001; Duffy, 2005; Delfino, Dettori & Persico, 2010; Duffy, Miller, Parson, & Meloth, 2009; Hartman, 2001; Lin, Schwartz & Hatano, 2005; Peeters et al., 2014; Van Eekelen, Boshuizen & Vermunt, 2005; William & Atkins, 2009) claim

that teachers need to be metacognitive themselves to be able to transfer MC to their teaching and students as well as using metacognition for facilitating their jobs in effective scaffolding and instructional adaptations. For this reason, Williams and Atkins (2009) argue that developing teachers' cognitive and metacognitive capacities is a prerequisite for effective implementation of MC strategies inside the classroom, stating that "it is even more important for teachers to be metacognitive than it is for their students" (p. 40). Literature suggests that developing teachers' MC is important for teachers' own learning and professional growth; making teachers' job easier; promoting teachers' adaptation and adjustment of instructions to students' needs which provides an overall better quality of classroom instructions; and more effective promotion of MC inside the classroom (as discussed in Chapter 2).

Despite this interest, very little is known about teachers' MC; research on MC in teachers is scarce (Wilson & Bai, 2010), with various methodological concerns about the few existing studies. Investigating MC and SRL in real life situations and classroom settings are more recommended for ecological validity compared to the more common lab studies (Brown, 1978; Perry, 2002; Perry, VandeKamp, Mercer, & Nordby, 2002; William &Atikins, 2009). In fact, studies that investigated teachers' MC used offline measures for assessing MC including self-reports recommended studying teachers' MC and SRL and their promotion in actual classroom setting (Ozturk, 2017b; Van Eeklen et al, 2005; Wilson & Bai, 2010).

In addition, there is a lack of theoretical foundations for investigating actual teachers' thinking and MC in the actual classroom. Although research suggests that expert and effective teachers are metacognitive, there is no empirical evidence to support this (Duffy et al.,2009).In fact, there is no common theoretical umbrella for investigating teachers' thinking and MC. MC is studied under a variety of names including adaptive teaching (Parsons, 2012), scaffolding (Hartman, 2001), reflective practice (Parsons & Stephenson, 2005). As Corno (2008) argued: "if teachers need to know more about theories of adaptive teaching, then researchers need to know more about the actual practice of adaptive teaching" (p. 161). The lack of theoretical framework as well as evidence from actual classroom settings of what metacognitive teaching is, raises the need for investigating teachers' metacognitive instructional practices inside the classrooms. Referring to the Egyptian context, no previous research has assessed the level of teacher's MC and its use in their instructional practices at Egyptian schools. In fact, we know nothing about

such vital skill for teachers in the Egyptian context that makes investigation of such a topic essential.

1.3. Purpose of the study

This study aims to adapt the existing Metacognitive Awareness Inventory (MAI) (Schraw & Dennison, 1998) into Arabic and test the psychometric properties of the adapted version. It also aims to investigate Egyptian teachers' MC levels through multiple measures and to explore teachers' metacognitive instructional practices inside an actual classroom setting.

1.4. Research Questions

1. What are the psychometric properties of an Arabic version of the Metacognitive Awareness Inventory (MAI)?
2. What is the metacognitive awareness level of Egyptian teachers?
3. Are there significant differences in Egyptian teachers' metacognitive awareness based on their years of experience, gender, grade level, subject taught and type of school (private versus public)?
4. What are the various metacognitive skills that teachers use in their instructional practices?

Chapter 2: Review of literature

Chapter 2 includes a review of literature on the conceptual and methodological overlapping between MC and SRL. It refers to definitions of the construct of MC, discussions about the various components of MC and concepts, constructs and issues related to MC. Discussions about validity issues of the several methods of assessing MC are also included. In addition, Chapter 2 refers to the interpreted reasons for the gap between research-based theories and practice, with an argument for the value of promoting teachers' own metacognitive capacities. The chapter ends with the operational definitions of the main constructs to be assessed.

As stated in Chapter 1, there is some confusion in the literature between the two constructs of SRL and MC where they are used interchangeably. Therefore, the following section is devoted to identifying the conceptual and historical origins and overlap, similarities and differences between the two constructs while justifying the reason for choosing teachers' MC as the focus of my study.

2.1. Conceptual differences and similarities between metacognition (MC) and self-regulated learning (SRL)

Researchers in the field of metacognition (MC), self-regulation (SR) and self-regulated learning (SRL) have expressed serious confusion among these constructs, with many questions about the differences and similarities among them. Such confusion is emphasized by Dinsmore, Alexander and Loughlin (2008), which motivated them to pursue an intensive literature review in which they analyzed 255 studies on SR, MC and SRL. In their rationale, they stated their "concomitant inability to articulate sufficiently the conceptual boundaries between these three often entangled bodies of literature. In effect, the more we read, the more researchers' language left us confused" (p. 392). These conceptual considerations grabbed the attention of other educational psychologists (e.g: Alexander, 2008; Azevedo, 2009; Fox & Riconscente 2008; Lajoie, 2008; and Schunk, 2008). Some of these scholars find such confusion to be normal in the field of education where most of the central constructs in the field are not clearly defined, as the more popular a construct becomes, the more conceptually complex it gets (Alexander, 2008). On the other hand, recommendations have been provided for researchers in the field, including a clear definition identifying relevant theories and ensuring that assessments clearly reflect the

processes (Schunk, 2008). A further exploration of the theoretical and historical roots of the three constructs may clarify and disentangle the differences between the constructs.

   2.1.1. Historical and Theoretical roots of the constructs. MC and SR both emerged at the same time (1970s), introduced by two different scholars from different theoretical backgrounds Zimmerman (2002), Flavell (1976) and Bandura (2001). John Flavell (1976) was the first to lay the foundation for the field of MC through his work on metamemory. The construct was then developed by the work of Baker and Brown (1984) who were the first to introduce the self-regulatory part of MC (Dinsmore et al., 2008; Pintrich, Wolters & Baxter, 2000; Veenman, 2011; Veenman, 2015a) through dividing the construct into knowledge of cognition and regulation of cognition. The construct was then expanded by Nelson and Narens (1994) who differentiated between the monitoring and control-- processes of the regulatory mechanisms (Dinsmore et al., 2008).

   SR stemmed from the work of Albert Bandura who focused on the interaction between human, environment and behavior that is known as reciprocal determinism (Lajoie, 2008). Bandura's (2001) social cognitive theory enhanced the role of motivation in self-regulation through his research on self-efficacy (Dinsmore et al., 2008; Lajoie, 2008). It was also clear in literature that the contemporary research on MC influenced by Flavell or Brown was an extension of Piaget's original theory that reflected its cognitive focus (Dinsmore et al., 2008; Fox & Riconscente 2008; Schunk, 2008), whilst Bandura's SR was rooted in neo-behaviorism with more empiricist frameworks (Dinsmore et al., 2008).

   SRL was later introduced in the mid-1980s through the work of Zimmerman who used Bandura's theory in the field of learning and education (Pintrich et al., 2000; Thoutenhoofd & Pirrie, 2015; Zimmerman, 2013). An important distinction between SR and MC on one side and SRL on the other side is the former's focus on regulation of behavior, emotions and/or cognition in its broader sense and the latter's focus on students' own regulation of their academic learning (Dinsmore et al., 2008; Fox & Riconscente 2008; Lajoie, 2008). A major issue about SRL is that it developed later on to include other views and models from different theoretical backgrounds. For this reason, SRL and SR show greater theoretical diversity compared to MC (Dinsmore et al., 2008).

   Dinsmore et al. (2008) explain the difference between MC, SR and SRL, when they note that all lie under the big umbrella of constructivism, relating to Moshman's (1982)

classification of endogenous, exogenous and dialectical constructivism. According to Moshman (1982), endogenous constructivism focuses on the internalized construction of knowledge including several cognitive processes; reflection, the role of prior knowledge and abstraction. This paradigm is particularly reflective of Piaget's work, which explains why Dinsmore et al. (2008) include MC under this category. On the other hand, exogenous constructivism highlights the reciprocal interaction between the child and his/her environment. In other words, exogenous constructivism is rooted in mechanisms where internalization is an adaptation process of the input compared to the prior knowledge (Harris & Graham, 1994; Moshman, 1982). Therefore, Dinsmore and colleagues categorize SR under exogenous constructivism. Dialectical constructivism stands somewhere in between, as it encompasses both paradigms. Fosnot and Perry (2005) consider it as the interplay between cognitive and social constructivism. Knowledge construction is seen as the complex reciprocity between the dynamically changing individual and world (Harris & Graham, 1994). Moshman (1982) explains that dialectical constructivism is rooted in contextualism with a great emphasis on interactionism. For this reason, Dinsmore et al. (2008) labeled SRL as dialectical constructivism.

   2.1.2. A comparison between MC and SRL. While comparing the three constructs, SR can be easily excluded, as the main focus of the study is teacher's self-regulatory capacity in the educational field which is more relevant to SRL. Thus, the focus is to compare the differences and connections between the other two constructs; MC and SRL. The majority of scholars view MC as a subordinate of SRL.As Dinsmore et al. (2008) note, SRL follows an integrative path that merges cognitive, metacognitive, motivational and contextual factors.

   Despite the social cognitive roots of SRL, various proposed models from other theoretical backgrounds have emerged (Azevedo, 2009). Scholars in the field of SRL agree that the field is still on its midway identifying the processes of SRL (Boekaerts, 1999). From a social cognitive view, SRL is the personal beliefs, competencies, behaviors in addition to the dynamic interaction of the environment in which a learner is able to metacognitively, motivationally and behaviorally actively participate in his/her own learning (Zimmerman, 2013). Pintrich et al.'s (2000) view of SRL includes monitoring, control and regulation of cognition and other factors that impact learning including motivation, self- system and effort. Boekaerts (1999) views SRL as a process, rather than an event, including cognitive, metacognitive and affective processes while Winne and Hadwin's (1998) information processing view of the components of SRL as

MC, intrinsic motivation and strategic action with a great emphasis on metacognitive monitoring and control.

All frameworks agree on the complexity of SRL as a construct regardless of the theoretical background of their frameworks. A study made by Zimmerman and Martinez-Pons (1990) on 45 gifted middle class students from different ethnicities in the US in grades 5, 8 and 11 shows that students' beliefs of verbal and mathematical efficacy are strongly related to the use of self-regulated strategies. This gives a justification for Zimmerman's triadic view of SRL and his strong emphasis on self-efficacy as an important factor in SRL (Zimmerman 1995, 2002, 2013). Pintrich et al. (2000) highlight the influence of regulation and control of emotions in addition to motivational beliefs on performance, learning, and cognition. In addition, Boekaerts (2002) argues for broadening the conceptualization of learning and suggests an integrated model to explore the complex phenomenon of SRL.Even in information processing models, there is still a high emphasis on the complexity of learning. The proposed model by Pressley, Borkwski and Schneider (1989) of the characteristics of good information processors does not only include cognitive and metacognitive capabilities but also motivational beliefs, self-efficacy, low anxiety as well as aspirations and beliefs to become better information processors. The same idea is emphasized in Vygotsky's view of sociocultural learning, as he did not view cognitive and affective domains as separate but rather interdependent (Manning & Payne,1993).

Despite the complexity of learning that is strongly reflected in SRL as a construct, the wide scope of SRL has its own shortcomings in research contexts, as the broader the scope, the broader the measurement of the construct is. For example, Dinsmore et al. (2008) criticize the broad use of self-reports to assess SRL, in that they did not uncover the complexity that SRL was supposed to reflect in the first place. For this reason, I believe in focusing individual research studies on subcomponents of SRL which have a separate purpose. For example several studies done by Zimmerman and other colleagues focused on self-efficacy as a sub-component of SRL and its impact on learning and achievement (Pajares, 1996; Schunk, 1991; Zimmerman, Bandura & Martinez-Pons,1992; Zimmerman, 2000). These studies had a narrow focus and offered great insights to the field. Similar studies should separately focus on MC as a subcomponent of SRL.

2.1.3. MC as the key component of SRL. Based on the previous arguments and discussions, my study views SRL as the "more global and inclusive construct" (Pintrich et al., 2000. P. 45), with a special focus on MC as a key subcomponent of SRL. There is an interaction

between MC and SR in controlling, monitoring and regulating various strategies to perform a task (Tarricone, 2011). In the end, both constructs are concerned with monitoring and control; the main difference is what is monitored and controlled (Dinsmore et al., 2008). My main focus is the monitoring and control of cognition which refers to MC. I will make use of literature from both constructs while I will be using the concept of SRL in the meaning of metacognitive aspect of SRL.

I choose Boekaerts's (1999) model of SRL components as cognitive, metacognitive and affective processes, as an example to clarify the reason behind focusing on MC rather than any other components. First, while comparing between motivation and MC, the motivational and affective roles in influencing learning is undeniable for sure. However, motivation influences the process whilst MC is the process itself. For this reason, Pintrich et al. (2000), while referring to the components of SRL and MC, stated that although SRL includes the control and regulation of aspects like motivation, effort, goals and self-system, regulation and control of cognition is more prominently studied in research compared to these aspects of SRL. Second, while comparing between MC and cognition, scholars view MC at a level above cognition (Nelson &Narens, 1994; Schraw, 1998b; Veenman, 2011). The supervisory role played by MC is elaborated as a metaphor of MC as the driver and cognition as the vehicle (Veenman, 2011).

Several SRL scholars highlighted the special role MC plays in SRL. While explaining Winne and Hadwin's (1998) information processing model, Winne and Perry (2005) argued for the centrality of metacognitive monitoring and control in SRL. In the same vein, Schraw, Crippen and Hartley (2006) argued for the special role of MC as a subcomponent of SRL stating that:

> Each of these components is necessary, but not sufficient, for skilled science learning. We believe that the role of metacognition is especially important because it enables individuals to monitor their current knowledge and skill levels, plan and allocate limited learning resources with optimal efficiency, and evaluate their current learning state. A number of researchers have argued that cognitive strategies and high motivation alone are insufficient for skilled self-regulation. (p. 116)

An additional finding that may support this focus on MC as a subcomponent of SRL is that teachers are found to be more resistant to implementing metacognitive instructions compared to motivational and cognitive strategies (Dignath & Büttner, 2018). Given all these previous points,

the reasons behind choosing MC as the main construct for my study become clear with the use of literature from both fields in my study.

 The next section focuses on reviewing the various definitions of MC and its components in the literature with a further elaboration on the relationship between cognition and MC.

2.2. MC and its components

2.2.1. Defining MC. There are various definitions for MC that complement rather that contradict each other. The diverse definitions are all centered in learner's ability to "reflect upon, understand and control one's own learning" (Schraw & Dennison, 1994, p. 460) The earliest definition of MC is rooted in Flavell's work on metamemory (Brown, 1987) where MC is defined as one's knowledge about one's own cognitive processes and products related to them in addition to "the active monitoring and consequent regulation and orchestrating of these processes in relation to the cognitive objects or data on which they bear, usually in the service of some concrete goal or objective" (Flavell, 1976, p. 232). MC is also defined as "decision-making processes that regulate the selection and the use of various forms of knowledge" (Zimmerman, 1989, p. 329). This may explain the reasons for studying metacognitive functions under the umbrella of executive control (Brown, 1978, 1987; Kuhn & Dean, 2004). MC also includes learners' awareness of their own strengths, weaknesses and resources needed to meet the demand of a particular task in addition to knowledge and skills needed for regulating engagement in tasks to optimize learning (Winne & Perry, 2005).

 The term "meta" is a Greek word that means after or beyond (Tarricone, 2011). When the term "meta" accompanies whatever term, it generally refers to "whatever about whatever" (Nelson, 1996, p. 105). This reflects why MC is perceived as an "epiphenomenon" (Brown, 1978, 1987). It also makes sense that the most common definitions for MC are cognition about one's own cognition (Flavell, 1979) or thinking about thinking (Kuhn & Dean, 2004). The second part of the term MC refers to "cognition" that shows that MC is mainly concerned with "one's knowledge and control of own cognitive system" (Brown, 1987, p. 66). It is viewed as the cognition that regulates, monitors and reflects on higher order cognitive processes (Kuhn, 2000a). It is considered as "a higher-order agent overlooking and governing the cognitive system, while simultaneously being part of it" (Veenman et al., 2006, p. 5).

 Brown's (1987) description of the construct of MC as, "fashionable but complex, and often poorly understood"(p. 65), seems to be true till now. In fact, MC has been described for

decades as a "perplexing, mystifying and complex construct" (Tarricone, 2011, p. 3). This is not because of the underdevelopment of the theory of MC, but rather in the multifacetedness, complexity and absence of clear common definition for MC (Tarricone, 2011). Despite the great similarities in defining MC, there are considerable discussions in the literature about defining the exact components and the nature of these components of MC (e.g: Pintrich et al, 2000; Schraw, 2000; Schraw & Moshman, 1995; Veenman et al., 2006). Flavell's (1979) classical classification divides the phenomenon of MC into four main components: (a) metacognitive knowledge, (b) metacognitive experiences, (c) goals (or tasks), and (d) actions (or strategies).

       2.2.2. Components of MC. There are several models for MC but there is an agreement that main distinction is between knowledge of cognition and regulation of cognition (Baker & Brown, 1984; Brown 1987; Pintrich et al., 2000; Pintrich, 2002; Schraw 1998a, b; Schraw & Dennison, 1994; Schraw & Moshman, 1995; Veenman et al., 2006). Regulation of cognition is described in terms of "executive control" and "executive functioning" (Brown, 1978, 1987; Tarricone, 2011). Knowledge of cognition is referred to as metacognitive knowledge (MK) and regulation of cognition is referred to as metacognitive skills (MS) (Tarricone, 2011; Veenman et al., 2006; Veenman, 2011). MS and MK are the terms to be used in this study. These two components are closely related (Brown, 1987; Schraw & Dennison, 1994; Schraw & Moshman, 1995; Schraw, 1998a, b) whereas any attempt to separate these components leads to oversimplification (Brown, 1987) despite its necessity for purposes of clarity and research (Tarricone, 2011). Despite this consensus, there is still a disagreement the nature of each component (Veenman et al., 2006) with a variety of proposed models on and confusion about some subcomponents.

       The following section will review the definitions and components of the two main facets of MK and MS. The section includes the various discourses about each facet and the value of each facet in influencing the regulatory process of MC. The section will also refer to the regulatory process using Nelson and Naren's (1994) model as the core of MC.

       2.2.2.1. Metacognitive knowledge (MK). Metacognitive knowledge (MK) is the knowledge or beliefs about any variables that affect the outcome of a cognitive enterprise (Flavell, 1979). It refers to "the part of one's acquired world knowledge that has to do with cognitive matters" (Flavell, 1987, p. 21). MK includes both the general knowledge about

cognition in addition to knowledge about one's own cognition (Pintrich, 2002). Some models label metacognitive knowledge as metacognitive awareness. However, the term awareness reflects an "online" or "at the moment" experience that contradicts with the "static" nature of metacognitive knowledge (Pintrich et al., 2000).

