METACOGNITION: A THEORETICAL FRAMEWORK

Psychology in general and developmental psychology in particular, are presently awash in a "meta" flood (metacognition, metamemory, metaperception, metalanguage, and so on). It seems that these constructs reflect a relatively new, stimulating and very attractive research perspective as suggested by a number of review articles.

During the last 40 years metacognition has become one of the major fields of cognitive developmental research. Research activity in metacognition began with John Flavell, who is considered to be the "father of the field" and thereafter a considerable amount of empirical and theoretical research dealing with metacognition can be registered.

Moreover, a number of strategies aiming to enhance children's metacognitive abilities have been suggested, which teachers through all educational levels can apply in their instruction. Such strategies are set out in the relevant section dealing with the development of Metacognition in practice and contribute to both the promotion of critical thinking in education and staff development.

The concept of metacognition

Metacognition is a concept that has been used to refer to a variety of epistemological processes. "Metacognition" essentially means cognition

about cognition; that is, it refers to second order cognitions: thoughts about thoughts, knowledge about knowledge or reflections about actions. So if cognition involves perceiving, understanding, remembering, and so forth, then metacognition involves thinking about one's own perceiving, understanding, remembering, etc. These various cognitions about cognitions can be labelled "metaperception", "metacomprehension" and "metamemory" with "metacognition" remaining the superordinate term.

Flavell (1978) referred to it as "knowledge" that takes as its object or regulates any aspect of any cognitive endeavor". Moore defines it as "an individual's knowledge about various aspects of thinking" and it has also been described as "the abilities of individuals to adjust their cognitive activity in order to promote more effective comprehension"

In a more recent review Flavell (2000) divides metacognitive theory into two areas of study: **knowledge** and **processes**. Metacognitive knowledge includes understanding of how minds work in general and how your own mind works in particular. The processes of planning, monitoring, and regulating thoughts are generally known as *executive processes*, which involve the interaction of two levels: At one level is the creative, associative, wandering mind and above it is the executive, trying to keep it on task.

Gradually, the concept has been broadened to include anything psychological, rather than just anything cognitive. For instance, if one has knowledge or cognition about one's own emotions or motives concerning a cognitive enterprise (e.g. being aware of his anxiety while solving a problem in an exam paper), this can be considered metacognitive. In fact, the recent literature completes the term, by adding to its cognitive domain, the emotional one - referring to the emotions *that accompany the cognitive processes* and the person's ability to monitor them, as well as the domain of cognitive habits. Similarly, Flavell (1979), when trying to define the concept of metacognition, refers to all those conscious *cognitive or affective experiences that accompany and pertain to an intellectual enterprise.*

Moreover, a definition of 'metacognition' according to Paris and Winograd "captures two essential features…:self-appraisal and self-management of cognition. Self-appraisals are people's personal reflections about their own knowledge states and abilities, and their affective states concerning their knowledge, abilities, motivation, and

characteristics as learners. Such reflections answer questions about "what you know, how you think, and when and why to apply knowledge strategies". Self-management refers to "metacognition in action", that is, mental processes that help to "orchestrate aspects of problem solving" including "the plans that learners make before tackling a task", "the adjustments they make as they work", and "the revisions they make afterwards". It is important to note, here, that "theoreticians seem unanimous – the most effective learners are self - regulating". Key to effective self-regulation is accurate self-assessment of what is known or not known. Only when students know the state of their own knowledge can they effectively self- direct learning to the unknown.

Shortly, the definition of metacognition has been broadened and includes, not only "thoughts about thoughts" as it was before considered, but the following notions as well: **knowledge of one's knowledge, processes, and cognitive and affective states; and the ability to consciously and deliberately monitor and regulate one's knowledge, processes, and cognitive and affective states.**

Although metacognition may have sometimes indistinct boundaries, key distinctions can be made and a scheme offered that will be useful for organizing and assessing the experimental literature.

First, we can distinguish between knowledge and skills - between "knowing that" and "knowing how", the old distinction between theory and practice, between competence and performance. One may "know that" s/he should distinguish relevant from irrelevant information in a problem, and another has the ability to do this in practice, perceiving what is relevant in a "noisy" environment. Similarly, one may know that different strategies can be applied in different problems, and another has the ability to select the suitable strategy, when needed, to resolve a problem.