There are various classifications of MK. A group of scholars classify MK into the declarative, procedural and conditional knowledge about self and strategies (Pintrich et al., 2000; Schraw, 1998a, b; Schraw & Moshman, 1995; Schraw, Crippen, & Hartley, 2006; Tarricone, 2011). Another group viewed MK as classified into three interrelated and interacting categories: person, task and strategies (Flavell, 1979, 1987; Pintrich, 2002; Pintrich et al., 2000; Efklides, 2001, 2008). In fact, declarative knowledge may be seen as equal to self-knowledge, procedural knowledge to strategic knowledge, and task knowledge to conditional knowledge (figure 1). Knowledge about strategy and task are the most common forms of knowledge referred to in MK (Pintrich et al., 2000).

Metacognitive Knowledge (MK)

Self-knowledge
Beliefs about:
1) Intra-individual differences
2) Inter-individual differences
3) Universals of cognition

Strategic knowledge
General strategies of learning
(What and how)

Task knowledge
-Task information
-Task demands
(When and why)
considers the contextual, cultural and situational factors
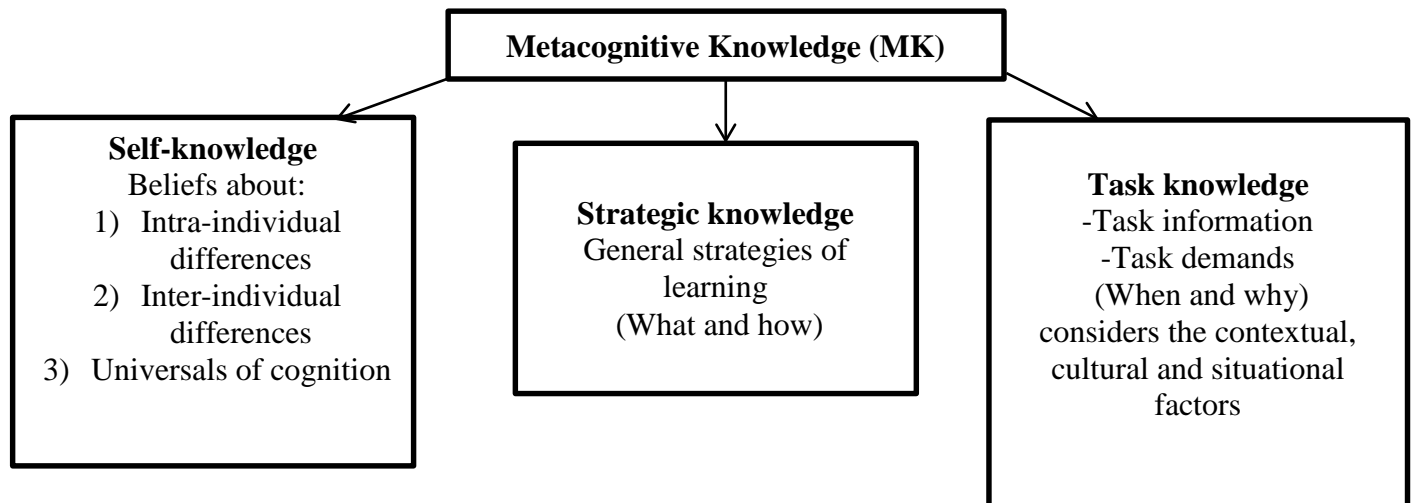
Figure 1. The three subcomponents of MK

Self (declarative) knowledge. It is the acquired knowledge and beliefs about a person's own or other's cognitive process. This knowledge is categorized into beliefs about intra-individual, inter-individual differences and universals of cognition (Flavell, 1979, 1987; Tarricone, 2011). Intra-individual knowledge is the knowledge and beliefs about one's own intra-individual variations as a learner (Flavell, 1987; Tarricone, 2011), including knowledge about one's own strengths and weaknesses (Pintrich et al., 2000). Inter-individual knowledge is the

knowledge about others' abilities of learning compared to self (Flavell, 1987; Pintrich et al., 2000; Tarricone, 2011), while universals of cognition are the acquired ideas about the universal forms of how human's mind work (Flavell, 1987). They are the knowledge of the general standards for cognition, including intuitions, misunderstandings, perceptions and impressions of general abilities, properties and processes of learning (Tarricone, 2011), like the need for a person to pay attention to the task to be able to learn (Pintrich et al., 2000).

This form of cognition is highly related to culture and childhood development and experiences (Flavell, 1987). Self-knowledge is important for knowledge and beliefs about an individual's own motivations (Tarricone, 2011). Tacit beliefs about self and others play a vital role in cognitive enterprises (Flavell, 1979). Self-knowledge can be correct or incorrect and this type of knowledge can be very resistant to change (Veenman et al., 2006). Pintrich (2002) highlighted the value of the accuracy of self-knowledge, as inflated or underestimated self-knowledge has a negative impact on learning.

Self-knowledge includes knowledge about one's own strengths and weaknesses in addition to various components of the self-system and motivational beliefs including self-esteem, self-appraisal, attributional beliefs, beliefs about their capability of achieving tasks (self-efficacy), the goals behind performing a task, interests in performing a specific task (Pintrich, 2002; Tarricone, 2011). Pintrich el al. (2000) consider all the subcomponents of self-knowledge as motivational except for the universals of cognition. As stated earlier, these motivational aspects, although highly related, are studied under the big umbrella of SRL. For this reason, the focus here is about one's own cognition rather than motivational aspects. At the same time, some aspects of intra-individual knowledge, including one's own knowledge of cognitive strengths and weaknesses, is still necessary while investigating MC.

Strategic (procedural) knowledge. This subcategory is concerned with the various strategies that can be used to achieve specific goals (Flavell, 1979), including all general strategies for learning, thinking and problem solving (Pintrich 2002). It refers to the knowledge about what and how strategies can be used rather than the actual use of strategies (Pintrich, 2002), as the actual use of a strategy is to be categorized under MS.

Task (conditional) knowledge. Task knowledge considers the influence of task variations on cognition (Pintrich et al., 2000). The main aim of this category of MK is what understanding the task implies for managing it (Flavell, 1979). Task knowledge is divided to two

subcategories: task information and task demands (Flavell, 1979). Task information is the available information about the task whilst the task demands include the awareness, knowledge and understanding of the characteristics of the task that enable the learner to manage the progress or the failure of the task (Tarricone, 2011). Task knowledge requires understanding the difficulty level of cognitive tasks that require the use of different cognitive strategies which develops through experience (Flavell, 1979). Knowledge about the effectiveness of strategies is constructed through experiences during the interaction of person with previous tasks in which reflection on previous experiences plays a key role in enabling the awareness of complexity of the task, learner's limitations and strategies and processes needed for meeting the task demands (Tarricone, 2011).

An important aspect of task knowledge is knowledge of when and why a strategy is used. This is referred to as conditional knowledge. Conditional knowledge is knowing when and why (Schraw, 1998a; Tarricone, 2011) and where (Tarricone, 2011) to use the declarative and procedural knowledge, specially the strategy knowledge (Schraw, 1998a; Tarricone, 2011). Conditional knowledge considers the contextual, cultural and situational factors for using certain strategies (Pintrich, 2002), enabling the adaptive usage of various strategies (Pintrich et al., 2000; Pintrich, 2002). Individuals with high conditional knowledge assess the demands of the task effectively and, in response, select the best strategy for the situation (Schraw et al., 2006). However, insufficient domain knowledge, lack of awareness of task demands and weak monitoring are factors that lead to the inhibition of conditional knowledge (Tarricone, 2011).

MK has three main characteristics that differentiate them from MS. First, MK is often "statable" that means that it can be easily brought to the conscious level, unlike MS (Baker & Brown, 1984; Brown, 1987). Second, other important characteristic of MK is that it can often be "fallible". Adults can know and state many facts about cognition that are not true (Brown, 1987). MK has different levels of clarity, complexity, accuracy and consistency (Tarricone, 2011). Third, there is agreement among several scholars that MK is static and stable compared to the "online" and dynamic nature of MS (Baker & Brown, 1984; Brown, 1987; Efklides, 2008; Pintrich et al., 2000).

MK has a great value in learning. MK also influences the selection of cognitive strategies depending on the self and task knowledge. MK creates a framework for a learner to

understand his/her as well as others' cognition that guides the interpretation and control decisions taken in a specific situation (Efklides, 2006). Furthermore, knowledge of strategies is the initial stage to using them in which students with no knowledge about strategies will not able to use them. Knowledge about strategies and tasks are vital for transfer of learning in other situations. In addition, accurate knowledge about one's own strengths and weaknesses enhances cognitive adjustments and adaptation to various tasks (Pintrich, 2002). Schraw & Moshman (1995) referred to several studies that reveal that good learners have greater MK than poor learners and that this knowledge leads to better performance.

        2.2.2.2. The regulatory process of MC. It is important to shed light on the dual regulatory process of metacognitive monitoring and regulation. Understanding this process enables identification of the roles of the subcomponents of MS. Therefore, the next section discusses Nelson and Narens' (1994) model that represents the relation between cognition and MC in addition to the regulatory processes of monitoring and control.
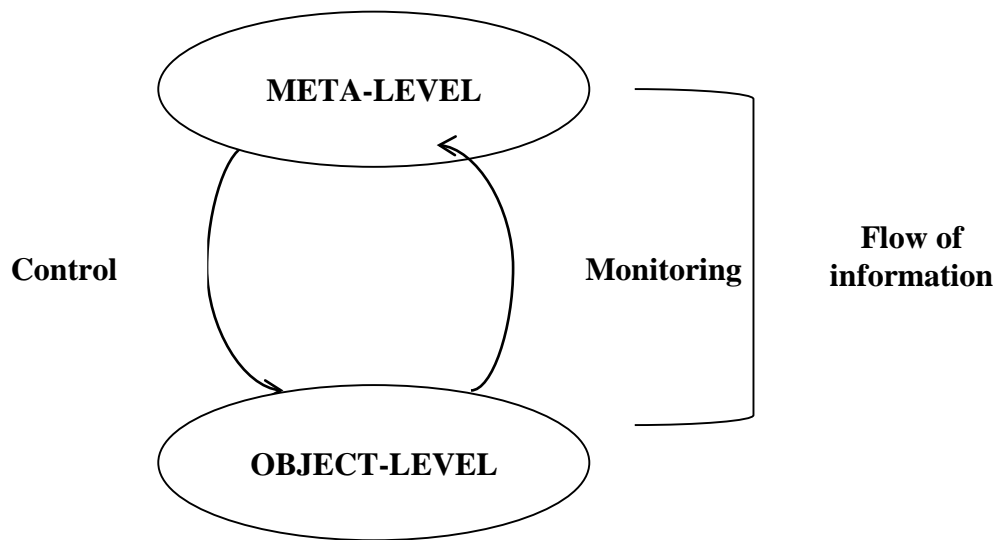
Figure 2. The hierarchical relationship and flow of information between meta-level and object level Reprinted from *Metacognition: Knowing about knowing* (p. 11), by J. Metcalfe and A. Shimamura, 1994, Cambridge, MA: Bradford Books. Copyright 1994 by Bradford Books. (Nelson & Narens, 1994, p. 11)

        The relationship between cognition and MC and metacognitive monitoring and control. Nelson and Narens (1994) create a hierarchical model clarifying the relationship between MC and cognition (see Figure 2). They classify the metacognitive system as two interrelated levels: object and meta-level. The meta-level is at higher level modifying the object level. The *execution*

processes take place at the object level, which includes the lower order cognitive activities, whilst the *executive* processes takes place at the meta-level that is at a higher order governing the object level. In fact, the model of meta-level contains two components: goals and strategies for how the object level can achieve these goals (Nelson, 1996).

The flow of information, from or to these levels, is called "monitoring" and "control" processes. Monitoring is gathering information about the state of the object level to the meta-level, a process that is described as providing "data driven feedback" (Schraw 1998b, p. 53). The control process is the flow of information from the meta-level to object level. The control process informs the object level of the next steps to be done, modifying the object level either by changing the state of the process or changing the whole process (Nelson, 1996; Nelson & Narens, 1994). Nelson and Narens (1994) use a metaphor for control processes which they saw as a thermostat. This happens through initiating, continuing or terminating an action. Veenman (2011) uses another metaphor to articulate the relationship between cognition and MC as a vehicle (cognition) and a driver (MS).The boundaries between the two levels are sometimes clear and other times very fuzzy. In addition, both mechanisms are working simultaneously (Nelson & Narens, 1994).

The relationship between monitoring and control is highlighted in literature and often referred to as a *regulatory loop* that is iterative and reciprocal (Schraw, 1998b, 2000) whereas the degree to which a person can apply the control processes is highly dependent on the generality and accuracy of the loop (Schraw, 1998b). There are three assumptions about the regulatory loop. First, the relationship between the two levels is hierarchical yet asymmetric. Second, even if this relationship is hierarchical, the process does not take place in a strict parallel manner. The third assumption is that both processes draw from a "common pool of limited resources" (Schraw, 1998b).

This ongoing and intertwined relation between the two processes makes it hard to find clear boundaries between them in reality. It is hard to separate the processes of metacognitive monitoring and control in research even if they are conceptually separate (Pintrich et al., 2000; Pressley & Afflerbach, 1995).The same idea goes for the relationship between cognition and MC. Even if MC is at a higher level compared to cognition, MC draws on cognition that creates a strong, intertwined and circular relation between the MC and cognition that is hard to separate while assessing MC (Veenman et al., 2006).

Metacognitive monitoring. Metacognitive monitoring is viewed as the gateway to metacognitive regulation as this process creates cognitive evaluations that are important for the enactment of metacognitive regulation (Winne & Perry, 2005). For this reason, "effective learning requires an active monitoring of one's own cognitive activities" (Baker & Brown, 1984, p. 354). Monitoring is either prospective concurrent or retrospective. Judgments are mainly divided into four types: Ease of learning (EOL); Judgment of Learning (JOL); Feeling of Knowing (FOK), and confidence judgments (Nelson, 1996; Nelson & Narens, 1994; Pintrich et al., 2000).

Ease of learning (EOL) are the judgments that take place before acquisition, when a learner starts a new task (Pintrich et al., 2000; Nelson & Narens, 1994) and pertain to items that are not learned yet. EOL is a prediction of how easy learning will be (Nelson, 1996). Judgment of Learning *(JOL)* are judgments that take place during or soon after acquisition, predicting the performance of subsequent and future recall (Nelson, 1996; Nelson & Narens, 1994). Feeling of Knowing (FOK) is like JOL, taking place during or after acquisition. FOK are judgments about the knowledge or remembering of a currently unrecalled item (Nelson & Narens, 1994). A very common incident of FOK is when a learner cannot recall something but knows that he/she knows it (Pintrich et al., 2000), which is related to the 'tip of the tongue' phenomenon (Brown, 1978; Pintrich et al., 2000; Nelson, 1996). Confidence judgments are concerned with an individual's confidence about a retrieved response or performance (Nelson, 1996; Pintrich et al., 2000). This judgment comes after one's performance. It can also take the form of error detection. Calibrating these judgments with learner's actual performance is important in metacognitive monitoring (Pintrich et al., 2000).

2.2.2.3. Metacognitive skills (MS). MS are described in terms of executive functioning (Brown, 1978, 1984; Tarricone, 2011). They are all the activities and processes a learner engages in to adapt, evaluate, change and control his/her cognition and behaviors to support the learning process and problem solving (Pintrich, 2002; Schraw, 1998a; Tarricone, 2011). MS "are perceived as an acquired program of self -instructions for control over and the regulation of cognitive activity at the object level" (Veenman, 2015b, p. 91).

Unlike MK, MS are dynamic and non statable. This means that these activities are not necessarily brought to a conscious level and awareness (Brown, 1987). There are two reasons explaining this. The first is that regulatory processes reached a high level of automaticity at least

in adults. The second reason is that many of these skills have developed without conscious reflection (Schraw 1998b; Schraw & Moshman, 1995; Schraw et al., 2006). MS activities are usually covert and cannot be assessed directly but are rather inferred from behaviors. For example, it can be inferred that a learner is monitoring or evaluating his/her learning when he/she spontaneously recalculates the outcome of a math problem (Veenman, 2011). The dynamicity and the covertness of MC behaviors lead to several problems and issues in reporting and assessing this form of MC, as discussed in a coming section.

There are several classifications of MS in the literature; however, there is almost an agreement that the essential and main classification is planning, monitoring and evaluation (Baker & Brown, 1984; Brown, 1987; Schraw, 1998a, b; Schraw & Moshman, 1995; Schraw et al., 2006). There is a distinction between metacognitive activities at the beginning, middle and end of a task. Brown (1987) and Veenman (2011) classify MS into three main categories: activities prior to undertaking a problem (planning), activities that take place during learning (monitoring), and activities that evaluate the outcomes (checking outcomes). Under each category, there are several behaviors discussed and suggested by scholars. I use these three main classifications to elaborate on the process while referring to other classifications within.

Activities prior to performing a task: (planning/ task analysis). Borkowski et al. (2000) use term "task analysis" to describe the first stage of executive function. It is initial stage for strategy selection. Planning includes predicting outcomes and selecting strategies in addition to various forms of trial and error (Brown, 1987). This prediction/ estimation include estimating their own capabilities, estimating task difficulty and predicting the outcome of strategic activity. There are other activities included before the task activities; orienting, analyzing the task, activating prior knowledge, goal setting and planning (Veeman, 2011). At the retrieval phase, activities also include selection of search strategy and termination of search (Nelson, 1996). Schraw and colleagues' model of planning includes goal setting, activating prior knowledge, allocation of time and resources in addition to selection of strategy use (Schraw, 1998a; Schraw & Moshman, 1995; Schraw et al., 2006).

Activities while performing a task: (monitoring & control). Monitoring is one's online awareness of their performance through engagement in periodic self-testing (Schraw, 1998a; Schraw & Moshman, 1995; Schraw et al., 2006). This may be related to Veenman's notion of self -instructions (Veenman, 2015b). Monitoring includes testing, revising and changing

strategies (Brown, 1987). Activities in this stage include; note taking, monitoring and checking, managing, implementing and modifying the plan, and managing time and resources (Veenman, 2011). The metacognitive activities during acquisition are selection of strategy, time allocation and decisions to terminate studying (Nelson, 1996).

*Activities at the end of a task: (evaluation).*Evaluation is the assessment of the outcome and one's learning process ; ie: the product and efficiency of one's own learning (Schraw, 1998a; Schraw & Moshman, 1995; Schraw et al., 2006).Evaluation includes comparing the outcomes and actions against one's own criteria of efficiency and effectiveness (Brown, 1987). Activities include; evaluating, drawing conclusions, reflecting and recapitulating (Veenman, 2011).

Executive functioning or MS are perceived as the "most important process in the entire metacognitive system" (Borkowski, Chan, & Muthukrishna, 2000, p. 4). As argued by scholars, the presence of MK does not guarantee its usage which highlights the importance of investigating MS (Veenman, Bavelaar, De Wolf, & Van Haaren, 2014; Veenman et al., 2006). There is empirical evidence that supports that MS help in improving performance in three ways; they help improving better use of attentional resources and existing strategies in addition to greater awareness of comprehension breakdowns (Schraw, 1998a). Executive functioning also manages all processes by initiating or terminating processes. Executive functioning also interacts with the task and its demands to select appropriate strategies (Tarricone, 2011).

The next section discusses the various methods used in assessing MC with the various validity issues related to each method. It also gives a justification for the used method for the study.

2.3. Other related issues and constructs to MC

This section discusses three main related issues to MC in light of the study. These three issues include the domain specificity and generality of MC that is important for assessing MC in adults. In addition the section discusses the relationship between MC and epistemic beliefs/cognition and the role of reflection in MC.

2.3.1. Domain generality vs. Domain specificity of MC and development. The topic of domain generality and specificity of MC is vital in education and learning. This issue is crucial for metacognitive training as well as studying teachers' or adults' MC (Pintrich et al., 2000; Schraw, 2000). As for, domain generality/ specificity determines the level of transfer of learning

from one domain to the other. Domain generality of MC means that strategies can be easily transferred across different tasks as well as different domains (Meijer, Veenman & van Hout-Wolters, 2006; Veenman et al, 2006). Domain specificity supports the opposite view which means that "metacognition is really a function of expertise" (Schraw, 2000, p. 302).

Research in the field is indecisive about the domain specificity/generality of MC (Pintrich et al, 2000; Schraw, 2000; Veenman et al., 2006). The majority of research findings support Schraw's (1998a, b) previously stated hypothesis of domain generality of MC (compared to the domain specificity of cognitive skills) including MK, monitoring (Schraw 1996; Schraw, Dunkle, Bendixen & Roedel,1995; Schraw & Nietfeld, 1998), regulatory strategy use (Wolters & Pintrich,1998) and MS (Veenman, Elshout & Meijer,1997; Veenman & Verheij, 2003). While other studies support the domain specificity hypothesis (Kelemen., Frost & Weaver, 2000) in which metacognitive activities vary among various tasks (Glaser, Schauble, Raghavan & Zeitz, 1992). Veenman et al. (2006) refer this disagreement to the grain of analysis. Veenman , Elshout and Meijer (1997) conduct a similar study to Glaser et al. (1992) and find that although different tasks stimulate different activities, a deeper level of analysis shows that these activities may originate from similar metacognitive grounds where the regulatory processes while performing different tasks correlate across domains. This is supported by further studies on various students (from fourth graders to university students) across different domains support the domain generality of MC (Veenman & Beishuizen, 2004; Veenman & Verheij,2003; Veenman, Wilhelm & Beishuizen, 2004).

Evidence suggests that MC changes with age in terms of quality and domain generality. Longitudinal and developmental studies still support the notion of domain generality in older students. However, they support the domain specificity in younger students in first grade compared to the domain general nature of MS in third graders (Veenman & Spaans, 2005). This discrepancy can be interpreted in light of the incremental development of MC in which domain specific knowledge develop and integrate to more domain general (Schraw, 1998b). Longitudinal studies also report a gradual increase in the domain generality of MS faced by an opposite decrease in the domain specificity across age of 12 to 14 (Van der Stel & Veenman, 2008, 2010; Veenman, 2011; Veenman & Spaans, 2005). In light of these findings, a conclusion can be drawn that MS:

> develop on separate islands of tasks and domains that are very much alike…….For very young students the "high road of transfer "(Salomon & Perkins, 1989) through general metacognitive skills across dissimilar tasks and domains may not have been developed yet. Later on their metacognitive skills become more integrated and applicable to a variety of tasks and domains. (Veenman & Spaans, 2005, 172).

To conclude, students at the age of 12 develop more domain general metacognitive activities till reaching the age of 14 where this transition process is completely developed (Veenman, 2011, 2015b). With referral to the purpose of the study, where adults are the target population, the domain generality of MC is supported and chosen while choosing or developing tools as evidence is supporting this belief specially in investigating adults.

Table 1

Different Models Explaining the Relation Between Cognitive, Metacognitive and Conceptual Levels

Kuhn (2000b), Kuhn and Dean (2004)	Schraw and Moshman (1995)	Kitchener (1983)
Epistemological understanding/ knowing	**Metacognitive theories**	**Epistemic cognition/ metacognition**
Evaluatist	Formal	The process of epistemic
multiplist	Informal	monitoring and evaluation
Absolutist	Tacit	
realist		
Metacognitive knowing and meta-strategic knowing	Metacognition	Metacognition
	cognition	cognition

2.3.2. MC and conceptual knowledge, epistemology and epistemic cognition . While reading about MC, confusion and overlapping between various concepts including epistemology, personal theories and reflection occurs where many of teachers mix between these three concepts. This confusion is understood and considered problematic in the field of teacher education as teacher educators mix MC with reflection (Duffy, Miller, Parson, & Meloth, 2009) with the referral to the common well recognized notion of developing teachers as reflective practitioners (Schon, 1987). This confusion is also shown in literature in the special interest of

scholars in the relation between teachers' epistemology, beliefs and teachers' practices and MC (Hofer & Sinatra, 2010; Maggioni & Parkinson, 2008; Olafson & Schraw, 2006; Schraw & Olafson, 2002). Therefore, there is a need to disentangle such confusions between these concepts and their role in MC in light of the study. The section briefly refers to three main models identifying the relationship between MC, cognition and the third level that includes metacognitive theories, epistemology and epistemic cognition (as shown in table 1).

2.3.2. 1. MC and conceptual knowledge/ metacognitive theories. Schraw and Moshman (1995) extend Nelson and Naren's two levels model to three level model relating cognition, MC and the third level; conceptual level where they referred to the conceptual level as metacognitive theories (Schraw, 1998b). Metacognitive theories are highly important while discussing how MK is formed and how they impact both cognitive and metacognitive processes. Schraw and Moshman (1995) define metacognitive theories as theories that are "relatively systematic structure of knowledge that can be used to explain and predict a broad range of cognitive and metacognitive phenomena." (p. 356). These theories coordinate beliefs allowing individuals to predict, explain and control of one's, other's and general cognition. Schraw (1998b) views metacognitive theories as important not only for monitoring performance but also for monitoring one's own self-regulation of his/her own cognition. These theories develop and change through personal experience and reflection (Schraw & Moshman, 1995).

Schraw and Moshman (1995) classify metacognitive theories into three forms; tacit, informal explicit and formal explicit. Tacit theories are loosely systemized theories that are acquired without any explicit awareness of possessing a theory. Individuals are not aware of the existence of these theories or the evidence that support or refute these theories (Schraw & Moshman, 1995). This may explain why skilled learners solve complex problems while being unable to explain their thoughts or behaviors (Schraw, 1998b). This also explains why tacit theories, even if untrue or maladjusted, are hard to change. Informal theories are beliefs that individuals are aware of their presence but they have not explicitly constructed a theoretical structure building or integrating these beliefs. Unlike tacit theories, informal theories are featured by emerging awareness of the constructive processes (Schraw & Moshman, 1995). This makes informal theories subject to conscious analysis and modification which is an important step for formalizing these theories (Schraw, 1998b; Schraw & Moshman, 1995). Explicit theories are

highly systemized beliefs about a phenomenon including explicit theoretical structures. These theories are rare especially in areas outside an individual's expertise. Explicit theories have a great impact on performance and understanding of performance. Formal metacognitive theories enable individuals to make informed decisions about their self-regulatory behaviors. (Schraw & Moshman, 1995).

In response to this three level classification, Schraw (1998b) makes three assumptions. The first is that knowledge at the low level (cognitive level) is domain specific while the knowledge at the metacognitive and conceptual level is domain general. This means that transfer of knowledge and information takes place at higher level compared to lower levels. The second assumption is that the construction of MK and metacognitive theories is incremental and ongoing process that takes place over a long period through reflection and experience. The third is that the degree at which an individual is capable of changing their conceptual and metacognitive knowledge depends on the extent to which this knowledge is explicit. Therefore, individuals possessing informal and formal theories are at a better chance of changing them.

2.3.2. 2. MC, epistemology and epistemological understanding. Kuhn (2000b) connects these theories to epistemological understanding and meta-knowing (MK). Hofer (2001) also makes a connection between MC and epistemological understanding defining the latter as "knowing about knowing" (p. 365). She also referred to this relation between MC and personal theory of knowledge or what is called "personal epistemology". These concepts are considered as "epistemic theories" and the metacognitive employment of these theories as "epistemic metacognition" (Hofer, 2004). This connection between constructs is an emerging field (Hofer, 2004; Hofer & Sinatra, 2010) that may be confusing and irrelevant to the study. However, the main important point is to have a general overview of the relationship between these concepts and MC. Hofer (2001, 2004) refers to two models for explaining the relationship between MC and epistemic theories; Kuhn (2000b)'s model of epistemological knowing and Kitchener's (1983) model of epistemic cognition.

In Kuhn's model (Kuhn, 2000; Kuhn & Dean, 2004), MK (referred to as meta-knowing) is considered as an area of study under the big umbrella of epistemological understanding/ meta-knowing. Her developmental model describes how epistemological knowledge develops through the "transition from simply knowing that something is true to evaluating whether it might be" (Kuhn, 2000b, p. 317). She classifies the development of epistemological understanding/

knowing into four categories; realist, absolutist, multiplist (relativist) and evaluatist. The realist reflects the lowest level of development in which the view of knowledge as an exact copy of reality. An absolutist starts to view knowledge as slightly deviating from reality. A multiplist views knowledge as generated by humans or opinions that are all equal. The highest level of epistemological understanding is the evaluatist develops the belief that some opinions/facts are more right than others. An evaluatist make a judgment about opinions based on evidence and arguments (Dean & Kuhn, 2004; Hofer, 2001; Kuhn, 2000b).

       2.3.2. 3. MC and epistemic cognition. The second model referred by Hofer (2001) is Kitchener's (1983) model of epistemic cognition that is defined as; "the processes in which individuals engage in order to consider the criteria, limits, and certainty of knowing" (Maggioni & Parkinson, 2008, p. 446). In fact, Hofer (2004) gives it the name of epistemic MC. Epistemic MC operates in accordance with cognitive and metacognitive levels involving in the monitoring of the epistemic nature of problem solving .The process includes awareness of certainty and limits of knowledge as well as the criteria for the process of knowing (Hofer, 2001, 2004). This monitoring process occurs during solving an ill-structured problem or argumentation around a complex problem (Hofer, 2004). There is also an assumption that epistemic MC impacts the adaptive use of MS that is crucial for teachers' adaptive use of instructional practices (Maggioni & Parkinson, 2008). In conclusion, the main difference between the two models is that Kuhn's model is more concerned with the developmental levels whilst Kitschener's model is more concerned with the process of developing knowledge. In addition, this third level is what develops and monitors the process of MC.

       2.3.3. Reflection as the heart of MC. Reflection and MC are two intertwined concepts in the field educational and developmental psychology whereas "the concepts of multiple and reflective access are key issues in the field of MC and developmental psychology" (Brown, 1987, p. 72). This explains the special interest of using reflection as an effective process for promoting metacognitive development (Kuhn & Dean, 2004; Schraw 1998b). Schraw and Moshman's (1995) model of metacognitive theories elaborated on the vital role of reflection in developing formal theories whereas reflection is the process at which an individual brings these theories to explicit revision and questioning which is considered as the initial step for changing

that leads to developing and constructing conceptual knowledge (Schraw 1998b; Schraw & Moshman, 1995). This is also emphasized in defining epistemic cognition as a process that takes place when people reflect on that nature of their own knowledge (Maggioni & Parkinson, 2008). Therefore, the more able an individual is to bring his/her personal/metacognitive theories to the conscious level, the more able an individual is to change, review and modify them.

The conscious access to these static theories directly and indirectly promotes and facilitates MS and executive functioning (Tarricone, 2011). Brown (1987) highlights the value of this conscious access in developing MS stating that: "Even if skills are widely applicable, rather than tightly welded, they need to be conscious and statable. Conscious access to routines available to the system is the highest form of mature intelligence " (p. 71). This explains social constructivist theorists' interest in verbalization and its role in reflection in which reflection is "a socially mediated, dialectical process relying upon verbalization, both internal and external." (Tarricone, 2011, p. 27). Both verbalization and reflection are crucial in development, monitoring and evaluation of metacognitive strategies. Reflection includes conscious self-review and questioning in addition to conscious self-regulation that provides insights for learning and problem solving (Tarricone, 2011). In fact, this explains the continuous emphasis on self-interrogation and self-correction as means of promoting MC (Baker & Brown, 1984; Brown, 978; Flavell, 1976; Schraw, 1998b). My conclusion about the difference between MC and reflection is that MC is the process of thinking about one's own thinking or cognition about one's cognition while reflection is the process of bringing this cognitive process to the conscious level. A better learner is the one who is capable of bringing this process to the conscious level to review and change. This leads Tarricone (2011) to consider reflection as the "quintessence of metacognition" (p. 11).

2.4. Assessing MC

There is almost a consensus on the difficulty in measuring MC as well as the necessity of studying it (Schraw, 2000). As Akturk and Sahin (2011) stated that the measurement of MC is difficult for nor only being an implicit behavior but also that individuals are not consciously aware of these implicit processes. For this reason, there are discussions about the validity and reliability of several assessment methods. Furthermore, there are different classifications of measurements of MC. The first classification is measurements of SRL including MC as a process

or an aptitude (Winne & Perry, 2005). The second classification is prospective, concurrent and retrospective methods (Veenman, 2005). The third classification is online and offline methods (Ozturk, 2017a; Pintrich et al., 2000; Saraç & Karakelle, 2012; Van Hout-Wolters,2002; Veenman, 2005; Veenman et al. 2006).

The most common classification is online and offline methods (Ozturk, 2017a; Pintrich et al., 2000; Saraç & Karakelle, 2012; Van Hout-Wolters,2002; Veenman, 2005; Veenman et al. 2006). This classification is according to the time when data are collected (Saraç & Karakelle, 2012). Online measures are based on actual behavior of students in which assessments are applied while a participant is performing a task (Veenman, 2005, 2011; Veenman et al, 2006; Saraç & Karakelle, 2012). Such method offers access to individuals' actual thought (Schraw, 2000) in which participants do not interpret or reconstruct their thoughts. They either verbalize their thinking (think aloud protocols) or paraphrase (observation) it (Veenman, 2011). Online assessments include think-aloud protocols (e.g: Pressley & Afflerbach,1995), observations (Whitebread et al., 2009) and log files (Veenman, Bavelaar, De Wolf & Van Haaren, 2014).

On the other hand, offline measures are measures administered before or after a task (Veenman et al., 2006). They ask the participant questions about his/her use of strategy (Veenman, 2011). They include interviews (e.g: SRLIS, self-regulated learning interview schedule Zimmerman & Martinez-Pons, 1986)., self-reports (e.g: Metacognitive Awareness Inventory (MAI) (Schraw & Dennison, 1994), LASSI, learning and study strategies inventory (Weinstein & Palmer, 1990), MSLQ, motivated strategies for learning questionnaire (Pintrich, Smith, Garcia & McKeachie, 1991). or teacher ratings (Desoete, 2008; Saraç & Karakelle, 2012).

Veenman (2005) refers to a similar classification of measure of MC that is related to the time in which data are collected. He classifies them according to whether they are administered prospectively, concurrently or retrospectively to the performance. Prospective measurement occurs when the instrument is administered before the performance. It is based on student's past experiences. Concurrent measurements are administered during the task performance. While, retrospective measurements are administered after the performance. In this sense, prospective and retrospective measurements are considered as offline measures whilst concurrent measures are considered as online measures.

The third classification is Wine and Perry's (2005) classification in which they classify measuring SRL and MC as an aptitude or an event. As an aptitude, MC is considered as an enduring personal quality that predicts future behavior whilst an event is like a snapshot that describes the thought processes in action. The major two differentiating features between the two measures are the aggregation and kind of information that each measurement represents. Measurements of MC as an aptitude can stand alone, independent of other measurements. They include interviews, self-reports and teacher's ratings. In this case, measurements differ within the same individual across a long period, different tasks and settings. Measurements of MC as an event include three levels; occurrence, contingency and patterned contingency, that makes it very complex. They include think aloud protocols, observations and error detection (Winne & Perry, 2005). The majority of research measures SRL as an aptitude which is considered as a shortcoming in research (Perry, 2002).

   2.4.1. Offline Measures. They include two main types; self- reports and interviews.

   2.4.1.1. Self- reports. Self-reports are the most commonly used in the field of MC and SRL (Dinsmore et al., 2008; Perry, 2002; Winne & Perry, 2005).There are several forms of self-reports that are domain general (MAI, MSLQ, LASSI) or domain specific (e.g: Index of Reading Awareness (IRA) (Paris, Lipson & Wixson, 1983) (Pintrich et al., 2000). There are several advantages of self-reports. They are easy to administer to a large number of students, easy to be used by teachers and easy to score (Pintrich et al., 2000; Ozturk, 2017a; Veenman, 2005, 2011; Winne & Perry, 2000). They also do not have an intrusive nature as they do not interfere with the learning process (Van Hout-Wolters, 2002) or the classroom environment (Akturk & Sahin, 2011).

   2.4.1. 2. Interviews. Interviews are protocols where participants describe their behavior before or after performing the task (Winne & Perry, 2005). The most formalized forms of interviews are done by Zimmerman and Martinez Pons (1986, 1990), *Self-Regulated Learning Interview Schedule (SRLIS)* (Pintrich et al., 2000; Winne & Perry, 2005). Interviews enable a deeper investigation of participants' ideas instead of the yes or no form of self- reports (Akturk & Sahin, 2011). A special form of interviews is stimulated recall where participants describe their behavior while observing their records (either videotapes or documents of their performance) (Van Hout-Wolters, 2002; Veenman, 2005; Winne & Perry, 2005). In these terms, stimulated recall interviews can be used to view SRL as an event or an aptitude (Winne & Perry, 2005).

2.4.2. Online measures. They include observations, think aloud protocols.

2.4.2. 1.Think aloud protocols. In think aloud protocols, participants are asked to verbalize their thinking while performing the task (Ozturk, 2017; Saraç & Karakelle, 2012; Venman, 2005; Winne & Perry, 2005). The main difference between interviews and think-aloud protocol is that in think-aloud protocols students describe their thinking while performing the task (Winne & Perry, 2005). Researcher's interference is very minimal. Unlike interviews, the researcher only interferes to remind the participant when the participant stops verbalizing his/her own thinking. (Ozturk, 2017; Saraç & Karakelle, 2012; Venman, 2005; Winne & Perry, 2005).

There are several points researchers need to take into account while using think aloud protocols. Think aloud protocols may slow down the cognitive process (Baker & Cerro, 2000; Ozturk, 2017a; Van Hout-Wolters, 2002; Veenman, 2005) due to its disruptive nature (Van Hout-Wolters, 2002).In addition, affective and personal factors like anxiety may interfere with the cognitive processes (Baker & Cerro, 2000; Ozturk, 2017). Furthermore, the task needs to be new and at a level of difficulty that stimulates metacognitive processes (Baker & Cerro, 2000).

2.4.2.2. Observations. In systematic observations, participants are observed by judges while performing a task through videotaping. The judges interpret and score the behavior according to a coding schema. Judges may physically attend while performing the task but they don't intervene (Ozturk, 2017a; Saraç & Karakelle, 2012). It is favored among the think aloud protocols (as an online tool) for tackling the relationship between the context and behaviors (Winne & Perry, 2005; Ozturk, 2017a). Baker and Cerro (2000) recommended observing participants while performing an authentic task in a more ecologically valid context. It could also be used for children who cannot verbalize their behaviors in think aloud protocol (Veenman, 2005; Winne & Perry, 2005). Observations are sometimes supplemented by stimulated recall interviews and detailed field notes (Perry, VandeKamp, Mercer, & Nordby, 2002; Winne & Perry, 2005).