Ann Brown distinguishes between knowledge about cognition, and regulation of cognition. *Knowledge* about cognition can be "stable, stable but fallible or late developing" information that human thinkers have about their own cognitive processes, which usually remains relatively consistent within individuals. *Regulation,* on the other hand, can be "relatively unstable, rarely stable, and age independent"; ... Regulation of cognition refers to the activities used to regulate and oversee learning. One may show self-regulatory behavior in one situation but not another, and a child may show self-regulatory behavior where an adult

does not. Regulation may be also affected by patterns of arousal (anxiety, fear, interest) and self-concept (self-esteem, self-efficacy).

These processes include planning activities (predicting outcomes, scheduling strategies and various forms of vicarious trial and error, etc.) prior to undertaking a problem; monitoring activities (monitoring, testing, revising, and re-scheduling one's strategies for learning) during learning; and checking outcomes (evaluating the outcome of any strategic actions against criteria of efficiency and effectiveness) at the end (Brown et al 1983).

Kluwe (1982) brought further definition to the concept of 'metacognition' describing activities referred to as 'metacognitive': (a) the thinking subject has some knowledge about his own thinking and that of other persons; (b) the thinking subject may monitor and regulate the course of his own thinking, i.e. may act as the causal agent of his own thinking" (p.202). Moreover, Kluwe uses the term 'executive processes' to denote both monitoring and regulating strategies. Executive *monitoring* processes involve one's decisions that help: (a) to identify the task on which one is currently working, (b) to check on current progress of that work, (c) to evaluate that progress, and (d) to predict what the outcome of that progress will be. Executive *regulation* processes are those that are "directed at the regulation of the course of one's own thinking". They involve one's decisions that help

(a) to allocate his or her resources to the current task,
(b) to determine the order steps to be taken to complete the task, and
(c) to set the intensity or
(d) the speed at which one should work the task.

Flavell (1981) makes a second important distinction between metacognitive experiences and metacognitive knowledge. "Metacognitive experiences" are conscious feelings during some cognitive activity that relate to the process - for example, during a communication task, feeling that you do or do not understand; or feeling hesitant about the choice you have made. "Metacognitive knowledge" on the other hand, is described by Flavell as "that part of your accumulated world knowledge that has to do with people as cognitive agents and their cognitive tasks, goals, actions and experiences". Some examples of this kind of metacognition are: when you are able to describe your understanding of what goes on, to explain and recognize feelings of uncertainty or confusion in some people, etc.

Briefly, *'metacognition' refers to all processes about cognition, such as sensing something about one's own thinking, thinking about one's thinking and responding to one's own thinking by monitoring and regulating it.*

As for whether the term 'metacognitive' should be used to describe thoughts that were once metacognitive but have since become non- conscious and automatic remains a datable issue. Nevertheless, many researchers adopt a convention that reserves the term 'metacognitive' for conscious and deliberate thoughts that have as their object other thoughts

On the other hand, Koriat proposes that although metacognitive feelings appear to be an integral part of conscious, explicit cognition, they are actually two sided:

> They serve to interface between implicit-unconscious-automatic processes on the one hand, and explicit-conscious-controlled processes on the other. Therefore, this double-sided nature of metacognition shades some light on the relationship between two layers of consciousness.

Koriat therefore, distinguishes between two levels of experience, each with its own mode of operation: "The higher level involves an explicit mode of operation, characterized by relatively high degrees of consciousness and control, whereas the lower level involves an implicit mode of operation, characterized by relatively low degrees of consciousness and by automatic influences". And as Koriat continuous "it would seem natural to place metacognitive monitoring and control at the heart of the notion of consciousness". Therefore, she sees "surprising that some leading experts arrived at the conclusion that metacognitive processes are, in fact, more properly seen as being part of unconscious and implicit functioning"

It seems that in our cognitive system there are at least two hierarchical levels, with cognitions of the first level serving as the object of cognitions at the second level. However, the existence of a two-level does not necessarily imply conscious awareness (of the first level by the second level). Classical developmental theorists, such as Vygotsky (1934, 1962) and Piaget included conscious awareness as a defining attribute of metacognition. In contrast, in an information-processing theory

such as Sternberg 'meta' components played a major role in the absence of any attribution of conscious awareness.

Koriat and Levy-Sadot used the terms noetic judgments (or judgment of knowing) and noetic feelings (or feeling of knowing) to refer to the types of subjective feeling and showed how this distinction applies to the various forms of monitoring one's own knowledge.

Nelson and Narens (1994) further subdivided the kinds of monitoring judgments we use to into three categories:

1. ***Ease-of-learning (EOL) judgments*** occur *in advance of acquisition,* are largely inferential, and pertain to items that have not yet been learned. These judgments are predictions about what will be easy/difficult to learn, either in terms of which items will be easiest (Underwood, 1966) or in terms of which strategies will make learning easiest (Seamon & Virostek, 1978).