2.4.3. Validity issues of online and offline measures. There are three validity indices needed for discussing MC: internal consistency, construct validity and external validity. Internal consistency is very common in measuring the reliability of instruments using either Cronbach's alpha or Cohen's Kappa. External validity is relating MC to other variables that are expected by the theory of MC. Construct validity is any form of data analysis (correlational or experimental) that argues for the presence of unobserved behavior (Pintrich et al., 2000). Construct validity is

supported by establishing convergent validity using multi-method approaches (Veenman et al., 2014) in which the instrument correlation with other measures designed to assess similar constructs is examined (Hinkin, Tracey, & Enz,1997).Several scholars state that the construct validity is the central issue in discussing assessment of MC (Pintrich et al., 2000; Veenman 2005). The next section reviews current methods for assessing MC with referral to each method's pros and cons.

Offline measures are widely criticized for being insufficient in accurately gauging an individual's thinking compared to online measures (Dinsmore et al., 2008). This is justified by several reasons. First, offline measures are criticized for their construct irrelevant variance due to individual differences in consciously accessing and verbalizing their strategy use (Pintrich el al., 2000). Second, memory failure and distortion are other shortcomings (Van Hout-Wolters, 2002; Veenman, 2011). Stimulated recall, although better than self-reports in yielding better retrospective memory reconstruction, is still not as accurate as online assessments (Veenman, 2005, 2011). Third, a participant while rating his/her metacognitive abilities tends to compare himself/herself to a specific reference point. The variation in the reference points chosen by the same learner for each question leads to data disparity. Fourth, participants may tend to choose socially desirable as well as biased and inaccurate responses (Pintrich et al., 2000; Van Hout-Wolters, 2002; Veenman; 2005, 2011). For example, a student may pick a strategy because they think it is a valuable one, not because he/she uses it (Pintrich et al., 2000). Veenman (2005) finds interviews as less open to social desirability and varying reference points compared to self-reports. However, participants may still not be able or willing to express their ideas (Baker & Cerro, 2000) and questions may induce socially desirable and biased reports (Baker & Cerro, 2000; Schraw, 2000) including experimenter's bias (Veenman, 2005). Interviews are also criticized of being hard to score especially open ended questions (Baker & Cerro, 2000) and time consuming (Akturk & Sahin, 2011; Pintrich et al., 2000; Van Hout-Wolters, 2002; Veenman, 2005).

Scholars' criticism of construct validity of offline measures is supported by empirical evidence. Several studies show low correlation between online (think-aloud protocols/log files) and offline measures (self-reports) (e.g: Cromley & Azevedo, 2006; Desoete, 2008; Hadwin et al., 2007; Veenman, Prins & Verheij, 2003). Other studies show low correlation among offline measures (e.g: Desoete, 2008; Saraç & Karakelle, 2012; Sperling, Howard, Miller, & Murphy,

2002). Some studies show that students overestimate their metacognitive activities in self-reports compared to their actual activities in log file registrations (e.g: Winne & Jamieson-Noel, 2002). In addition, studies comparing online and offline measures reveal that correlations between online measures are moderate to high while the correlation among offline measures are low to moderate (Schellings, van Hout-Wolters, Veenman, & Meijer, 2013; Veenman, 2005). Furthermore, studies show that online measures are more correlated to students' performance and scores on a task than offline measure, which indicates that online measures are better predictors of learning (e.g: Cromley & Azevedo, 2006; Sperling et al., 2002). Veenman (2005) finds that offline measures are correlated to learning performance ranging from slightly negative to 0.36 whilst online measures are correlated to performance in a range from 0.45 to 0.9. Veenman (2011, 2015) concludes that offline measures can assess MK but not MS.

Although online measures are considered to be more valid and reliable as they are obtained by observing people employing their self-regulatory skills while working on a specific task (Pintrich et al., 2000; Schunk, 2008), there are several drawbacks of online measures. They are generally criticized of being labor intensive and time consuming in terms of judges and video transcription (Veenman, 2011) besides their difficulty of being used on a large scale (Pintrich et al., 2000). They are also hard to score (Baker & Cerro, 2000).This is explained by the challenging nature of interpretation of the metacognitive capacity (Van Hout-Wolters, 2002) that may be underestimated by judges. In addition, judgments are subjective to the rater's own inferences (Ozturk, 2017a; Van Hout-Wolters, 2002) which requires experienced judges (Ozturk, 2017).Another problem, with think aloud protocols, is that it is not applicable in a setting of a classroom environment (Akturk & Sahin ,2011). They are rarely used in educational practice (Van Hout-Wolters, 2002).

In addition, despite the criticism of offline measure, some evidence shows a different view. Sperling, DuBois, Howard, & Staley, (2004) found a significant correlation between MAI and MSLQ self-reports in one study. A further study comparing two online measures (think-aloud and accuracy ratings) and two off-line measures (self-report and teacher ratings) reveals a significant correlation among offline measures and negative correlations among online measures (Saraç & Karakelle, 2012). Offline measures, even if as not as good as the online ones, they can still predict performance and show validity. For example, MAI and IRA as self-reports show positive relations to students' performance. The same is found in MSLQ and SRLIS. Even if not

high, this finding still indicates that offline measures can still at least differentiate between low and high achievers (Pintrich et al., 2000). Saraç and Karakelle (2012) conclude that offline measures tend to measure more conscious processes whilst online measure unconscious processes, which indicates that each one measures a different aspect of the complex construct. They call for reconsidering the Veenman's view of self-report as "quick and dirty" (Veenman, 2005, p. 93). Pintrich et al. (2000) believe that self-reports can still be considered as reasonable measure of MC including MS.

   2.4.4. A call for multi-methods designs. One can conclude that there is no one perfect method of measuring MC. Each method has its pros and cons (Veenman et al., 2006). What can be considered as strength in one measure is a weakness in the other (Pintrich et al., 2000). Schraw's (2000) conclusion is that all methods have their strength and weakness and none of them guarantee an accurate measurement across all contexts affirming that there is no one size fits all measurement. Therefore, careful choices are needed based on the purpose, context and the needs of the study (Pintrich et al, 2000; Schraw, 2000). This is considered as an initial step for valid interpretations (Winne & Perry, 2005).

   The majority of scholars in the field recommend a multi-method approach (Boekaerts & Cascallar, 2006; ; Dinsmore et al, 2006; Pintrich et al., 2000; Saraç & Karakelle, 2012; Schraw, 2000; Van Hout-Wolters, 2002; Veenman et al, 2006; Winne & Perry, 2005). Despite the validity issues of offline measures, integrating different data is more recommended than eliminating them (Ozturk, 2017). In fact, neither qualitative nor quantitative measures are enough on their own to illuminate the nature of MC (Dinsmore et al., 2008). A mix of both measures can enable the gathering of information on the process and the product and the research will benefit from the strengths of both methods (Van Hout-Wolters, 2002) offering a holistic and complementary view and understanding of MC and its processes (Azevedo, 2009; Saraç & Karakelle, 2012). Multi-method designs help clarify the conceptual models of MC (Pintrich et al., 2000) and allow teachers and researchers to capture the complex process of SRL (Boekaerts & Corno, 2005).

2.5. Metacognitive teachers and promotion of MC

  As stated in chapter 1, MC and SRL play an indispensable role in learning and preparing the youth for the 21st century. For this reason, metacognitive strategies are investigated since the 1980s till present and are found to be promising in effectively developing MC in both high and

low achieving students (e.g: Chinnappan & Lawson, 1996; Cross & Paris,1988; Dignath & Büttner, 2008; Palinscar & Brown,1984) with a big emphasis on the teacher's role in promoting MC. As stated by Schraw (1998a):

> Educational research and practice strongly support the notion of general cognitive skills instruction. High quality instruction enables students of all ages to construct domain-specific and domain-general strategies, metacognitive knowledge about themselves and their cognitive skills, and how to better regulate their cognition. The starting point in this endeavor is for teachers (or expert students) to ask themselves what skills and strategies are important within the specific domain they teach, how they constructed these skills within their own repertoire of cognitive skills, and what they can tell their students about using these skills intelligently. (p. 123)

In a similar vein, Pressley et al. (1989) view the role of schooling and teachers in addition to the role of modeling in enhancing the good information processing model stating that:

> Monitoring of performance, processing reflectively, planning for cognitive actions, diminishing anxiety, attending to tasks in the face of distractions, and seeking out academically stimulating activities (e.g., reading good books and magazines) should be encouraged during each school day. Consistent modelling and encouragement of these tendencies - through prompting to plan, modelling of reflective problem-solving combined with appropriate re-explanations when children encounter difficulties, and exposing students to teachers who enjoy academic activities and who themselves are intellectually stimulating - should do much to encourage children to internalize a cognitive style consistent with good information processing. (p, 865)

In fact, teachers have the central role in promoting these new notions of teaching in learning. This new overwhelming role urges for great intellectual abilities by teachers where they can identify students' needs and develop an environment that suits these needs where MC and SRL are the center and goal of learning.

2.5.1. Teachers' skills and the gap between research and practice.

In practice, this new role seems to be imaginary. Despite the empirical evidence that MC and SRL can be taught in addition to scholars' optimistic view of the teachers' capability of effectively performing this new role, a gap between theory and practice is witnessed (Schneider, 2008; William & Atkins, 2009). Several studies reveal that although instructions have proven to have an impact on children's development, very few teachers are found implementing such strategies (Moely et al., 1992). A recent international report , analyzing PISA reports focusing on students' SRL in 26 countries, finds that the majority of students in the most of the countries lack

the competency of self- regulation (Artlet, Baumert, Julius-McElvany & Peschar,2003). Other research show the same finding where very little or almost no instructions promoting self-regulation in literacy instruction are found over a whole year in 10 elementary classes in the US (Pressley, Wharton-McDonald, Mistretta-Hampston & Echevarria, 1998). Schneider (2008), after two decades of Pressley et al.'s (1989) proposed model, portrays the gap between this model and reality where effective teachers represent a minority. A meta-analysis of 49 studies with primary students and 35 studies with secondary students investigating the various characteristics of training promoting SRL reveals that although SRL has an impact on students', training done by researchers show more significant effect compared to regular teachers (Dignath & Büttner,2008) that indicates a problem faced by teachers in implementing effective SRL strategies.

       Such a gap is explained in different ways. Some scholars link the problem to the lack of communication between research and the actual practice in the applied field. Pressley et al.'s (1998) analysis is that:

> With the exception of one teacher who took pride in being traditional, most of the teachers we observed were clearly attempting to be up to date, at least with respect to some aspects of their teaching. That some of the instruction we observed in some areas seemed not to be informed by contemporary thinking seems to us to reflect a failure of the research community to communicate with the teaching community. (p. 189)

Other scholars refer the problem to the lack of teachers' understanding of metacognitive strategies. Schneider (2008) assures that teachers ' understanding of conceptual basis of effective learning is a precursor for effective use of metacognitive strategies. Research reveals that although teachers' show slightly positive beliefs towards promoting SRL compared to constructivism, they do not provide the necessary strategies (Dignath-van Ewijk & van der Werf, 2012). Dignath and Büttner (2018) find that teachers lack the knowledge about metacognitive strategies and are more reluctant to implementing them compared to motivational and cognitive strategies of SRL.

       For this reason, there is an emerging interest to investigate other determinants of teachers' SRL promotion. The major determinant found are teachers' variables including their satisfaction beliefs and self-efficacy about implementation of SRL and experiences with independent learning in their classes (Dignath, 2016; Lombaerts, Engels & van Braak, 2009). While others relate the problem of implementation to teachers' involvement in continuous cognitive and

metacognitive processes' adaptations rather than just knowing about instructional strategies that requires certain capacities and skills that teacher education does not prepare them for (William & Atkins, 2009). In response, an emerging body of literature supports the need for developing a metacognitive teacher and/or the need for investigating teachers' metacognitive and self-regulatory capacities (Dembo, 2001; Duffy, 2005; Duffy, Miller, Parson, & Meloth, 2009; Hartman, 2001; Lin, Schwartz & Hatano, 2005; Peeters et al., 2014; Van Eekelen, Boshuizen & Vermunt, 2005; William & Atkins, 2009). There is a belief that "metacognition directs and controls the instructional behaviors of teachers in the classroom" (Artzt & Armour-Thomas, 1998, p. 7).The same argument is built in the field of SRL arguing for teacher' own regulatory capacities as a critical determinant for promoting and implementing SRL (Peeters et al., 2014).

Hartman (2001) calls this notion "teaching metacognitively" where teachers need to teach" with and for metacognition" (p. 149). Teachers teach *with* MC through thinking metacognitively about their instructional goals and practices for effective use of instructions. Teachers also need to teach *for* MC through using these instructions to promote students' own MC.

2.5.2. Developing a metacognitive teacher; does it really matter?.

There may be some questions about the actual value of investigating teachers' MC in specific. Investigating teachers' MC may not seem logic to policymakers and other stakeholders from outside the teaching and teacher education circle with a question of so what or how will this directly impact students' learning? The coming section argues for the value of teachers' MC and its direct and indirect impact on students' learning for four main reasons. From my own personal experience as a teacher and reviewing literature, I believe that developing teachers' MC is important for teachers' own learning and professional growth; making teachers' job easier; promoting teachers' adaptation and adjustment of instructions to students' needs which provides an overall better quality of classroom instructions; and more effective promotion of MC inside the classroom.

2.5.2.1. MC is important for teachers' own learning and professional growth.

As stated in chapter 1, MC and SRL play a vital role in lifelong learning that teachers as well as students may benefit from. With the new shift in learning, there is a view of teachers' as learners. For this reason, several scholars argue for the need of MC and SRL in promoting teachers' own learning (Dembo, 2001; Peteer et al., 2014). In fact, teachers are faced with several

skills that they have not acquired either at school or in their teacher preparation which requires teachers' self-regulation of learning to be able to acquire them (Van Eekelen et al., 2005) let alone teachers who work in the field without an initial teacher education as commonly seen in our context; especially in private schools. There is a difference between teachers regulating their own learning and their own teaching (Peteer et al., 2014; Van Eekelen et al., 2005) as research shows that teachers can regulate their teaching but cannot regulate their learning (Van Eekelen et al., 2005). I am more focused here with regulating their own learning that will definitely impact their own teaching. Self- regulation of teacher's own learning is a prerequisite for promoting teacher's own self-regulation of teaching and instructions. Dembo (2001) has a similar view:

> I think educational psychology should have two complementary goals future teachers. The first goal is to teach future teachers to become more effective learners. The second goal is to teach them to be more effective teachers. I believe that attaining the first goal may help in the attainment of the second goal. (p. 25)

Furthermore, MC develops teachers' self-directed learning. It is quite noticeable in the field of instructional leadership and supervision that the main goal of various supervision models is to develop a self-directed teacher (Glickman et al. 2010; Nolan & Hoover, 2008; Zepeda, 2007). Glickman and colleagues' (2010) developmental model of supervision classified the approaches of supervision into four models based on the teachers' developmental level. The ultimate developmental level is the self-directed teacher who can make mindful decisions on his/her own. Van Eekelen et al. (2005) considers self-directed learning as the adult version of learning in which learners need to " reflect, assess, and evaluate rather than uncritically accept and internalise information" (p. 449). Van Hout- Wolters, B. (2002) considered metacognitive and cognitive strategies as parts of self-directed learning. Although Glickman's model aimed for taking the teachers from their current developmental stages to reach the level of self-directed teachers, very few percentage of teacher reach this level (Glickman et al. 2010). Dembo (2001) referred to the same findings in pre-service teachers. Therefore, developing teachers' MC may find solutions for developing self-directed teachers.

2.5.2.2. MC makes teachers' job easier.

Unlike what people from outside the field think, teaching is a really hard intellectual process that requires high level of thinking and problem solving. Shulman (2004) described the profession of teaching stating that:

> After 30 years of doing such work, I have concluded that classroom teaching-particularly at the elementary and secondary levels- is perhaps the most complex, most challenging, and most demanding, subtle, and frightening activity that our species has ever invented. ..the only time medicine even approaches the complexity of an average day of classroom teaching   is an emergency during a natural disaster. (p. 504)

It is not only teachers' feelings, research finds that teachers' decision making is at two minutes intervals, which means that they make hundreds of decisions per day. Most of their thoughts are found to be mainly about students followed by instructional and curriculum practices (Clark & Lampert,1986). In addition, teachers with high self-regulatory capacities are more adaptive to stressful environments that are often experienced by most of teachers. Self-regulated teachers have more tendencies to internal coping and reinforcing skills (Peteer et al., 2014; Manning & Payne, 1993). Teachers need to be self-regulated learners to keep up their motivation through understanding themselves, cope with the complexity of the teaching profession and understand the needs of their students (Delfino, Dettori & Persico, 2010).

Furthermore, there is view that teachers' MC is more complex compared to students' MC. Although both need to be strategic in their monitoring and control of their cognitive processes during a lesson, a teacher has an additional role in making the "moment to moment" decisions of identifying effective strategies, adjusting instructions and monitoring the learning of students (Duffy et al., 2009). As a teacher, I can sense this difference between a learner's and teacher's MC. Usually research in student's MC investigates his/her MC in reading or in mathematics. In such cases, a student uses his/her metacognitive abilities interacting with, understanding or solving a "static" problem in a textbook or a worksheet where variables are not constantly changing. In teaching, a teacher uses his/her metacognitive abilities interacting with human's brain in its utmost active and dynamic state "learning". The problem is that it is not one active brain; it is several active brains at different levels of activity and engagement. Therefore, there are multiple levels of complexity at one time. Awareness of this cognitive process that is reflected in studying teachers' MC is crucial in field of teacher education (Manning & Payne, 1993) as it may facilitate this tough work that teachers face. This is not only a humanistic call for supporting teachers. In fact, there is a global concern about retaining teachers specially novice ones whose one of the reasons for their dissatisfaction towards the teaching profession is the work load and stress with the more and more demands on teachers' shoulders nowadays (OECD, 2005).

2.5.2.3. MC promotes teachers' adaptive instructions.

This argument is built on that best teachers "combine and adapt many methods and materials to fit the situation in which they find themselves"(Duffy, 2002, p. 331-332). Intelligent teaching is based metacognitive thinking of the teachers about instructions in which they can strategically manage the use of these instructions (Hartman, 2001). Scholars believe that the teaching profession is characterized by highly changing situations that requires teachers who are highly adaptive to the social and instructional changes in their classrooms in which no class is like another one. Therefore, "successful teachers must recognize that virtually every situation is different, must see multiple perspectives and imagine multiple possibilities, and must apply professional knowledge differentially." (Lin et al., 2010, p. 162). Similarly, Duffy (2005) states that:

> Teachers face a continuous stream of problematic, ill-defined, and multidimensional situations. There are no easy answers; instead, teachers must adapt "on the-fly" to pupils' developing understandings and to opportunities for situating instruction in motivating tasks. Consequently, instruction is not a tidy endeavor that can be predicted in advance (p. 300).

He then elaborates on how promoting MC can offer an effective alternative to traditional training that prescribes certain strategies. This argument is supported in literature in which effective teachers are described as teachers' who possess: "adaptive expertise", disciplined/ wise improvisation"," response-based instructions" (Duffy et al., 2009; Fairbanks et al., 2010), "thoughtfully adaptive" (Duffy, 2005) or "adaptive metacognition" in which a teacher adapts her/himself and his/her environment in response to the classroom variability (Lin, Schwartz & Hatano, 2005).

2.5.2.4. Teachers' MC promotes effective transfer of MC to the class.

Metacognitive teachers are more able to fluently model MC for students and more aware of metacognitive strategies that enable him/her to use them more effectively. The argument about teachers' self-regulatory capacities in modeling SRL is considered as the clearest argument (Peteer et al., 2014) due to foundational role of modeling in Bandura's social cognitive theory and consequently on the theories of SRL (Bandura, 2001; Bandura & Walters,1977; Schunk, 1989). In SRL research, scholars highlighted how self-regulatory skills are acquired through instructions and social modeling by parents, teachers and peers (Schunk & Zimmerman, 1997; Zimmernan, 2002). Modeling is important in scaffolding students' self-regulatory

competence where a learner transfers from the observational level to imitative to self-controlled and lastly self-regulated through modeling, social guidance and feedback (Schunk & Zimmerman, 1997). Modeling also gains that attention of MC theory scholars as an effective strategy for promoting MC where they included modeling of both teachers and peers (Efklides, 2008; Flavell, 1987; Schraw, 1998a, b; Schraw et al., 2006; Schraw & Moshman, 1995). They highlight the role of social modeling referring to Piaget's and Vygotsky's notions of "interiorization" where social forms are internalized to covert forms within a person. This highlights the role of social modeling by adults whose roles are to engage learners in activities that develop these skills (Kuhn & Dean, 2004).

As a teacher whenever I have a professional development about promoting MC, I have this question popping up; How can we teach something we are not sure whether we master or not? Can someone ask a teacher to teach students multiplication and division while not making sure that this teacher has reached an adequate level of mastery in multiplication and division him/ herself? Do all adults fully develop metacognitive capabilities that they are able to transfer to the next generation? Why do Educators make this assumption that teachers are metacognitive and can deliberately transfer their high MS to their students? In seems that reality is way different from this assumption. Teachers in developed countries know very little about MC where their definitions about MC do not go beyond the general notion of independent learning (Veenman et al., 2006). Duffy et al. (2009) refer to primary studies that report that the majority of teachers in the US do not rise to the level of being highly metacognitive. In addition, Hofer (2001) refers to studies that suggest that most individuals do not reach a high level of epistemological understanding which is an essential for metacognitive development (Kuhn, 2000a).

An important reason for directly promoting students' MC is to develop a metacognitive teacher who is aware of his/her regulatory process of MC that enables him/her to use metacognitive strategies more effectively in his/her class. If research finds that students use strategies that they find effective, teachers are supposed to do the same (Dembo, 2001). This may explain why teachers usually teach the same way they were taught regardless of the effectiveness of these strategies (Dembo, 2001; Hartman, 2001). Gordon, Dembo & Hocevar, (2007) hypothesize that "If pre-service teachers demonstrate the use of self-regulatory skills in their own learning, they may take the process further by developing their own strategies for teaching self-

regulation to their students" (p.37) and their research supports their hypothesis in which experienced in- service teachers with high self-regulatory capacities are found to have a better sense of the effective strategies for promoting SRL in students. The same conclusion was drawn by Ozturk (2017b) that teachers need to develop their MC and their knowledge of MC first to effectively transfer this to their practice.

2.5.3. Studies on teachers' MC.

There are very little studies specifically done on teachers' own MC (Duffy et al., 2009; Wilson & Bai, 2010; Ozturk, 2017b). However, studies on expert and effective teachers provide characterization that is closely aligned with the conceptualization of MC (Duffy et al., 2009). A study reveals that experienced and effective teachers are more able to monitor and interpret events as well as the instructional strategies used. They are more able to speculate the reasons behind students' behaviors and offer strategic solutions for these problems compared to less effective and experienced teachers who can describe rather than evaluate classroom behavior (Sabers, Cushing & Berliner, 1991). Duffy et al. (2009) referred to plentiful studies supporting their argument that effective and expert teachers are described to have metacognitive behaviors, I refer to only few of them. Berliner (1994, 2004) assures that expert teachers are more sensitive to task and social characteristics and demands, more flexible. They also have faster and more accurate recognition of patterns. A qualitative study using in depth interviews and classroom observations of nine outstanding teachers finds that those effective teachers are very well aware of their practices as well as the goals underlying these practices. Although very well planned, they do not miss the opportunity to enrich the lessons based on their students' participation (Wharton-McDonald, Pressley & Hampston,1998). This responsiveness to students' responses reflects how adaptive in monitoring their practices rather than having a rigid fixed plan. Therefore, research suggests that effective teachers are metacognitive (Duffy et al., 2009).

Despite the shortage of enough studies on teachers' MC, the few studies directly analyzing the relationship between MC and instructional practices are promising. Artzt and Armour-Thomas (1998) found that teachers' MC plays a very well defined role in instructions specially monitoring and adjusting instructions to students' needs. Ozturk (2017b) after classifying participants into highly metacognitive and metacognitive teachers using (MAI self-report) and finding that participants do not possess knowledge and competency about teaching

MC, she provided these teachers with professional development about teaching MC and used think aloud protocol to assess the change in their instructional planning. Her findings are that highly metacognitive teachers transfer their MC into more authentic lesson plans creating instruction moments for MC compared to the metacognitive teachers who adopted similar instructional designs to the professional development. Such findings predict a strong relationship between teachers' MC and their teaching for MC. A further study using self-reports to measure experienced teachers SRL and its impact on their teaching practices, including goal orientation and their cooperative classroom management techniques, reveals a relationship between teachers SRL and these behaviors (Gordon, Dembo & Hocevar, 2007).

Duffy and colleagues (2009) referred to several problems in investigating teachers' MC. First problem lies in the aforementioned problem of confusing MC with self-regulation and reflection. In the field of teacher education, there is an additional confusion between teachers' MC and other terms like "teacher as a researcher". I may also add the notion of "teachers as reflective practitioners" (Schon, 1987).The second situations, students and teacher's own career level. Another important reason is the new era of accountability in which the "MacDonaldization of teaching" (Pearson, 2007, p.154), where teachers are follow procedures rather than being mindful and independent thinkers, has become the trend. A third vital problem is the preceding methodological problems of investigating teachers' thinking with either the validity issues of self-reports and other offline tools and the time consuming labor intensive methods of qualitative research. A fourth problem raised by Manning and Payne (1993) is the lack of theoretical foundations for research on teachers' thinking.

This may explain the reason why very little research is done in the field of teachers' MC. Though there are plentiful of studies that aim to investigate students' self-regulatory capacities, little is known about teachers' metacognitive capacities and the way they put them into action (Capa-Aydin, Sungur, & Uzuntiryaki, 2009; Gordon et al., 2007; Van Eeklen et al, 2005). Although researchers and educators defend that effective teachers are metacognitive, there is no or very little research evidence supporting this notion. This indicates a need to understand how teachers' MC develops, what factors are needed to promote MC or how to support teachers to teach metacognitively (Duffy et al., 2009; Jiang et al., 2016; Peteer et al., 2014).

One of the problems investigating teachers' MC or their implementation of metacognitive strategies that very rare studies used methods that investigate teachers' actual performance in classroom setting. In fact, these studies consider this as limitations of their studies (Wilson & Bai, 2010; Ozturk, 2017b). There is a general need for more qualitative research for more ecologically valid studies in which behaviors are studied in a practical setting reflecting" individuals acting within psychological, disciplinary, social, and cultural contexts" (Perry, 2002, p. 1) that give detailed description of the characteristics of SRL in real contexts and real times (Perry, VandeKamp, Mercer, & Nordby, 2002) rather than "laboratory like studies" (William & Atkins, 2009). As stated earlier, there is only one research investigating teachers' MC in the actual classroom setting (Artzt & Armour-Thomas,1998). In addition, there are no studies found done relating teachers' own MC to their instructional practices, which is recommended by scholars (e.g: Duffy et al., 2009). The only study that relates MC to instructional practices is the study done by Ozturk (2017b) who used an offline self-report in assessing teachers' MC.

2.6. Operational Definitions

2.6.1. Metacognitive awareness. It is the awareness of one's cognition that includes knowledge of cognition (MK) and regulation of cognition (MS) (see table 2)

2.6.2. Teacher's metacognitive instructional practices. Teacher metacognitive instructional practices are all cognitive behaviors needed to regulate and controls teacher's own and students' cognition. As stated by Hartman (2001) that for teachers to teach metacognitively they " need to self-regulate their instruction before, during and after conducting lessons in order to maximize their effectiveness with students" (p. 151).

Following the same stages of Artzt and Armour-Thomas (1998) and the metacognitive behaviors mainly in Meijer and colleagues' (2006) and other behaviors (Gourgey, 1998), metacognitive instructional practices are divided into three main categories according to the time cognitive behaviors take place; pre-active (planning), active (monitoring and execution), post active (evaluation and elaboration) stages.

Table 2

Definitions and Instruments

Construct	components	Instrument	Reference
Metacognitive awareness	**Metacognitive knowledge.** Knowledge about: - *Declarative knowledge*. self, skills and abilities as a learner. - *Procedural knowledge*. strategies and how to implement strategies - *Conditional knowledge*. why and when to use strategies **Metacognitive skills.** - *Planning*. goal setting, planning and allocation of resources - *Monitoring.* assessment of one's use of strategy - *Information management*. sequence of skills and strategies used to efficiently process information - *Debugging*. strategies for correcting performance and comprehension errors - *Evaluation*. analysis of the performance and effectiveness of the strategy used.	Metacognitive Awareness Inventory (MAI)	Schraw & Dennison (1994)
Metacognitive instructional practices	**1. Pre-active stage:** - Orienting - Planning **2. Interactive stage:** - Monitoring - Evaluation **3. Post active stage:** - Elaboration - evaluation	Taxonomy of Metacognitive Activities in Text studying (TMATS)	Meijer et al. (2006)

Chapter 3: Methodology

3.1. Research Design

As stated earlier, multi-methods can be more useful in providing a complete and comprehensive picture and thus can compensate the disadvantages of each method while investigating MC. Therefore, the study applied a mixed-methods design: a quantitative study followed by the qualitative study (Table 3). For the quantitative phase, first, the English version of the MAI was translated into Arabic. A pilot study for the Arabic version of the MAI was followed by the main study of adapting the Arabic version of MAI with a larger sample of teachers. For the qualitative study, teacher's MC while planning and implementing their lessons were investigated.

3.2. Phases of the study

Table 3

Phases of the Study

Phase 1. Adaptation of MAI	Phase 2. Quantitative Study	Phase 3. Qualitative study
Backward and forward translation	Administration of adapted scale to teachers	Pre-observation interview
Pilot Study		Classroom observation
Reliability analysis	Descriptive statistics, t-test and ANOVA	Post- observation interview

3.2.1. Phase 1. Adaptation of MAI

3.2.1.1. Current instruments assessing teacher's MC. There are several self-reports available in the literature assessing adult's and teacher's MC. The most suitable self-reports for the study are: 1) the Metacognitive Awareness Inventory (MAI) (Schraw & Dennison, 1994); 2) the metacognitive awareness inventory for teachers (MAIT) (Balcikanli, 2011); and 3) the Teacher Metacognition Inventory (TMI) (Jiang, Ma, & Gao, 2016). The coming section is a comparative view of the three inventories with a clarified reason for favoring the MAI among the other teachers' inventories (see table 4).

The Metacognitive Awareness Inventory (MAI) (Schraw & Dennison, 1994) is a 52-item inventory that is classified into main categories: knowledge of cognition (metacognitive knowledge) and regulation of cognition (metacognitive skills). MAI consists of 8

subcomponents; three are included under the heading of metacognitive knowledge (declarative, procedural and conditional) and five represent metacognitive skills (planning, information management strategies, comprehension monitoring, debugging and evaluation). As found by Schraw and Dennison (1994), the inventory showed high internal consistency (.90) and statistical correlation between knowledge (r=.54) and metacognitive skills (r= .45) and convergent validity (relation between MAI and test performance). There is a positive correlation between the inventory and student performance.

The Metacognitive Awareness Inventory for Teachers, MAIT is a modified version of MAI especially designed for teachers (Balcikanli, 2011). Unlike the MAI, the MAIT has fewer (24) items. It also uses a five-point Likert scale. The Cronbach alpha reliability of this scale ranges from, 0.79 to 0.85 (Balcikanli, 2011), which indicates that it has an adequate reliability. The final version of MAIT includes 6 dimensions of 2 main components MK and MS; declarative, procedural and conditional knowledge as well as planning, monitoring and evaluation for the MS (Balcikanli, 2011).

The Teacher Metacognition Inventory, TMI (Jiang, Ma, & Gao, 2016) is a 28-item inventory with six subscales; teacher metacognitive experiences, metacognitive knowledge about pedagogy, teacher metacognitive reflection, metacognitive knowledge about self, teacher metacognitive planning, and teacher metacognitive monitoring with a rating scale from 1 to 5. A positive point of the TMI is that it included metacognitive experiences to the construct unlike the MAI and MAIT. TMI showed a satisfactory internal consistency (a =0.936) with inter-item correlation of 0.343. The average corrected item-total correlation (CITC) of the TMI was 0.534 (Jiang, Ma, & Gao, 2016).

Table 4

Details About the Various Self-reports for Assessing MC

	MAI	MAIT	TMI
Number of items	52	24	28
Components	8	6	6
Reliability of items/ internal consistency	.9	0.79 to 0.85	0.936

MAI is preferred over TMI and MAIT for several reasons. First, MAI is considered as a general metacognitive self-report that assesses MC regardless of a specific domain (Ozturk,

2017a; Pintrich et al., 2000; Saraç & Karakelle, 2012; Schraw, 2000). This is more suitable to the need of our context as there are no reliable instruments for assessing MC found in any of the domains. Second, as discussed in a previous section, there is more support for the domain generality of MC in adults. Therefore, there is no special necessity for adapting a domain specific tool, especially when it is already compensated by an online tool for assessing teachers' MC in the special context of teaching. Third, while comparing between MAI and MAIT, as Jiang el al. (2016) noted, the MAIT is a modification of MAI by adding teaching aspects to the statement. Therefore, there is no major difference between the two inventories. Fourth, MAI is more broadly cited in comparison to MAIT and TMI, which tends to make it a better way to add to the collective body of knowledge. Fifth, the positive aspect of including metacognitive experiences to the TMI is not an added value as the chosen approach is to include ME under the big umbrella of MS.

　　　3.2.1.2. Adaptation of MAI self-report into Arabic language. Permission was taken from the second author of the MAI. Then, the Arabic version for the MAI was developed through backward translation. Three bilingual translators are asked to separately translate the MAI into Arabic language. The three translators are: a professor in clinical psychology, a teacher of English and the author of the study. The three versions were discussed between the second and third persons until a consensus over one agreed-upon version was developed. The final version was translated back to English by the author of the study with a comparison between the original MAI and the translated version to ensure that the two versions are similar.

　　　3.2.1.3. Pilot study. The adapted version of the scale was pilot-tested on a sample of 160 teachers from the PED (professional educator diploma) at AUC, teachers from two secondary schools in addition to an online version that was distributed among teachers' communities on social media. Teachers were selected through convenience sampling. After signing paper consent (for the paper version of the MAI), general instructions were given to teachers about the inventory where teachers are asked to answer items as "carefully and truthfully as possible" (Schraw & Dennison, 1994, p. 463).

　　　Using SPSS, the overall reliability of the Arabic version of the MAI was measured as acceptable (Cronbach's alpha=0.92). As aforementioned, there are two main scales for the MAI including knowledge of cognition and regulation of cognition with eight subscales of the MAI; declarative knowledge (DK), procedural knowledge (PK) and conditional knowledge (CK),

planning (P), information management (IMS), monitoring (M), debugging (DS) and evaluation (E). The Cronbach alpha of each subscale is .77, .67, .73, .79, .76, .74, .36, .70 respectively. It was worth noting that there was a mistake in the online version for item 52 that lead to 10 scales rather than 5, a problem that led to a low reliability and is shown in the high standard deviation of the item. For this reason, item 52 was subject to further investigation in the main study. The overall analysis of the pilot study shows that the Arabic version of MAI is well worded and easy to understand with acceptable reliability. There was no need to omit or adjust items. Therefore, the final Arabic version of the MAI contains 52 items with eight subscales.

Table 5

Reliability of the Scales and Subdimensions

Cronbach's alpha of each scale	Metacognitive knowledge (MK)				Metacognitive skills (MS)			
	.88				.89			
Cronbach's alpha of each subscale	DK	PK	CK	P	IMS	M	DS	E
	.77	.67	.73	.79	.76	.74	.36	.70

3.2.2. Phase 2: Quantitative study.

In this phase, further information was added to the MAI including gender, years of experience, the type of school they work in (public, private, international) and the stage they teach (preschool, primary, preparatory or secondary).

Participants. Convenience sampling was used for selecting participants. The convenient sample was found to be the most suitable way of sampling in the Egyptian context due to the difficulty of access to schools. In an attempt to overcome the limitations of the convenience sampling, the sample was as diverse as possible. The self-report was distributed among 31 schools in three main administrations (idara) in Cairo: Al Nozha, New Cairo and Basateen and Dar el Salalm. The three administrations represent the various socio-economic levels of schools in Cairo. The schools include 26 public schools, 3 private schools and 2 international schools. In addition, the self-report was also distributed among teachers attending the professional educator diploma (PED) at AUC. The vast majority of teachers who attend the PED are teachers in international and private schools. An online link shared on groups of teachers' communities through social media that received only one response. The very low response rate of the online

version led to excluding it from the data analysis. A consent form was signed by participants to show their willingness in participating in the study.

The number of teachers who agreed to participate in the study was 394. The sample included 286 female teachers and 80 male teachers;155 primary teachers, 87 preparatory teachers, 97 secondary teachers and 41 kindergarten teachers and 3 teachers who taught other stages. A total of 151 teachers work in public schools,72 teachers in experimental schools, 76 teachers in private schools and 80 teachers in international schools. The sample included 87 teachers who teach Arabic, 44 teachers who teach science, 64 teachers who teach math, 96 teachers who teach foreign language and 94 teachers who teach other subjects. The years of teaching experience of the participants ranged from 1 to 52 years, with a mean of 18.13 years ($SD = 10.22$).

Data Analysis. SPSS was used to analyze the data. Descriptive statistical analyses were used to find the means, Cronbach alpha and SD of subscale and overall scores. Independent samples t-tests were used to compare means between two groups (by gender, work at private or public school); and one-way ANOVA was used for more than two groups (i.e., years of experience, grade level and subjects).