2. ***Judgments of learning (JOL)*** occur *during or after acquisition* and are predictions about future test performance on *currently recallable* items. However, we now believe, in contrast to the above, that JOL should be defined as follows: Judgments of learning (JOL) occur *during or soon after acquisition* and are predictions about future test performance on recently studied items.
This newer formulation of JOL, although in some cases yielding overlap with the above formulation of FOK, appears to be more useful than the earlier formulation.

3. ***Feeling-of knowing (FOK) judgments*** occur *during or after acquisition* (e.g., during a retention session) *and* are judgments about whether a given cur*rently nonmalleable* item is known and/or will be remembered on a subsequent retention test. [Empirical investigations of the accuracy of FOK judgments usually have the subsequent retention test be a recognition test , although several other kinds of retention tests have been used.

Perhaps surprisingly, EOL, JOL, and FOK are not themselves highly correlated. Therefore, these three kinds of judgments may be monitoring somewhat different aspects of memory, and whatever structure underlies these monitoring judgments is likely to be multidimensional (speculations about several possible dimensions occur in Krinsky & Nelson, 1985, and Nelson et al., 1984).

It seems that most of our behaviors represent a mixture of influences from both implicit, subconscious activations, and conscious considerations. This mixture is nicely demonstrated by slips of actions that ensue from automatic influences on deliberate behavior, resulting in actions that are not as intended (Reason, 1983).

Before ending this section, we can summarize the notion of 'metacognition' classifying it in the following basic components :

(1) *Metacognitive Knowledge* (also called metacognitive awareness) refers to what individuals know about themselves and others as cognitive processors.

(2) *Metacognitive regulation* is the regulation of cognition and learning experiences through a set of activities that help people control their learning.

(3) *Metacognitive skills* refer to conscious control processes such as planning, monitoring of the progress of processing, effort allocation, strategy use and regulation of cognition.

(4) *Metacognitive experiences* are those experiences that have something to do with the current, on-going cognitive endeavor.

Flavell's Classical Model

According to Flavell, the monitoring of a wide variety of cognitive enterprises occurs through the actions and interactions among four classes of phenomena :

    a) metacognitive knowledge
    b) metacognitive experiences
    c) goals (or tasks) and
    d)   actions (or strategies)

The first two have already been mentioned earlier, but will be analyzed in detail below. As for the last two, Flavell states that goals (or tasks) refer to the objectives of a cognitive enterprise, while actions (or strategies) refer to the cognitions or other behaviors employed to achieve them.

Let us now turn our attention to the analysis of metacognitive knowledge and metacognitive experience, as this had been proposed by their introducer, Flavell:

Metacognitive Knowledge

This refers to the segment of acquired world knowledge that has to do with cognitive matters. It is the knowledge or beliefs accumulated through experience and stored in long-term memory that concern the human mind and its doings. Some of this stored knowledge is declarative ('knowing that') and other procedural ('knowing how'). For example, your declarative knowledge is knowing how and when to supplement your poor memory by the use of shopping lists and other external memory aids. One's knowledge of any given metacognitive item, could, of course, be both declarative and procedural. For example, one might both know as a verbalizable fact that writing a shopping list is a good memory strategy and also 'know to' write them on appropriate occasions.
    As already made clear, metacognitive knowledge consists primarily of knowledge or beliefs about what factors or variables act and interact to affect the course and outcome of cognitive enterprises. These factors or variables fall into three major categories: person, task and strategy.

The **person category** encompasses everything that you might believe about the nature of yourself and other people as cognitive processors. It can be further categorized into beliefs about intra-individual differences, inter-individual differences, and universals of cognition. An example of the first subcategory would be one's belief that one person remembers more easily than another; of the second, a belief that one can learn most things better by listening than by reading; of the third subcategory the ascertainment that we usually forget many of the things we have learned as time passes.

The second category is knowledge of **task variables**. The individual learns something about how the nature of the information encountered affects and constrains how one should deal with it. An example would be the knowledge that it is easier to learn the essence or gist of something, such as a story, than it is to learn it verbatim.

Strategy variables are about what strategies are likely to be effective in achieving what goals in what sorts of cognitive undertakings. A child may come to believe, for example, that one good way to learn and retain information, is to pay particular attention to the main points and try to repeat them to him/herself in his/her own words.

Finally, most metacognitive knowledge actually concerns interactions or combinations among two or three of these three types of variables. To illustrate a combination involving all three, one might believe that a pupil (unlike his/her brother - person variable) should use strategy A (rather than strategy B, - strategy variable) in task X (as contrasted with task Y - task variable).