Table 6

Demographics of the Sample

Variable		Percentages
Gender	% male	21.9
	% female	78.1
Having a degree/ diploma in education	Yes	81.5
	No	18.5
Subjects	Arabic	22.1
	Math	16.6
	Science	11.4
	Foreign language	24.9
	Other subjects	24.4
Grade level	Primary	40.5
	Preparatory	22.7
	Secondary	25.3
	Preschool	10.7
	Other stages	0.8
Type of school	Governmental	39.8
	Experimental	18.9
	Private	20
	International	21.1

3.2.3. Phase 3: Qualitative study: Teacher's online metacognitive instructional practices

3.2.3.1. Participants and setting. The study took place in a religious (Islamic) international school in Cairo where boys and girls are segregated. Students' socioeconomic level is from middle to high. The school offers American curriculum but with a few adjustments and Islamic

integration activities. The language of instruction of science, math and social studies is English. More sessions are given in English compared to mother tongue (Arabic) sessions.

Purposeful sampling method of four female teachers was used. The four teachers were selected for being experienced and known for their high performance. The second reason for their selection was to include teachers across the three stages—elementary, middle and high school—and the three core subjects (math, English, Arabic) so that a comprehensive understanding of MC could be reached. The lack of access to male teachers was the main reason for having only female teachers. In addition, the short time of the study led to choosing only four teachers. Pseudonyms were given to the teachers. Ms. Sara is an elementary math head teacher who has been teaching elementary math for five years. She has attended a variety of professional development courses. She is currently teaching grade three boys. Ms. Noura is a high school middle teacher who has been teaching middle and high school for three years. She teaches grade 9 girls. Ms. Nada is a middle school Arabic teacher who has been teaching Arabic for 20 years in both national and international schools. She is teaching grade 7 girls. Ms. Aisha is a middle school teacher who has been teaching for eight years. She is currently teaching grade 8 girls.

3.2.3.2. Procedure and data collection. Data were collected through three different means: a semi-structured pre-observation interview with teachers discussing teachers' general planning, characteristics of the class; followed by a class observation; followed by a post observation interview to collect data about the teachers' own reflections and evaluation of the lesson. All interviews and observations were audiotaped while class observations were also videotaped for easy referral. A stimulated recall interview was used if needed after the video analysis to ask teachers' about their thinking and the reasons behind certain behaviors. In fact, a think aloud protocol was intended to take place instead of the pre-observation interview as a more preferable "online" method. However, it was found not to be feasible based on the experiences in the first trial with one of the participants. As teachers plan for their lessons in several phases rather than a short period, it is difficult to spot their "online" thinking in think aloud protocol. In addition, interviews can still assess MC as both aptitude and event (Winne & Perry, 2005). For this reason, the pre-observation interview was found to be a more effective and feasible method for data collection.

Two successive cycles of the pre-observation interview, class observations and post observation interview were held with each of four teachers except for the Arabic teacher with

whom one cycle was performed as the second cycle was interrupted by exams. Transcriptions were made for both audiotapes and videotapes. Teachers and students are asked to act as they typically do, disregarding the videotaping. In addition, no changes in the classroom settings based on the presence of the camera were made. It is also worth mentioning that interviews with teachers were conducted in teachers' mother tongue.

   3.2.3.3. Data analysis and theoretical frameworks. Following the same steps of similar studies in both fields (e.g., Meijer et al., 2006; Parsons, 2012; Parsons & Vaughn, 2013; Whitebread, et al., 2009), the present study follows an iterative process for identifying the various online metacognitive activities used by teachers. The analysis goes back and forth between the data and the previously created framework in which "a combination of top-down (i.e., theoretically driven) and bottom-up (i.e., empirically driven) strategies was used by combining pre-coded categories and observed statements of participants simultaneously" (Meijer et al., p. 223). This approach is familiar in qualitative research in which:

> The researcher may change categories or their names, delete categories, or add them in light of new data. In short, there is fluid interaction between data collection, data analyses, and construction of conclusions. Analyses and data collection are interwoven enterprises. (Pressley, 2000, p. 265)

   As aforementioned, the main problem while investigating teachers' MC is that there is no clear framework to follow while investigating this important phenomenon. For this reason, a framework was created primarily through merging literature from both basic and applied fields; and reviewing literature in the previously mentioned areas of teacher thinking with the already identified taxonomy for studying metacognitive activities in the domain of text-studying and problem solving (Meijer et al, 2006).

   As stated by Veenman et al. (2006), the well-known frameworks for describing metacognitive activities in the domain of reading are two main taxonomies: Meijer et al. (2006) and Pressley and Afflerbach (1995). The taxonomy developed by Meijer et al. (2006) was chosen over Pressley and Afflerbach's for two reasons. Firstly, it is more recent and built on Pressley and Afflerbach's work that is viewed as "very detailed, presumably exhaustive" (Meijer et al, 2006, p. 218). Secondly, Meijer's taxonomy includes two domains of both text studying and problem solving that gives a broader view while investigating the phenomenon in a different domain.

A review of literature in the fields of scaffolding (Hartman, 2001), behaviors of expert teachers (Berliner, 2004; Duffy, 2005; Sabers, Cushing & Berliner, 1991), adaptive instructions (Corno, 2006; Parsons, 2012; Parsons & Vaughn, 2013) and metacognitive instructional behaviors (Temur, Özsoy & Turgut, 2019) are used as guiding framework for interpreting metacognitive instructional practices.

It is also worth mentioning that the aim of the study is investigating teachers' metacognitive instructional practices in which the focus is on thinking processes behind the choice of a certain strategy or behavior rather than agreeing or disagreeing with the strategy itself and whether it belongs to the popular constructivist vs. behaviorist debate (Tobias & Duffy, 2009). A mindful and effective teacher is the one who knows the best strategy to be used for a specific situation and student (Wharton-McDonald, Pressley & Hampston, 1998). In addition, MC is subject to errors and illusions (Nelson, 1990), meaning that the correctness of teachers' metacognitive instructional practices is not subjected to judgment.

Chapter 4: Findings

This chapter summarizes the findings of both studies, quantitative and qualitative in relation to the research questions. The pilot study answered the first question of the psychometric properties of the adapted version of MAI where it was found to be a reliable tool for the study. The quantitative findings answer the two questions of the overall score of teachers' metacognitive awareness as well as the significance differences between various teachers. The analysis included descriptive statistical analysis of the total means and scores of MAI as well as the subscales to answer these questions. The findings also include comparisons of the total scores and scores of each subscale between teachers, based on different variables. The qualitative findings answer the last question about the various metacognitive skills used by teachers to adapt their instructional practices. The findings include the main themes of metacognitive behaviors exhibited by teachers.

4.1. Quantitative phase

4.1.1. Descriptive statistics. The overall reliability coefficient (Cronbach's alpha) of the MAI in the main study is measured as .96. It is worth highlighting that the reliability of the subscale debugging (DS) (α= .68) is significantly higher than that of the pilot study (α = .36). This confirms that the low reliability of the debugging subscale at the pilot stage was due to the mistake in item 52. The total average score of the MAI is 92.04 (*SD* =22.74) (N =394). The mean scores of knowledge of cognition (MK) is 29.81 (*SD* =7.73) and regulation of cognition (MS) is 15.86 (*SD* =15.86), respectively. The reliability, mean scores and *SD* of each subscale is shown in Table 7**.**

The Likert scale was labeled from 1 (strongly agree) to 5 (strongly disagree).The means of the total of MC is x̄= 1.81 with a very slight difference in means of the two main scales; MK x̄=1.8 and MS x̄=1.81. The planning subscale is found to be the lowest and execution subscale is the highest. There are very slight differences between the subscales. However, the overall mean scores of the MAI of Egyptian teachers are found to be high (as shown in table 6).

Table 7

Descriptive Statistics of MAI

Number of participants= 394

Scale	N of items	Total mean score	SD of the total score	Means of the likert scale	SD of the likert scale	α
MK	17	29.81	7.73	1.80	.46	.90
Subscales						
DK	8	14.10	3.80	1.81	.48	.78
PK	4	7.02	2.27	1.80	.56	.71
CK	5	8.68	2.60	1.78	.52	.70
MS	35	62.22	15.86	1.81	.45	.93
Subscales						
P	7	11.68	3.60	1.70	.51	.78
IMS	10	17.39	5.00	1.76	.49	.80
M	7	13.29	3.69	1.93	.52	.76
DS	5	8.64	2.70	1.76	.54	.68
E	6	11.28	3.33	1.92	.56	.73
Total	52	92.04	22.74	1.81	.44	.96

4.1.2. Results of t-test. An independent t-test was applied to find if there is a significant difference between male and female teachers. The t-test showed no significant difference in the overall metacognitive awareness between male (87.33±29.58, *p*= .057) and female teachers (92.81±20.43). However, female teachers show significantly higher metacognitive knowledge (MK) (30.17±6.78, *p*= .004) compared to male teachers (27.86 ±10.28) in all three subscales DK (14.33±3.40, *p*= .02), PK (7.07 ±2.09, *p*= .01) and CK (8.77±2.34, *p*= .02) compared to male teachers (12.88±4.81), (6.86 ±2.87) and (8.13±3.27) respectively. In addition, the monitoring (M) subscale of female teachers (13.51±3.37, *p*= .03) was significantly higher than male teachers (12.29±4.56).

A t-test was also used to compare between teachers who teach in private and public schools. In the statistical analysis, public schools include both governmental and experimental schools whilst private schools include both private and international schools. No significant

difference was observed between teachers in public (92.15±21.78, *p*= .85) and private schools (91.73±24.37).

        4.1.3. ANOVA results. Analysis of variance (one way ANOVA) between teachers' metacognitive awareness at different grade levels showed no significant difference in the overall score, but there was a difference in procedural (PK) and conditional knowledge (CK) subscales. A Post Hoc test was performed to measure which groups have significan*t differences. Secondary level teachers showed a significantly higher PK (7.33±2.61, *p*= .02) compared to primary teachers whilst there was no significant difference among teachers from other grade levels. On the other hand, kindergarten teachers showed significantly higher CK (9.41±2.75, *p*= .01) compared to primary teachers (8.3±2.29) with no significant differences among teachers from other grade levels.

        One way ANOVA showed a significant difference between teachers with different years of experience in overall score as well as metacognitive knowledge (MK) including declarative knowledge (DK). Post Hoc tests revealed that teachers with between 6-15 years of experience of show no significant difference in total score compared to teachers with 0-5 years of experience, but the more experienced teachers showed a significantly higher overall score (95.90±19.66, *p*= .01) compared to teachers with 16+ years of experience (89.36±20.96). In MK, there was no significant difference between the years of experience (0 to 5) and (6-15) but teachers of years of experience (6 to 15) are significantly higher than(31.17±6.62, *p*= .00) teachers with 16+ years of experience (28.71±7.40). Both teachers with years of experience of (1-5) (14.53±3.46, *p*= .04) and (6-15) (14.92±3.36, *p*= .01) show significantly higher DK than teachers with 16+ years of experience (13.47±3.59). On the other hand, there is no significant difference in DK between teachers of (0-5) and (6-15) years of experience.

        ANOVA shows no significant difference in total score of metacognitive awareness between teachers teaching different subject areas (Arabic, math, science and foreign language). The only significant difference found was in DK. Post Hoc test shows that teachers of Arabic show significantly higher DK (13.01±3.31, *p*= .01) than foreign language teachers (14.44±3.56).

4.2. Qualitative phase

The qualitative phase answers fourth research question about the various metacognitive instructional practices used by teachers. Descriptive analysis of data reveals various emerging themes in teachers' Metacognitive activities including planning, monitoring, execution and evaluation. It was noticed that there are no discrete differences between the stages where overlap is viewed between all categories especially between the monitoring and control where behaviors can be coded under both activities. In addition, two emerging themes related to teachers MC were found and reported. The main themes emerged from data set are seen on Table 8.

4.2. 1. Pre-active stage (Planning). For the planning part, several activities were found to be done by teachers during their planning phase. However, other activities are hard to grasp through an offline measure like an interview, such as activating prior knowledge, organizing thought by asking oneself or identifying and repeating important information. An interesting finding is that certain MC behaviors while planning was done by the teacher as a model for her students.

4.2.1.1. Sub-goaling and allocating time. Teachers are found to make sub-goaling on both levels the curricular (long term) level and lesson (level) through the cycle. It was very obvious how teachers chunk the big lesson into micro objectives and the same goes for curriculum maps. In addition, teachers clearly state time needed more frequently for lessons at the macro level (curricular level) rather than the micro level (the lesson level). However, it seems that experienced teachers reached a level of automaticity in allocating time as most teachers finished what they were planning to do in their lessons even if they did not state the time frame for each activity.

An example of how teachers sub-goal their learning objectives at the macro level is Ms. Sara's

reply on how she chunks the goals the lesson exemplifies this:

> Ok the main goal is to teach them to add mentally. I chunk the lesson into two main parts: to add without regrouping first and then with regrouping...
> For the "with regrouping part": I need number bonds from 1 to 9..... The number bonds from 1 to 9 is easy for the kids so it may take one day for introduction and another day for practice.......

Table 8

Main Themes of the Qualitative Study

Planning	Subgoaling and allocating time.
	Hypothesizing/ empathizing.
	Backward/inductive reasoning (logical development of the content).
	Using external resources to help in reaching instructional goals.
	Ignite students' interest about the topic.
	Raising gradually the level of complexity of practice given to students.
Monitoring	Scanning the class for possible misbehavior, disengagement, distraction.
	Checking the relevance and quality of answer/ questions.
Execution	Managing and tracking time and resources.
	- *Giving instructions to troubleshooting an expected problem and allocating resources for the task completion.* - *Multitasking.* - *Prioritizing.*
	Elaborating.
	- *Modeling.* - *Think Aloud: Self instructions/ self-interrogating.* - *Elaborating using illustrations.* - *Organizing the main ideas of the lesson.* - *Stressing on important information.* - *Asking probing questions/rephrasing students' responses.*
Evaluation	Stating accomplished goals/ difficulties met.
	Inferring/ analyzing.
	Formulating an action plan based on their conclusion.
Other themes	Absence of mindfulness of the actual need of the objectives stated in real life.
	In catering for individual differences, teachers focus on supporting struggling students with little attention to above level students.

> For the second Part of the lesson it will be a bit difficult.... As they still don't know what will extend the 10 that's why they get stuck. And it also needs many steps so it may take around 3 to 4 days...

When being asked allocating time in her class and how she manages time in class, Ms Aisha stated:

> To be honest I don't really focus on time..... But of course I have to catch up at the end.... I don't strictly frame the time.... I know giving timing for each activity is very important. It helps me manage my class.... But it doesn't work with me this way.... At the end the nature of the students and the lesson as well as the students response (whether they get it or not, to what extent they are responsive) are what monitors the time……but definitely I catch up at the end and finish what is supposed to be finished.

This is an example of how experienced teachers each a level of automaticity in managing their time.

 4.2.1.2. Hypothesizing/ empathizing. Teachers tend to put themselves in their students' shoes while planning specially for hard lessons. It also seems that they link their own personal experiences and struggles in learning to find solutions for their students.

Ms. Aisha, when being asked about her planning of the lesson and how she plans and comes out with the activities in class, she stated:

> While planning I put myself into my students' shoes..... How will I understand this lesson if I were them? In a way that doesn't make me feel bored.... Especially that I I'm a person who easily gets bored.... That's why I can sense how boredom is suffocating.... That's why while planning the most important thing is to put myself in their place..... so my main target is how to understand or they meet the objectives in a very simple way......

On the other hand, Ms Nada, after stating detailed strategies she uses in teaching writing, responded to the interviewer's inference that she is passionate about teaching writing by saying:

> I used to hate writing as a child…but I love it now…I really find the kids struggling in this branch in specific….A thing that I really find troublesome…it was so troublesome for me as child as well ….although I was so talkative and had a good flow of ideas….in addition, the kids nowadays don't tend to read that much…

Ms. Noura stated a similar response when being asked of how she chunks her objectives:

> I put myself in the students' shoes…what do you need to understand this point?..........I even sometimes ask my teenager brother, if he understands the objective in a specific way or it needs a modification…I experiment the strategy on him (smiling).

In fact, it seems that this empathizing enables teachers to imagine and troubleshoot problems.

 4.2.1.3. Ignite students' interest about the topic. Teachers focus on connecting their lessons with things that are either real life experiences or games. Ms. Sara, while thinking about how she starts her lesson on place value and comparing numbers, she replied:

> I need to think about something that grabs their attention for the lesson….It could be a comparison between the prices of Intendo, Gameboy and play station on different

>   websites…..I may even start with an advertisement…I want an engaging advertisement that silences them….

Similarly, when asked about her planning in general, she referred to a previous experience in teaching a challenging lesson, Ms. Aisha stated:

>   For example last year in grade 7, we had a really hard topic about the declaration of Independence.... It was really boring and I wasn't able to connect it to their lives..... Those kids didn't witness the revolution..... They were too young.... I tried to simplify it as much as possible with a variety of ways and when they started to understand, they had several questions about the topic... Because it doesn't make sense to just rush into the topic without understanding the main reasons from which the declaration of independence emerged.

> *4.2.1.4. Backward/inductive reasoning (logical development of the content).* Although

used by one teacher (Ms. Aisha), but it is a very important strategy that she planned for her

students' thinking where she pushed students to use inductive reasoning to understand the topic.

She finds this strategy vital in her planning:

>   Tomorrow the first thing I will start with is showing them scenes.... And I will ask them to guess the message of the author...... So this this what will happen in the first 15 minutes to grab their attention….. Instead of starting the lesson with the objective or stating the objective…….After we write on the board what they said, I will start adding some modifications.... To have the correct definition ...... From what they say but with my own modifications.... Then, we will be watching a video giving examples similar to what I gave.... Then there will be the exercise as an evaluation......

In another interview she stated the reason for using this strategy almost in all lessons, she stated:

>   "I don't feel comfortable at all while standing up explaining… I want to give them the aids that enable them to come up with the rule on their own"

> *4.2.1.5. Using external resources to help in reaching instructional goals.* The main

resources used by teachers are the textbooks, internet (online resources) and other teachers.

Textbooks are considered to be the main source of planning by all teachers. This was stated by

almost all teachers when being asked of how they plan for their lessons.

Ms. Noura stated:

>   I start my planning by reading the lesson from the book really well……the style of the book is that it explains the concept then gives practice and so on…. I usually follow the sequence of the book unless they already know the topic.

Ms. Sara:

>   "Sometimes I feel like that I'm unable to think on my own, when I have a feeling that I need help, I go to my team".

Ms. Noura:

>   I sometimes may ask my colleagues of other teachers of the best way to teach a certain topic.
>   While discussing the strategies to be used in her class, she also stated:

"It's my first time to make this activity….but I found it in the internet and I really liked it.

Ms. Aisha, when asked: How do you chunk your lesson? She responded: "It's mainly according to the book, the book is definitely guiding me". When she was asked: How do you allocate resources?, she said: "online.... based on the topic....."

The same idea was stated by Ms. Nada. In fact, the textbook is considered the first resource used by teachers followed by other teachers.

4.2.1.6. Raising gradually the level of complexity of practice given to students.

Teachers pay attention to gradually raise the level of complexity of the activities to reach the goals. This is very clear especially on practice.

Ms. Noura responded:"After reading the lesson quite well, I think of a familiar link to start my lesson then I start to gradually raise the difficulty adding more details a bit by a bit till I reach the goal…..

Ms. Aisha, in response to the reasons for picking the sequence of questions she used in her" practice and if it is related to scaffolding, she stated:

> Of course, whenever I make any evaluation or practice, I should always start with the easiest….I have to start with the easiest example or exercise and then I gradually make it harder….I always take them gradually from what they already know and then move upwards…that's my way in all lessons….specially in grammar…

4.2. 2. Monitoring

4.2.2.1. Scan the class for possible misbehavior, disengagement, distraction.

This is interpreted from teachers' frequent calling on students' names while working. When teachers are asked of the reasons of calling these students in specific, their reasons fall under the umbrella of re-grabbing their attention or stopping the student from distracting other students. Such behavior was found so frequently by all teachers. Ms. Noura for example commented on her frequent calling on a girl saying:" Rital is above average academically but she keeps on talking to the one behind her…for this reason, I call on her every now and then to refocus on the task……"

4.2.2.2. Checking the relevance and quality of answer/ questions. Teachers check the relevance of and quality of her question, examples as well as students' responses. This was interpreted through either their sudden change of examples or her feedback to students' responses.

Ms. Noura's reply on the reason for sudden change of numbers of one of the examples given to explain her lesson was:

> I usually do so when I find that the number I wrote is either incorrect or it will not let them understand the concept I am aiming to …….I was improvising and trying to put the best numbers that fits the area they don't get

On the other hand, Ms Nada's responses to students' responses to her questions:" I need a direct answer."……."You're right but I want a more precise description, the one mentioned in the book".

Teachers also, although not with high frequency, analyze the reason for students' wrong answers by hypothesizing the source of misconception.

Ms Noura, when a girl asked of the reason for the answer that she did wrong, replied:

> Because true and false will give you false (stressing on the word and using gestures with her hand)... Both should be true to get the true (showing 2 with her two fingers while moving them)

A girl: but this is an "or" (as the main lesson was translating real life problems to equations)
Ms. Noura:

> This is an "and" (circling the word and in the word problem on the projector)…The
>
> question says put true or false.... However it's p and Q (stressing on the words and and or
>
> and moving her fingers between the two words on the board)..... P&Q (still stressing on the
>
> word and).

4.2. 3. Execution

4.2.3.1. Managing and tracking time and resources.This takes places through various ways: giving instructions to troubleshoot an expected problem and allocating resources for the task completion. Teachers either stress on specific instructions that troubleshoot a problem that is expected to happen and resources needed before starting a task to save time.

Ms. Nada, while giving instructions for the group work task:

> Don't cut the cards before you arrange them……Do we all have scissors? ……..(adding to a girl's comment) , I want at least one pair of scissors….(looking at a girl)..Do you have one?....I need a pair of scissors and one glue stick with each group.

While monitoring the class after they started the task, a girl told her that they lost small cards while cutting, she replied: "That's what I said from the beginning, you should have had ordered first then cut the cards".

Multitasking. Teachers tend to multitask by giving either a task to the whole class or one person while she is focusing on another task (with one student or other tasks). They also tend to use above level students as a resource to offer support for struggling students.

Ms. Noura gives a task for a girl of taking the attendance while she is fixing the laptop and projector. She also uses above level students so frequently inside the class to help struggling ones, her comment was:

> I direct above level students to go and help struggling students once she is done….they are not usually interested in doing extra work. So, instead of talking or eating, she will help the struggling student…this way I'm helping both of them and I am saving time inside the class.

Prioritizing. A further way for managing time is through prioritizing based on the evolving constraints by skipping some steps or ending an activity.

Ms. Aisha skipped one of the two worksheets (one for theme and the another is for author's purpose) she was intending to answer in class and giving it as homework due to lack of time. When she was asked of the reason for selecting one worksheet over the other one, she replied:

> I found that I already practiced with the videos and songs I used. I was practicing the theme since the beginning of the session since the first video……. The theme does not need further elaboration unlike the point of view, there are several branches and details….

4.2.3.2. Elaboration. Elaboration includes several activities. These are the most frequent activities used by teachers inside the classroom. Teachers tend to use more than one strategy at a time rather than focusing on only one strategy.

Modeling. Teachers use themselves, other students or both to explain an activity that is not well understood by students.

Ms. Sara, who previously commented that she was trying the activity for the second time after stating that students did not understand the aim of the activity the first time they made it…so, she decided to model it inside the class:

> Now, the fifth person Iyad, the fifth person will be moving them around in order to form the greatest possible number….so, (modeling herself), I'm the fifth person in the group, so, I'll be starting to move them around…….looking at the students standing on the board…I

say to Adam, I need you to be the first…so Adam, you're the first….what's the number right now, who can tell me?...

Think Aloud: Self instructions/ self-interrogating. Teachers model their thinking for students as a very important strategy for students to help them infer the misconception or right answer. This happens through verbalizing their thinking:

> Ms Noura: (discussing a confusing activitiy) I will check..... Greater than 15 or less than 2..... Less than 2 means one (pointing to the girl who took the number one)..... Thank you Hafsa, she is correct....

A girl: I don't understand at all
Some girls are making noise as if they are frustrated
Ms. Noura moved towards the girls who are making noise
Ms Noura: Greater than 15.... Which numbers are greater than 15?....16 and 17...Did you get what we're doing now?
Some Girls: A-ha

Elaborating using illustrations. Ms. Nada for instance, in her reading session; a biography of Okba Ibn Nafie (a warrior), when girls did not understand the reason of his intentions to conquer Berber tribes:

> Okay…listen girls (moving to the board) what did Amr Ibn Elas conquer first? (girls responded the Levant region, she drew an arrow to the bottom) what did he conquer afterwards? (girls said Egypt, she started to draw the overall map of Egypt)…so, Egypt is here…both Egypt and Levant are conquered….(she then started to point to the left part of the map)…This part is totally uncovered, the western regions…. who lives in this region?...Tribes named Berber tribes…..

A very similar approach was done by both Ms. Nora while explaining math misconceptions through graph (number lines).

Organizing the main ideas of the lesson. Teachers tend to make the best use of organizing the board on a concept map on the board or asking students to organize their own ideas and thinking.

Ms. Sara started her lesson about number bonds by drawing a big concept map of the numbers groups of students are asked to find multiple ways of making these numbers through addition....she keeps writing the numbers thy found on the board….

On the other hand, Ms Aisha asked her 8th graders to draw their own concept maps of types of authors point of view before starting her lesson…They keep revisiting their concept maps throughout the lesson….

Stress on important information. This behavior is frequently used by almost all the four teachers. Teachers stress on important information by changing their tone of voice, gesturing or circling the important information on boards.

Ms. Aisha, while checking answers with students, when a girl answered with a wrong answer:

One girl: third person

Ms Aisha started stressing on the word "we" and repeating it many times pointing to herself and the rest of the class (that was stated in the passage they are practicing).....

The girl: first person

Asking probing questions/rephrasing students' responses. These behaviors were used more frequently by language teachers (Ms. Aisha and Ms Nada) where their aims are to elicit the correct responses and to enrich their languages by giving multiple meaning.

"Ms. Nada: What is the meaning of anger (استياء)?

A girl: sadness (حزن)

Ms Nada: it could be complaining as well (تذمر)…both are right but what do they both mean?

A girl: displeasure (غضب)

Ms. Nada: (acting as if she's thinking about and stating all other responses given by girls)….so if I'm angry from someone, I hate it, and upset with it(while counting on her hands)…what will this be?

A girl: rejection رفض"

4.2. 4. Evaluation

4.2. 4. 1. Stating accomplished goals/ difficulties met. Teachers state the main problems, goals and achievements they made or found through the lesson. This behavior is noticed among teachers as they are aware of areas of strengths and weaknesses of their performance and its impact on students.

For example, Ms. Nada was able to spot the main difficulty her students have after the session, stating:

I noticed that girls are behind in finding the closest synonym….they get so close to it but they don't get the most precise response.
Ms. Noura was also quite aware of what went well and the challenges she is still facing during her session:
The activity went really well, I was so concerned about it….The girls got it and started to work accordingly…one problem is that the class gets a bit noisy….i also still do not know

why students get disengaged in the middle of the session…I don't know to get their attention….

4.2. 4. 2. Inferring/analyzing. Teachers try to infer the reasons for a specific behavior, failure or success of an activity. Ms. Sara after a class visit commented**:**

The kids are still not listening…….. I shouldn't have played this game and allowed them to move around this way….I could have made it in a different way by sticking the cards all around the walls and had them to compete in four groups….this would have been better as they will move but with less chaos.

4.2.4.3. Formulating an action plan based on their conclusion. Teachers come up with action plans based on their evaluations which start a new cycle of thinking. In fact, these actions are done on both levels macro (curricular) level and micro (lesson) level.

For example, Ms. Sara formulated an action plan for the coming lesson based on her analysis.

"Ms. Sara: I think I need to establish a routine so that I can grab your attention..... I really need to establish a routine"
Ms. Nada: "I usually make use of my evaluation during the session to start with the problem I found the next session"

4.2. 5. Others emerging themes

4.2.5.1. Absence of mindfulness of the actual need of the objectives stated in real life.
Teachers have a greater focus on studying for the test rather than on authentic learning. It is a thing that some teachers are not aware of while others complain about how limiting this approach is. Being overwhelmed with many task demands and paper work are other reasons for this lack of mindfulness.

Ms. Aisha while complaining about the focusing on quantity rather than the quality of what she is obliged to teach stated that:

It's more about how they get this part clearly and completely..... But here I have a lot of things that couldn't be finished in this limited and short time..... We think that by using this way of giving too much we will get the utmost benefit for the students but this is not true...

On the other hand, Ms Sara, when being asked of the reason behind her concern that her students still struggle in differentiating between the digit and the place value, stated that they can easily read the numbers and know the place value but are unable to state the digit in the different places. When being asked of the actual value of this objective in real life, she replied:

It actually does not have any value in real life. They do understand hundreds, tens and ones. But let's agree that at the end these children are in a school and will be having an exam for their first time and they will be under pressure that they did not used to before. I'm so concerned with this.

In addition, the majority of Ms. Noura's strategies used are focused on practice from the book and extra practice from sheets. In addition, when being asked about how she caters for individual differences between students, she replied:

Unfortunately, I am not good at it. The best case scenario is that you differentiate in the content..... And you differentiate in the activities or the objectives as well..... But this doesn't usually happen……to be honest, what I feel at the end that all students should exactly the same point…they will all take the same exam at the end so I don't find it fair to give simple tasks to struggling students just because he/she is struggling….they have to be exposed to the same thing….

When she was asked of how she knows about her students' interest, she replied:

"For their interests, I try to know them from outside the class but I don't do it frequently…….We're so busy here!…."

4.2.5.2. Teachers focus on supporting struggling students with little attention to above level students. Teachers rarely state any activities done specially for gifted students rather than using them as a resource (helper) for struggling students.

In conclusion, Teachers' metacognitive instructional practices are found to be an interesting and deep phenomenon as it has multiple layers of complexity. It includes thinking about teachers' thinking about his/her instructions as well as students' thinking about these instructions. Therefore, it includes a high level of empathizing and understanding not only teachers' own self, motives and cognitive abilities as well as students'. It was and still challenging finding the fine lines between teachers' cognitive and metacognitive behaviors. In addition, while investigating teachers' metacognitive instructional practices, it is vital to investigate contributing factors to enable this high level of mindfulness inside the classroom.

Chapter 5: Discussion

The first question to be answered was about the psychometric properties of the adapted version of MAI. Although the factorial validity of the MAI was not investigated, the overall findings of the study show that the adapted version of MAI is a reliable tool to be used for further studies in the Egyptian context. In fact, studies investigating the factorial validity of the MAI show that "various exploratory factor analyses of the data were unsuccessful in producing a solution that was interpretable" (Teo & Lee, 2012, p. 100). The MAI was found to be a valid tool using methods other than testing the factorial validity. Other studies show that MAI show sound psychometric properties in terms of construct validity and reliability through correlating scores with other instruments (Sperling et al., 2004). In addition, despite the argument around the construct validity of the offline measures in general, MAI and other self-reports can still differentiate between high and low achievers when related to students' performance (Pintrich et al., 2000). For this reason, I relied mainly on the internal consistency of the MAI that is found to be high. The reliability of the adapted version of MAI is similar to the reliability of the original version (Schraw & Dennison, 1998) and other studies in other contexts like the Turkish (Akin, Abaci & Cetin, 2007) and Asian contexts (Lee, Teo & Chai, 2010).

Such results suggest that the adapted Arabic version of MAI could be used as a reliable instrument to assess adults' metacognitive awareness in the Egyptian context. The adapted version of MAI can be used as an effective and easy to administer quantitative instrument to assess and to track progress in teachers and adults' metacognitive awareness before and after various professional development programs and interventions throughout Egypt. The availability of a reliable tool facilitates the collection of data by researchers and teacher educators about teachers' metacognitive level that enables them to track the progress of teachers as well as the effectiveness of various professional development programs. It also enables researchers and policy makers to make informed decisions about the effectiveness of different professional development and teacher education programs as well the exact areas of development needed by teachers.

The second research question was about the metacognitive awareness level of Egyptian teachers. The study reveals that Egyptian teachers' level of metacognitive awareness is high (mean= 1.81) in all of the eight subscales with very slight differences between the subscales with overall score of 92.04. These scores are hard to compare to other studies as the likert scale in this

study was 1 (strongly agree) to 5 *strongly disagree) which is the opposite likert scale of the studies found. For example, metacognitive awareness level pre-service teachers (n=263) in the Turkish context using MAI shows overall mean scores ranging from 183 to 186 (Memnun & Akkaya, 2009). The MAI mean score of graduate and undergraduate education college students (n=178) in the US was 206.85 whilst MAI scores of college students (n= 109, 40) in the USA range from (129 to 197 respectively) (Sperling et al., 2004).

Despite the difficulty in comparing scores, one can conclude that scores of teachers' metacognitive awareness are high and similar to other contexts. It is worth highlighting that in-service teachers or graduated adults show higher scores compared to pre-service and undergraduate students in studies in different contexts (Lee & Teo, 2011; Stewart, Cooper, & Moulding, 2007; Young & Fry, 2008) except for one study that shows no significant difference between graduate and undergraduate students (Lee, Teo & Chai, 2010). In addition, undergraduate students show lower scores compared to themselves at older classes (Memnun & Akkaya, 2009; Sperling et al., 2004). Thus the score of MAI of in-service teachers was expected to be high. While comparing results in general, it is important to be aware of the cultural role of the total scores where participants may have compared themselves to their own culture (Paulhus, & Vazire, 2007). In the Egyptian context, it is known how we overestimate our intellectual abilities.

The third research question was about finding the significant differences between teachers of different gender, type of school, grade level, subjects and years of experience. The study shows no significant differences between metacognitive awareness in overall score. However, female teachers have significantly higher MK and monitoring score. These are similar findings to other studies that show no significant differences between teachers based on gender (Cihanoglu, 2012; Stewart, Cooper, & Moulding, 2007; Lee, Teo & Chai, 2010; Memnun & Akkaya, 2009). Similarly, the study shows no significant difference between teachers of different grade levels in total scores or the scores of the two main scales except that secondary teachers have higher procedural knowledge (PK) and KG teachers show higher conditional knowledge (CK). This confirms similar evidence by Stewart, Cooper, and Moulding (2007).

Interestingly, the study shows no significant difference between teachers of private and public schools in both total scores, scales or subscales. These findings challenge the stereotyping that private education equates higher quality of education. It also questions if private schools

really target at and foster mindfulness through effective teachers' professional development. Furthermore, the study shows no significant difference in the MAI scores between teachers of different subjects except in the subscale of declarative knowledge (DK) in which teachers of Arabic show significantly higher score compared to foreign language teachers. It is worth highlighting that DK includes knowledge about one's self, including one's abilities, others and universals of cognition. This needs further investigation of the reasons that makes teachers of Arabic (the mother tongue) show a higher level of DK.

Experience is found to play a vital role in teachers' metacognitive awareness of teachers since teachers of years of experience of 0 till 15 years shows a significantly higher score compared to teachers of 16+ years of experience. Teachers of 0 till 15 years show higher MK score specially in the declarative knowledge (DK) and no significant difference between teachers of 0 to 5 years of experience and teachers of 6 to 15 years. These findings are similar to and different from a similar study that shows that years of experience are correlated to teachers' metacognitive awareness. However, the study shows that the main difference is in the MS rather than the MK scale (Stewart, Cooper, & Moulding, 2007). Another study shows that teachers with experience show significantly higher scores in total score and all subscales, except monitoring and procedural knowledge subscales, compared to pre-service teachers (Lee, Teo & Chai, 2010).

This evidence is supported and explained by literature. Berliner (2004) referred to a study that shows that students' test scores are proportional to teachers' years of experience during the first seven years then scores reach a constant level for the next 17 years that slightly declines in the last years of the teacher's career. These findings are aligned with literature that suggests that novice teachers exert a high level of metacognitive thinking as everything is new. As they get more experienced, they still need metacognitive activity that gradually decreases when their work gets more routinized in which metacognitive activities are kept for limited non-routinized activities (Duffy et al., 2009; Hammerness, et al., 2005).

to the fourth research question was about investigating teachers' online metacognitive instructional practices and adaptations. The study reveals various themes that show that teachers use various metacognitive activities in their instructional practices including the main categories of MS: planning, monitoring, execution and evaluation (see table 8). The study supports Corno's (2008) classifications of teachers' adaptations into micro-adaptations that occur at the classroom level and are characterized by moment by moment changes in the classroom; and macro-

adaptations that occur at the large scale curricular level and based on data from formal summative assessments.

There are important findings in the planning. As aforementioned, metacognitive activities include three main stages planning, monitoring and execution and evaluation. The planning phase was aligned with findings in similar studies investigating adults MC and teachers' thinking. For example, allocation of time and resources, sub-goaling, hypothesizing, backward reasoning as well as use of resources are aligned with Meijer et al.'s (2006) framework. Logical development of the content is aligned with a previous study (Sabers, Cushing & Berliner,1991). Another interesting finding is how teachers hypothesize while planning for the lesson through empathizing or putting herself in her students' shoes. Other findings that are somehow were not previously mentioned in the literature including the planned gradual rise in complexity of practice/ activities given to students is an important aspect of scaffolding that is needed by teachers for effective learning.

In addition, it was observed that the main resource used by teachers is textbooks. This again raises several questions about the effectiveness of using a "prescribed" top down program—that is increasingly used by teachers in other contexts—and its impact on changing teachers from metacognitive professionals to technicians (Parsons & Vaughn, 2013). On the other hand, a promising finding is that teachers use each other as an important resource for planning and finding solutions for their problems inside the classroom. This again sheds the light on the importance of developing learning communities as an effective method for co-construction of knowledge (Kennedy, 2005). Developing learning communities is considered the key to scaffolding in teacher education (Manning & Payne, 1993).