Metacognitive knowledge can have a number of concrete and important effects on the cognitive enterprises of children and adults. It can lead somebody to select, evaluate, revise and abandon cognitive tasks, goals, and strategies. Furthermore, it can lead to any of a wide variety of metacognitive experiences and help us interpret the meaning and behavioral implications of these metacognitive experiences.

Metacognitive Experiences

The other major conceptual entity in the taxonomy is metacognitive experiences. Metacognitive experiences can be fully or less fully conscious and verbalizable, brief or lengthy, simple or complex in context. What makes them metacognitive experiences rather than experiences of another kind is that they have to do with some cognitive (and often affective) endeavour or enterprise, most frequently a current, ongoing one. For example, if one suddenly has the anxious feeling that s/he does not understand something and wants and needs to understand it, that feeling would be a metacognitive experience.

One is having a metacognitive experience whenever s/he has the feeling that something is hard to perceive, comprehend, remember or solve; if there is a feeling that s/he is far from the cognitive goal. Metacognitive experiences are especially likely to occur in situations that stimulate a lot of careful, highly conscious thinking, and provide many opportunities for thoughts and feelings about your own thinking to arise. They may also occur at any time before, during or after a cognitive endeavor; may be more apt to occur when the cognitive situation is something between completely novel and completely familiar; and when attentional and mnemonic resources are not wholly preempted by more urgent subjective experiences, such as pain, anxiety, or depression. Thus, a metacognitive experience can be any kind of *affective or cognitive* conscious experience that is pertinent to conduct in an ongoing cognitive situation or enterprise.

Metacognitive experiences can have very important effects on cognitive goals or tasks, metacognitive knowledge and cognitive actions or strategies. First, they can lead somebody to establish new goals or revise old ones. Experiences of puzzlement or failure, for example, can have any of these effects.

Second, metacognitive experiences can affect one's metacognitive knowledge store by adding to it, deleting from it, or revising it, as in Piaget's model of assimilation and accommodation.
Finally, metacognitive experiences can activate strategies aimed at either cognitive or metacognitive goals. As an example of the former, one senses (metacognitive experience) that s/he does not yet know a certain chapter in a text well enough to pass tomorrow's exam, so s/he reads it through once more (the cognitive goal here, to improve his/her knowledge). As an example of the latter, one wonders (metacognitive experience) whether s/he understands the chapter well enough to pass tomorrow's exam, so s/he tries to find out by asking oneself questions about it and noting how well s/he is able to answer them (the metacognitive goal, here, is to assess one's own knowledge).

Adding to the concept of 'metacognition', Efklides introduces another aspect of it, one that serves the control of cognition, namely**, metacognitive skills**. Since the components of metacognition serve the monitoring rather than the control of cognition , one could refer to this new aspect of metacognition, as one that serves the control of cognition. Metacognitive skills refer to conscious control processes such as planning, monitoring of the progress of processing, effort allocation, strategy use and regulation of cognition.

Before ending up with this model it must be noted that metacognitive knowledge, metacognitive experiences and metacognitive skills form partially overlapping sets. Some experiences have such knowledge as their content and some do not. Some knowledge may become conscious and comprise such experiences and some may never do so.

Moreover, metacognitive knowledge, metacognitive experience and metacognitive skills complement and enrich each other. For example, not only does some kind of metacognitive knowledge seem to be needed for one to interpret properly and act upon metacognitive experience, but conversely, metacognitive experience also contributes in adding information about persons, tasks, and strategies to one's developing store of metacognitive knowledge: The ideas and feelings one experiences while watching or playing, say, tennis, might contribute to the knowledge of tennis.

To put it simply, it seems likely that metacognitive knowledge, metacognitive experience and metacognitive skills, are constantly informing and eliciting one another during the course of a cognitive task.

An Alternative Model of Metacognition

Nelson and Narens suggest an alternative model of Metacognition and the 'control' - 'monitoring' processes. In this model there are two critical features: The first is the splitting of cognitive processes into two or more specifically interrelated levels. This model shows a simple metacognitive system containing two interrelated levels that Nelson and Narens call the "meta-level" and the "object-level."

The second critical feature of a metacognitive system is also a kind of dominance relation, defined in terms of the direction of the flow of information. This flow - analogous to a telephone handset - gives rise to a distinction between what they call "control" versus "monitoring"

This model is based on the idea that a meta-level contains a model of the object-level, these two abstract features, splitting into two interrelated levels (meta-level versus object-level) and two kinds of dominance relations (control versus monitoring), comprise the core of metacognition as use the term.