Both monitoring metacognitive behaviors found in the study are aligned with previous studies. Sabers, Cushing and Berliner (1991) found that effective teachers scan the class for possible misbehavior and keep on checking the relevance and quality of answers. Execution is centered on two main areas: managing and tracking time and resources and elaboration. Managing time and resources are aligned with Meijer et al.'s (2006) framework. Setting priorities is found to be a behavior made by expert teachers (Berliner, 2004). Elaboration is in fact the heart of scaffolding where it is named as the "responsive elaboration" (Duffy et al., 2009, p. 246). Several elaboration activities are considered to be metacognitive implicit instructions. For example, self-talk and self-questioning are frequently used by teachers and considered one of the

implicit metacognitive instructions (Schraw, 1998b). In addition, asking questions to stimulate the use of strategy or creating a supportive learning environment are other examples of implicit metacognitive instructions (Kistner et al., 2010). Similar behaviors are made by expert teachers (Duffy, 2005). Stressing on important information is considered a metacognitive strategy (Gourgey, 1998). In fact, it seems that teachers are using these implicit metacognitive strategies as a model to scaffold the development of MC in their students. Students learn the strategy through teachers' strategic modeling (Dignath & Büttner, 2018).

The three main evaluation activities carried out by teachers are all aligned with Meijer et al.'s (2006) framework. The last two emerging themes are important, in which they shed light on the lack of mindfulness of teachers while picking learning objectives needed by students and their focus on teaching for the test. This leads one more time to the "MacDonaldization of teaching" (Pearson, 2007) and its negative impact on learning. It was also observed that less attention to high achievers compared to struggling students reveals a need for special professional development programs to provide teachers with effective ways of differentiating instructions to these students.

Chapter 6: Conclusion

An exploration of the nature of reflective practice shows that a common element is the need for individuals to be aware of, and able to monitor, their own thinking, understanding and knowledge about teaching and to be aware of the different kinds of knowledge upon which they can draw to help develop their practice. (Parsons & Stephenson, 2005, p. 95)

Studying teachers' metacognition and its impact on promotion of effective instructional practices is essential for bridging the gap between theory and practice, since teachers are in charge of bridging this gap in the first place. For this reason, developing their intellectual skills with MC at the top of the list, as it has been found to be the most important predictor of learning (Wang, Haertel & Walberg, 1990) needs to be a prioritized item in the education reform agenda in Egypt.

6.1. Limitations.

There are several limitations for the study. For the quantitative study, although the sample was heterogeneous, a random sampling method was not used. Therefore, these results cannot be generalized and there is a need of replicating the study. On the other hand, there are some concerns about the qualitative study. First, the sample size of the teachers is very small and homogeneous, as the four teachers are female teachers in the same school. This took place due to access and timing constraints. Secondly, due to timing constraints, the study took place in the third and fourth weeks of the school year. A deeper understanding would have been achieved if visits took place throughout the year. As from personal experience, teachers' performance is affected by timing of the school year and the level of strength of the relationship between teachers and students that gradually develops throughout the year. Thirdly, data were only analyzed by the main researcher with no room for inter-rater reliability. In fact, there is a view that does not consider inter-rater reliability for unstructured interactive interviews an effective method for reaching in depth analysis whereas knowledge gained throughout the study is essential for the "fluid nature of coding" leading to a comprehensive understanding of the phenomenon that the inter-rater could not easily reach (Morse, 1997, p. 446). Similarly, inter-rater reliability of an interactive method of data collection like observations especially of an unfamiliar phenomenon like teachers metacognitive instructional adaptations may not lead to a comprehensive and in depth analysis.

6.2. Conclusion

The current study added to the body of knowledge in several ways. Firstly, it provided a valid and reliable quantitative measure of adults' metacognitive awareness that can be used in future research for the purpose of assessing teachers' and adults' metacognitive awareness. Secondly, it investigated the metacognitive awareness level of 394 teachers in Cairo, as well as differences in levels of teachers' metacognitive awareness relative to their years of experience, gender, subjects, grade level and type of schools where they work. The study reveals a high level of metacognitive awareness of Egyptian teachers compared to teachers in other national contexts. In addition, there is no significant difference between teachers in any of the aforementioned variables except for the years of experience. Thirdly, the study investigated teachers' metacognitive instructional practices in actual classroom settings through online measures for a more ecologically valid assessment. Observations are favored as an online measure as they tackle the relationship between the context and behaviors (Ozturk, 2017a; Winne & Perry, 2005). Lastly, the study offered a primary framework for investigating teachers' metacognitive instructional practices, that is both empirically and the theoretically driven.

6.3. Implications

In conclusion, "while recent research on thoughtfully adaptive teaching is beginning to yield data regarding the nature of teacher metacognition and the circumstances under which it occurs, this line of research is in its infancy" (Duffy et al., 2009, p. 247). Therefore, several recommendations for the field are offered, based on the findings and conclusions from the present research. In fact, this study offers a primary framework that needs replication in various contexts, at different times of the school year, among various teachers' populations who are teaching different subjects and grade levels. Such additional studies would provide a deeper understanding of these complex phenomenon and provide a much needed evidence-based framework for investigating teachers' thinking. Multiple case studies are found to be an effective research method for exploring teachers MC (Parsons & Vaughn, 2013).

MC is found to be the cognition about students' cognition or thinking about students' thinking. Such a phenomenon is fascinating, in which a link is found between teachers and their students' cognition. This phenomenon is connected to other instructional practices and strategies. A linkage to formative assessment is needed in which the commonalities and overlap between both concepts (Black & Williams, 2009). Furthermore, a linkage between teachers'

metacognitive instructional practices and implicit metacognitive instructions by teachers needs investigation. Brown, Campione and Day (1981) refer to this form of instructions as "blind training". In implicit instruction, a teacher indirectly promotes the use of a strategy without explicitly stating its value or use. A linkage between teachers' metacognitive instructional practices and open-ended tasks needs further investigation, since research suggests that teachers need to adapt their instructions more in open-ended tasks (Duffy et al., 2009). Furthermore, there is a need for investigating what type of school environments and culture promotes teachers' MC.

        For the Egyptian context, there are several recommendations. It is important to investigate effective strategies for developing the level of metacognitive awareness including teacher preparation programs and in-service teachers' professional development in general. Further professional development programs that support the development of learning communities for teachers and to provide them with effective strategies for supporting high achieving students are needed. At the policy level, policy makers need to be aware of and sensitive to the negative impact of the trend of teaching for the test and "Macdonalization" of education. Innovative policies are needed for keeping the balance between teachers' empowerment for making mindful decisions inside the classroom as well as the ability to monitor teachers' performance and tracking students' progress through standardization.

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APPENDICES

APPENDIX (1): IRB approval

CASE #2018-2019-061

THE AMERICAN UNIVERSITY IN CAIRO
INSTITUTIONAL REVIEW BOARD

To: Perihan Magdi

Cc: Dena Riad

From: Atta Gebril, Chair of the IRB

Date: Feb 6, 2019

Re: Approval of study

This is to inform you that I reviewed your revised research proposal entitled "Assessing teacher's metacognition and promotion of metacognitive instruction and constructivist learning environment" and determined that it required consultation with the IRB under the "expedited" category. As you are aware, the members of the IRB suggested certain revisions to the original proposal, but your new version addresses these concerns successfully. The revised proposal used appropriate procedures to minimize risks to human subjects and that adequate provision was made for confidentiality and data anonymity of participants in any published record. I believe you will also make adequate provision for obtaining informed consent of the participants.

This approval letter was issued under the assumption that you have not started data collection for your research project. Any data collected before receiving this letter could not be used since this is a violation of the IRB policy.

Please note that IRB approval does not automatically ensure approval by CAPMAS, an Egyptian government agency responsible for approving some types of off-campus research. CAPMAS issues are handled at AUC by the office of the University Counsellor, Dr. Ashraf Hatem. The IRB is not in a position to offer any opinion on CAPMAS issues, and takes no responsibility for obtaining CAPMAS approval.

This approval is valid for only one year. In case you have not finished data collection within a year, you need to apply for an extension.

Thank you and good luck.

Dr. Atta Gebril
IRB chair, The American University in Cairo
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Institutional Review Board
The American University in Cairo
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APPENDIX (2): The second author's of MAI approval

Sperling, Rayne Audrey rsd7@psu.edu via pennstateoffice365.onmicrosoft.com   Wed, Jul 11, 2018, 1:47 PM

to me

Dear Perihan Magdi,

Your project sounds interesting. You may use the MAI. Please use the instrument in accord with ethical guidelines for the use of human subjects and ethical standards established by the APA. Also please properly cite the instrument and the previous research with the tool. As you write up your work it will be particularly important to document how you have revised the instrument for future scholars and practitioners' use.

Good luck with your research,

Rayne

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APPENDIX (3): The Arabic version of MAI
استبيان درجة الوعي بما وراء المعرفه
Metacognitive Awareness inventory (MAI)
الهدف من الاستبيان هو تقييم درجة معرفتك لتعلمك ولا يوجد اجابة محدده صحيحة. ولهذا قم يا ختيار الى
اي مدي تقوم بفعل كل من الافعال المذكورة في الاستبيان. حاول ان تجيب باصدق شئ تراه في افعالك او ما
تعرفه عن نفسك.

1 دائما ما افعل   2غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

1. اسأل نفسي من حين لاخر عن مدى تحقيقي لاهدافي. (اثناء التعلم)

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

2. اضع عده بدائل في الاعتبار قبل حل المشكله.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

3. احاول ان استخدم الاستراتيجيات التي نجحت معي من قبل.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

4. اضبط وتيرتي اثناء التعلم لاتأكد من وجود الوقت الكافي.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

5. اعرف نقاط القوة والضعف في قدراتي الذهنيه والمعرفيه.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

6. افكر جيدا في ما احتاج ان اتعلمه قبل بدايه المهمة.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

7. اعرف مدى جودة ادائي بمجرد انتهائي من المهمة.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

8. اضع اهداف محدده قبل ان ابدأ المهمه.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

9. اتأنى عند المرور بمعلومه مهمة.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

10.   استطيع ان احدد اي معلومة هى الاهم للتعلم.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

11.   اسأل نفسي اذا كنت اضع في الحسبان كل الخيارات عند حلى للمشكلة .

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

12.   اجيد تنظيم المعلومات.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

13.   اوجه تركيزي عن وعي على المعلومات المهمة.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

14.   عندي غاية محدده لكل استراتيجيه استخدمها.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

15. اتعلم بشكل افضل عندما يكون لدى خلفيه عن الموضوع.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

16. اعرف ما يتوقع المعلم مني تعلمه.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

17. اتمتع بذاكره جيده للمعلومات.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

18. استخدم استراتيجيات تعلم مختلفة بحسب كل موقف واحتياجاته.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

19. اسأل نفسي بعد الانتهاء من المهمة اذا كانت هناك طريقة اسهل لانجازها.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

20. استطيع ان اتحكم في(درجة) جوده ما اتعلمه.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

21. اعيد النظر فيما اتعلمه من وقت لاخر لاتمكن من فهم العلاقات الهامة .

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

22. اسأل نفسي اسئلة عن الاشياء التي احتاجها قبل البدء.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

23. افكر في عده طرق لحل المشكله واختار افضلهم.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

24. اقوم بتلخيص ما تعلمته بعد الانتهاء.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

25. اطلب المساعده من الاخرين عندما لا استطيع فهم شئ معين.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

26. استطيع ان احفز نفسي للتعلم حين احتاج لذلك.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

27. اعرف اي استراتيجيه استخدمها عند التعلم.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

28. اجد نفسي محللا لدرجة الاستفاده من الاستراتيجيه التي استعنت بها عند التعلم.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

29.   استخدم قدراتي الذهنيه والمعرفيه لتعويض نقاط الضعف لدي.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

30.   اركز على معنى ودلالة واهميه المعلومات الجديده.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

31.   اصنع الامثلة الخاصة بي لجعل المعلومات اكثر دلاله ووضوحا.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

32.   احكم بشكل جيد على مدي فهمي للاشياء.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

33.   اجد نفسي مستخدما لاستراتيجيات التعلم المفيده بشكل تلقائئ.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

34.   عاده ما اتوقف اكثر من مره للتحقق من درجة استيعابي.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

35.   اعرف متى استخدامي لكل لاستراتيجيه سيكون اكثر فاعليه.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

36.   اسأل نفسي عن مدى تحقيقي لاهدافي بمجرد انتهائي.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

37.   استخدم صور او رسوم ايضاحيه لتساعدني على الفهم اثناء التعلم.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

38.   اسأل نفسي بعد الانتهاء من حل المشكله اذا كنت وضعت في اعتباري جميع الاختيارات.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

39.   احاول ان اترجم المعلومات الجديده الى كلمات من عندي.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

40.   اغير الاستراتيجيات التي استخدمها عندما يصعب على الفهم.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

41.   استخدم طريقة تنظيم النص لمساعدتي على فهم ما اقرأه.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

42.   اقرأ التعليمات بحرص قبل ان ابدأ المهمة.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

43.   اسأل نفسي هل ما اقرأه له صله بما تعلمته سابقا.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

44.   اعيد تقييم افتراضاتي عندما يصبح الامر محيرا.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

45.   اقوم بتنظيم وقتي كي انجز اهدافي بشكل افضل.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

46.   اتعلم اكثر عندما يكون الموضوع مثير لاهتمامي.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

47.   احاول ان اقسم ما ادرسه الي خطوات اصغر.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

48.   اركز على المعنى العام فضلا عن التفاصيل.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

49.   اسأل نفسي عن مدى اجادتي لما افعله عند تعلم اشياء جديده.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

50.   اسأل نفسي اذا كنت تعلمت بأقصى قدر ممكن عند الانتهاء من المهمة.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

51.   اتوقف واراجع المعلومات الجديده التي لم تكن واضحة.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

52.   اتوقف واعيد القراءه عندما يلتبس علي الامر.

1 دائما ما افعل   2 غالبا ما افعل   3 احيانا افعل   4 نادرا ما افعل   5 لا افعل تماما

APPENDIX (4): Interview questions

Pre-observation interview:
1. Please explain the context in which your plans were made, for example, the type of class, the type of student.
1. Explain the sequence of your lesson and how you decided on these steps.
2. Why did you pick these strategies?
3. What were your main goals for the lesson? How did you chunk the lesson?
4. How did you cater for the students' individual differences/ interests?
5. How did you allocate time and resources?
6. What were your areas of concern as you constructed the lesson?
7. What strategies do you use in classroom management?
8. Is there a special way for grouping your students?
9.

Post-observation interview:
1. Did it go as you expected/planned?
2. If you were to teach the lesson again, would you do anything differently?

Stimulated recall questions:
1. What were you doing/ thinking about in this segment and why?
2. Were you thinking of any alternative actions or strategies at that time?
3. What did you notice at this point? How did you respond to it?
4. Did any of the students' reaction cause you to act differently that you had planned?
5. Did you have any particular objectives in mind in this segment? If so, what were they?
6. Do you remember any aspects of the situation that might have affected what you did in this segment?

APPENDIX (5): Consent form

الجـامـعة الأمـريكيـة بالقـاهـرة

استمارة موافقة مسبقة للمشاركة في دراسة بحثية

عنوان البحث : (تقييم مهارات ما وراء المعرفة لدى المعلم و تعزيزماوراء المعرفة و بيئة التعليم البنائية داخل الفصل)

الباحث الرئيسي: (بريهان سيد مجدي)

البريد الالكتروني: perihanmagdi@aucegypt.edu

الهاتف: 01119887186

انت مدعو للمشاركة فى دراسة بحثية عن (تقييم مهارات المعلم الما وراء معرفيه و قدرته على تعزيز ماوراء المعرفة وبيئه التعلم البنائي داخل الفصل).

هدف الدراسة هو (توفير طرق قياس فعاله ودقيقة لتقييم مهارات ماوراء المعرفة لدى المعلم المصري)

نتائج البحث ربما تنشر فى دوريه متخصصه أو مؤتمر علمي أو ربما كليهما.

المدة المتوقعة للمشاركة فى هذا البحث (من 10 ل 20 دقيقة)

اجراءات الدراسة تشتمل على (هناك 3 مراحل للبحث في المجمل وهي تشتمل:
1. استخدام الاستبيان على عدد اكبير من المعلمين في عدة مدارس حكوميه وخاصة عن درجة الوعي بما وراء المعرفي لدى المعلم المصري بحسب اختلاف الخبره والخلفيه العلميه وغيرها من العوامل

2. تقييم المهارات الماوراء معرفيه و تعزيز المعلم لتنميه ماوراء المعرفة و بيئه التعلم البنائي داخل الفصل عن طريق مراسم التفكير بصوت عال و ملاحظة المعلم داخل الفصل)

المخاطر المتوقعة من المشاركة فى هذه الدراسة (لا يوجد اي مخاطر للدراسة)

السرية واحترام الخصوصية: المعلومات التى ستدلى بها فى هذا البحث سوف تكون (سرية)
هناك اسئلة في الاستبيان ستساعدنا على تحديد هويه المشارك لتكملة الجزء الثاني من البحث في حال الاحتياج لهذا).
أي أسئلة متعلقة بهذه الدراسة أو حقوق المشاركين فيها يجب ان توجه الى (بريهان سيد مجدي:
01119887186)

ان المشاركة فى هذه الدراسة ماهى الا عمل تطوعى, حيث أن الامتناع عن المشاركة لايتضمن أى عقوبات أو فقدان أى مزايا تحق لك. ويمكنك أيضا التوقف عن المشاركة فى أى وقت من دون عقوبة أو فقدان لهذه المزايا.

الامضاء: ....

اسم المشارك : ....
التاريخ : ..../................./.........
APPENDIX (6): CAPMASS approvals

تصريح

السيد الأستاذ / مدير مدرسة ..إدارة البرلس التعليمية..

تحية طيبة وبعد ؛

الرجاء تسهيل مهمة السيد/ السيدة .. بريهان سيد محمد الغناوى..

وظيفته /معاملة على كمبيوتر .. رقم بطاقة .٨١..... وهى كلاتى المسجلة للحصول على درجة الماجستير قسم التعليم المهنى والمقارن كلية الدراسات العليا التربية الجامعة الأمريكية .. لتحقيق ذلك الإجراء دراسة ميدانية بعنوان تقييم مهارات استراتيجية المعلم والموارد معرفية وقرار على تعرف على ماوراء المعرفة بيئة التعلم المباشر ملحوظة مرفق بصورة من موافقة أمن المديرية تتقفت في خلال الفترة من ١/٤/١٩..

مع ملاحظة الآتى:

١. عدم إعطائه اى بيانات احصائيه بناء على قرار الجهاز المركزى للإحصاء الا بعد الحصول على موافقة مسبقة من الجهاز المركزى وموافقة جهة الأمن.

٢. لا يسمح باستخدام التصريح الا من خلال المدة المخصصة لها والتى يمكن تجديدها فى حالة انتهاء التصريح قبل نهاية العمل من نفس الجهة الصادر منها فقط.

٣. التصريح شخصى ولا يجوز لاى فرد استخدامه ويتم سحبه بمعرفة مسئول أمن الإدارة للجهة المتردد عليها الزائر وتسليمه لمكتب أمن المديرية وبرفقة تقرير بالواقعة حيث سيتم التعامل مع الفرد و الجهة التى تقوم بذلك.

وتفضلوا بقبول فائق الاحترام ،،

مسئول أمن الإدارة

المدير العام

أ / يحيى حسين أحمد

٢٠١٩/٤/١